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Maiden Issue

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Vivekananda Group of Institutions

Arise Awake Achieve

Education is the manifestation of the perfection already in man". These are the words of the great philosopher and educator Swami Vivekananda. The contributions of the great people who devoted their life for the cause of education and youth have always inspired the promoters and, therefore, following the preaching of Swami Vivekananda, the promoters established VIT Campus, comprising of Vivekananda Institute of Technology and Vivekananda Institute of Technology (East), in 2008, to usher in technology revolution by using modern management techniques and harnessing potential of India. Another feather in the crown of Vivekananda Group of Institutions is Vivekananda Global University, established in the year 2012. Vivekananda Global University, Jaipur has been formed keeping in mind his teaching and mentoring ideals. The overall development of the techno-managers with a seeking spirit towards education is VGU's vision for its students. It Promises to develop as an institution with a commitment to excellence in education, research and consultancy and promote human advancement. Swami Vivekananda advocated the concept of 'total development' which includes physical, mental and spiritual. He also advocated incorporation of science and technology in curricula and laid emphasis on technical education that will develop industries. Our core values are inspired by Swami Vivekananda philosophy, and our institution is founded on his thoughts and ideas. To meet these ends, Vivekananda Global University encourage development of student's physical, mental, emotional, secular and spiritual faculties.

Each work has to pass through these stages - ridicule, opposition, and then acceptance.
Those who think ahead of their time are sure to be misunderstood.

Swami Vivekananda

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The aim of "Khoj - An Interdisciplinary Journal of Research" is to promote research activities through papers and articles publication in developing streams of Science and Technology. It aims at cooperation and growth of various organizations in the field of research and development. The Journal invites original manuscripts, review articles, and short communications in any aspect of engineering, applied sciences as well as management stream, that are not published or accepted for publication elsewhere. The Editor in Chief, in consultation with the editorial committee, reserves the right to accept or reject any manuscript or discussion.

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CONTENT

An Effective Analysis of Healthcare Systems using a Systems Theoretic Approach

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Abstract
The use of accreditation and quality measurement and reporting to improve healthcare quality and patient safety has been widespread across many countries. A review of the literature reveals no association between the accreditation system and the quality measurement and reporting systems, even when hospital compliance with these systems is satisfactory. Improvement of health care outcomes needs to be based on an appreciation of the whole system that contributes to those outcomes. The research literature currently lacks an appropriate analysis and is fragmented among activities. This paper aims to propose an integrated research model of these two systems and to demonstrate the usefulness of the resulting model for strategic research planning. In this paper, we discuss how to improve the overall performance of quality in healthcare systems. Additionally, what methods a researcher needs to adopt for system effectiveness.

Keywords: health, health care, hierarchical systems, SIPOKS, Supply Input Process Output Key Stakeholder, system effectiveness, systems theory

Introduction

The use of accreditation systems to improve healthcare quality and patient safety has been widespread across many countries [1-4]. Quality measurement incorporating clinical indicators and quality indicators, and reporting systems, have grown substantially as the more visible aspects of hospitals' quality improvement efforts [5-9]. Taken together, these systems comprise the health administration segment of the healthcare system, for convenience labeled the health administration system. The health administration system is believed to influence quality outcomes and considerable resources are spent by participating hospitals in this belief.

There is rich research literature on the association of the accreditation and measurement/reporting systems to quality in health care, but the results are unsatisfactory. The outcome of quality is not well correlated with accreditation requirements, even when hospital compliance with accreditation and measurement/reporting requirements is acceptable. In general, partial, inconsistent or conflicting results have been discovered [7, 10]. An important feature of this research is that it is concerned only with correlation, rather than the processes through which the impact of the systems occurs, and is fragmented: specialized to specific clinical or management perspectives or a system or subsystem taken in isolation. The fragmented research on the determinants of quality in healthcare reveals partial observation and ambiguous results.

Owing to these findings, some arguments have been made for "a more systematic use of theories in planning and evaluating quality-improvement activities in clinical practice". The idea is to use theories to describe the model lying behind a specific intervention and then design research to evaluate the model. The need for a theoretically driven approach to understanding complex social interventions and their effects has been strongly advocated [14] as the way to gain knowledge about the overall systemic effects of the health administration segment acting on the health care system, especially knowledge that will inform decisions about the use of health care resources to support the most valued processes. Yet, for all the interest in the use of the accreditation and measurement/ reporting systems to improve healthcare quality and patient safety, the science of healthcare performance measurement and management is still relatively embryonic, and there remains a paucity of hard evidence to guide policy and research planning from a firm theoretical basis.

According to systems theory, patient safety and quality of healthcare is an emergent property of the entire healthcare system [14], it follows that the improvement of health care outcomes needs to be based in a systematic appreciation of the whole system that contributes to those outcomes. Yet the research literature currently lacks an appropriate analysis of this sort. Therefore, the first aim of this paper is to use systems theoretic approach to develop an integrated research model of the accreditation and quality measurement/reporting systems, taken in relation to the hospital-level healthcare system. The second aim is to demonstrate the usefulness of the resulting model for strategic research planning. The paper provides an example of an adaptive-control study derived from the proposed model. It demonstrates a template for more advanced strategic research planning of quality improvement throughout the healthcare systems.

Methods & Designs

To achieve these aims, the research was conducted through the combination of a theoretical based study and a literature- based empirical study. The theoretical based study combines the basic concepts of systems theory and a general systems flow with the Supply Input Process Output Key Stakeholder (SIPOKS) process model to form the systems theoretic approach. The approach is used to initially develop a basic high level integrated systems model as a framework to guide the investigation of the effect of the accreditation and measurement/reporting systems on health care quality and then to examine, from a systems flow perspective in a lower level, the causal links within the system that impact on its effectiveness.

A literature-based empirical study used existing research or documentation as evidence with which to validate the proposed general relationships derived from the model. Australian experiences in accreditation and clinical performance data reporting, especially from the Australian Commission on Safety and Quality in Health Care and the Australian Council on Healthcare Standards (ACHS), are used as the major evidence base for evaluating the performance of these relationships and further as a design base to develop an example of an adaptive-control study. In order to gain a better understanding of systems theory, healthcare systems hierarchy, general systems flow and the SIPOKS process model, and the Australian research base used to form the adaptive-control study, their use is elaborated below.

a) Systems theory - The foundation of systems theory rests on two pairs of concepts: emergence and hierarchy; control and communication [14, 15]. According to the first pair of systems theory concepts, a general model of complex systems can be expressed in terms of a hierarchy of levels of organization [16]. The safety and quality characteristics of complex systems are an emergent property of the system as a whole, not a property of individual system components. According to the second pair of basic system theory concepts, an open and dynamic complex system like the healthcare system is viewed as a suite of interrelated subsystems that are kept in a state of dynamic equilibrium by feedback loops of information and control. Specifically, their relevant emergent properties are controlled by a set of safety and quality constraints related to the behavior of the system components or subsystems [18]. Regulation to required standards is the common form that enforcement of safety constraints takes in complex systems and is expressed through hierarchical regulation relationships [19]. Since control implies the need for communication, reverse communication within the system hierarchy from controlled to controller is required to stimulate systems' behavior towards the accepted standard of safety and quality [20].

   In the study, systems theory is applied to construct a healthcare system hierarchy which consists of interacted systems linked with control and communication in different layers.

b) Healthcare systems hierarchy - For the purposes of this paper the overall healthcare system may be simplified to a 4-layer model shown in Figure 1. Inter-layer relationships are characterized by vertical control and communication, but the full regulatory structure also includes significant horizontal interrelations as well as self-regulation. The proper functioning of all these relationships is important to the ultimate achievement of quality health care. The focus of this paper is on the middle two layers, the health administration system, with its two sub- systems - the accreditation system and the quality measurement and reporting systems - in relation to the hospital-level healthcare [19] system. A holistic healthcare systems relationship model made of the two-layer system hierarchy is constructed for detailed analysis. The relationship of the two health administration sub-systems to one another and to the hospital-level healthcare system 'below' them forms the focus of this study.

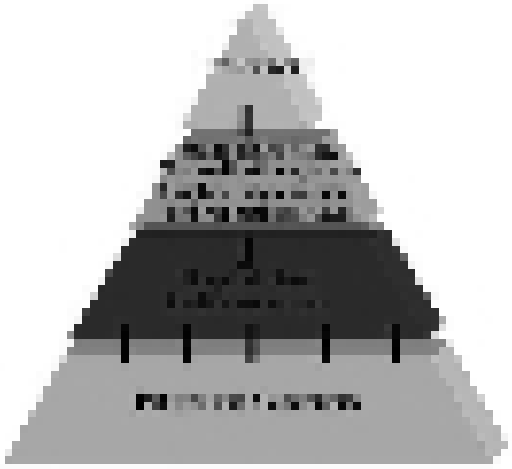

Figure 1

c) General systems flow and SIPOKS process model - A general systems flow is used where systems receive inputs and utilize transform and otherwise act on them to create outputs, whether to other systems or the external environment [21]. The SIPOKS process model partitions the overall systems flow into Suppliers, Input, Process, Output, and Key Stakeholders for convenient analysis. In this model, the supplier provides the required inputs to a system process, including people, equipment, materials, working procedures and methods, and general working environment. The process then utilizes transforms and otherwise acts on the inputs to produce a set of outputs that are used by key stakeholders, which may be suppliers to other processes in the same or different systems. A stakeholder is defined as any group that is impacted or interested in the performance of the process and the word 'key' denotes important stakeholders.

Applied to each of several interrelated sub-systems, SIPOKS can, for example, usefully analyze an extended process into shorter phases and link the analysis of interacting processes from different hierarchical levels for a specific purpose [22]. In this way, the SIPOKS analysis can provide insight into cause effect relationships within systems.

A literature-based empirical study used a wide range of existing research or documentation, from several countries, concerning the functioning of these systems and their interrelations as a basis for imputing general flow processes to them, of the hierarchical control and communication type which were of interest to the safety and quality of health care. The model processes obtained were thus broadly validated by their occurrence throughout developed healthcare systems.

Results

Using a systems theoretic approach, the holistic healthcare systems relationship model was developed, the overall effectiveness of the accreditation and measurement/reporting systems for providing quality of care was identified, and system weaknesses from a system flow perspective were discovered. An example of an adaptive-control study involving accreditation surveyors derived from this approach is developed. The holistic healthcare systems relationship model In practice, the hospital-level healthcare system is typically impacted by numerous accreditation and clinical or quality performance reporting systems, typically clinically differentiated. Ultimately these systems need to be discriminated and treated individually; however, in this study only their overall, shared interrelations are considered. Combining the concept of healthcare systems hierarchy and an analysis of control and communication relationships, a basic holistic healthcare systems relationship model is designed. As both the horizontal and vertical control/communication relationships are potentially relevant to maintaining an acceptable level of quality within the healthcare systems hierarchy, there are in principle four model relationships of direct interest. These are labeled P1 to P4 in Figure 2. Of note, the fourth relationship (P4) has hitherto essentially gone unrecognized and its potential remains underdeveloped. It will figure prominently in the study design proposal.

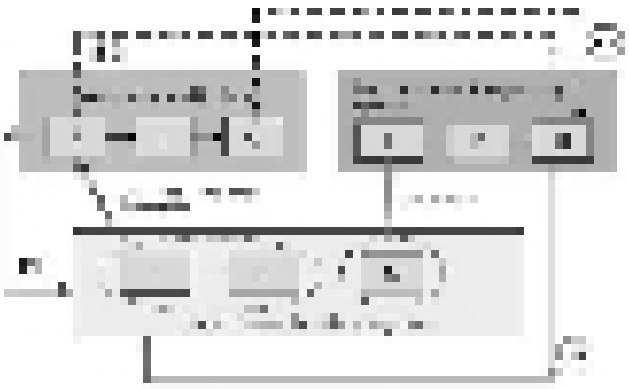

Figure 2

Two of these four relationships (P1 and P2) are vertical control and communication relationships, providing the outputs of the accreditation and the quality measurement/reporting systems, respectively, as inputs to the hospital- level healthcare system to improve quality of care. Relationship P1 is a control relationship that provides hierarchically determined practitioner standards while the P2 communicates outcomes to the hospital-level healthcare system for its own internal control response. The remaining two relations, P3 and P4, are horizontal control and communication relationships within the health administration system, to improve the focus and impact of accreditation on quality of care. P3 communicates correlations in the outputs of the accreditation and the quality measurement/reporting systems and P4 provides feedback from the output of the quality measurement/reporting system to the accreditation system input. While P3 is concerned with communication, P4 is intended as a control relationship. Strictly, P3 is at present a quasi-relationship because in practice there is no specific recipient of this research-generated information within the health care system. The information is in effect an indicator of system-wide coherence, and in that sense relevant to all, however no-one has a mandate to respond to it. In a more systematic institutional design this information might be fed to a government source (top layer of Figure 1) or other system-wide responsible entity to initiate and focus health care improvement research of the kind proposed below. This is a potentially important relationship outside the scope of this paper. Or it might also be directly utilized by P4 to focus its feedback as proposed here. In what follows it is treated as a potential communication relationship.

With respect to each of these relationships, the question arises as to what is known about its impact on quality of care. While considerable research has been directed toward understanding and improving P1 and P2 to produce improved health care, only P1 is well understood and supports practical reform. P2 has no satisfactory outcome as discussed below under 'Effectiveness of quality measurement and reporting system'. As for P3 and P4, complex, ambivalent findings hold in P3 and it currently lacks an effective feedback role, while little or no research has been directed toward understanding and improving P4. These claims are reviewed below for the four relationships.

System Theoretic Thinking in Research Design

Different research designs or approaches have been proposed to resolve issues of the accreditation and the quality measurement and reporting system separately. Braithwaite, et al [23]. Apply multi-method approaches to focus on two central aims: to examine the relationships between accreditation status and processes, and the clinical performance and culture of healthcare organization; to examine the influence of accreditation surveyors and the effect of accreditation surveyors on their own health organizations. Joly et al. [24] propose a logic model approach which focuses on inputs, strategies, outputs, and multiple level outcomes, with emphasis on accredited public health agencies as the input of interest. However these approaches need to be complemented by research using systems theoretic approach to help address the weaknesses from a system flow perspective and

to understand quality of care as an emergent whole-system property.

The quality measurement and reporting system is playing an increasingly important role in the healthcare systems. It has been utilized as a potentially complementary tool to accreditation for improving quality. However, the available evidence suggest that both the weakness of quality measurement and reporting system and the impetus from external systems to stimulate improvement can influence the effectiveness of quality of care. Therefore, improving the effectiveness of P2 requires an increase in the quality of feedback and the utilization of performance reports for data accuracy, validity, meaningfulness, timeliness, and the right stimulation from external systems, like government. This invites the systems theoretic approach to design a series of systematic studies covering each weakness from the system flow perspective and cascading up and down external systems to establish adequate control/communication relationships between systems. If we facilitate two pairs of basic systems theory concepts and system flow perspective in our research, the quality measurement and reporting system can be enhanced to support the right information in the right time for quality improvement in health care.

Reform must focus on how to get competition right and how to put in place the enabling conditions, such as the right information, the right incentives and time horizons, and the right mind-sets [25]. The research approach for the effectiveness analysis of the middle two-layer subsystems in Figure 1 can be used as an example for the effectiveness analysis of the whole healthcare systems hierarchy. Using systems theoretic model explores the relationships between systems and assesses their effectiveness in a clear system flow thinking. The overall analysis results of the approach provide an integrated conceptual cascade effect, which might bring possible adaptive-control studies from the additional implicit relationships between systems, or potential feasible ways of achieving the complete and adequate control/communication to create value based competition in healthcare systems could be realized more.

To improve the overall performance of quality in healthcare systems, researcher needs to adopt system theoretic thinking in research design and a holistic view of systems effectiveness. However, systems thinking can be challenging, especially taking a broad view of systems. This may limit the application of the systems theoretic approach.

Conclusion

As safety and quality is an emergent property of the healthcare system as a whole, not a property of individual system components or subsystems, the assessment of safety and quality from any perspective in one system or using any one tool is unlikely to give the complete picture.

A systems theoretic approach supported by research evidence provides the necessary holistic insight to understand the overall relationship and effectiveness among the three systems. A systems analysis reveals four inter-system relationships, the fourth hitherto unreported, along with the unsatisfactory vertical control and communication between the quality measurements/reporting system and hospital-level healthcare systems, and little or no concrete horizontal control and communication between the accreditation system and the measurement/reporting system. Overall the health administration systems do not yet have significant positive impact on the quality of care. To help advance the science of safety and quality improvement in healthcare systems and to inform decisions on the use of healthcare resources for optimized results, the paper examines system issues using the system flow SIPOKS model to give more supporting information on the system weaknesses. It provides a system thinking structure to assist the design of quality improvement strategies. An example of adaptive-control study design is derived from the implicit P4 relationship between the health administration systems that can overcome the present fragmented state of communication and control relationships among the relevant systems.

The effectiveness of quality delivered by each subsystem in the healthcare systems hierarchy can be affected by other subsystems. However, this research develops a prototype of using a systems theoretic approach for the effectiveness analysis within only the middle two-layer subsystems. There are not enough attentions to the effects from other systems; like the organizational context in hospital-level healthcare systems, patients, community, and the role of government, We believe that the basic two pairs concepts of systems theory and the system flow model can be applied to other layers in the healthcare systems. It is hoped that this analysis will stimulate wider debate on the application of holistic systems analysis for improving the effectiveness of systems on quality and safety in health care. In this paper, we discussed how to improve the overall performance of quality in healthcare systems. Additionally, what methods a researcher needs to adopt for system effectiveness. This paper aimed to propose an integrated research model of the two systems and to demonstrate the usefulness of the resulting model for strategic research planning.

References

[1] Scrivens E: Assessing the value of accreditation systems. Eur J Public Health 7:4-8. 1997,

[2] Pawlson L, O'Kane ME: Professionalism, regulation, and the market: impact on accountability for quality of care. Health Aff, 21(3):200-207. 2002

[3] Ovretveit J: Which interventions are effective for improving patient safety? A review of research evidence Stockholm, Sweden: Karolinska Institute, Medical Management Centre; 2005.

[4] International Society for Quality in Health Care: Global review of initiatives to improve quality in health care Geneva: World Health Organization; 2003.

[5] Gibberd R, Hancock S, Howley P, Richards K: Using indicators to quantify the potential to improve the quality of health care. Int J Qual Health Care, 16(Suppl I):i37-i43. 2004

[6] Williams SC, Schmaltz SP, Morton DJ, Koss RG, Loeb JM: Quality of Care in U.S. Hospitals as Reflected by Standardized Measures, 2002-2004. N Engl J Med, 353(3):255-164, 2005

[7] Fung CH, Lim YW, Mattke S, Damberg C, Shekelle PG: Systematic review: the evidence that publishing patient care performance data

improves quality of care. Ann Intern Med, 148(2):111-123, 2008
[8] Mannion R, Goddard M: Performance measurement and improvement in health care. Appl Health Econ Health Policy, 1(1):13-23, 2002
[9] McGlynn EA: Introduction and overview of conceptual framework for a national quality measurement and reporting system. Med Care, 41(suppl 1):1-7, 2002
[10] Greenfield D, Braithwaite J: Health sector accreditation research: a systematic review. Int J Qual Health Care 2008, 20(3):172-183.
[11] Walshe K: Understanding What Works - and Why - In Quality Improvement: The Need For Theory-driven Evaluation. Int J Qual Health Care, 19:57-59, 2007
[12] Pawson R, Greenhalgh P, Harvey G, Walshe K: Realist Review - A New Method of Systematic Review Designed for Complex Policy Interventions. J Health Serv Res Policy, 10(suppl I):21-34, 2005
[13] Grol R, Bosch M, Hulscher M, Eccles M, Wensing M: Planning and studying improvement in patient care: the use of theoretical perspectives. Milbank Q, 85(1):93-138, 2007
[14] Leveson ANG: Systems-Theoretic Approach to Safety in Software-Intensive Systems. IEEE Trans Dependable Secure Comput, 1(1):66-86, 2004
[15] Checkland P: Systems Thinking, Systems Practice New York: John Wiley & Sons; 1981.
[16] Bailey KD: Living systems theory and social entropy entropytheory, Special Issue: James Grier Miller's Living Systems Theory. Syst Res Behav Sci, 23(3):291-300, 2006
[17] Ackoff RL: Towards a System of Systems Concepts. Manage Sci 17(11):661-671, 1971,
[18] Rasmussen J: Risk Management in A Dynamic Society: A Modeling Problem. Safety Sci, 27(2):183-213, 1997
[19] Braithwaite J, Healy J, Dean K: The Governance of Health Safety and Quality Commonwealth of Australia; 2005.
[20] Rasmussen J, Svedung I: Proactive Risk Management in A Dynamic Society Karlstad, Sweden: Swedish Rescue Services Agency; 2000.
[21] Hitchins DK: Putting systems to work Wiley, Chichester; 1992.
[22] McGarvey B, Hannon B: Dynamic Modeling for Business Management New York: Springer; 2004.
[23] Braithwaite J, Westbrook J, Pawsey M, Greenfield D, Naylor J, Iedema R, Runciman B, et al.: A prospective, multi-method, multi-disciplinary, multi-level, collaborative, social-organisational design for researching health sector accreditation. BMC Health Serv Res 2006, 6:113-123.
[24] Joly BM, Polyak G, Davis MV, Brewster J, Tremain B, Raevsky C, Beitsch LM: Linking accreditation and public health outcomes: a logic model approach. J Public Health Manag Pract 2007, 13(4):349-356.
[25] Porter ME, Teisberg EO: Redefining health care: creating value-based competition on results Boston: Harvard Business School Press; 2006

Agile Software Development Life Cycle

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Abstract
Agile development is a relatively new term for a not so new concept. The process involves development - of software or information systems - by small teams, in a short time frame, and involving system users as well as developers. This research paper provides an introduction to agile development concepts, an overview of three approaches to its implementation, and references for more information. While the discussion here focuses on information system development, the ideas can be usefully applied to many kinds of relatively large-scale projects.

Introduction
Traditional software engineering methodologies such as System Development Life Cycle (SDLC) are called plan driven. In traditional methodologies the work starts by identifying requirements. Traditional methodologies include identifying requirements, validation, and training. Also traditional methodologies adhere to important phases that are essential for developers, such as planning, analysis, design, and implementation. These heavy aspects became to be known as heavyweight [1]. Thus some researchers tend to use more flexible method than traditional methodologies. Theses methodologies and techniques are based on iterative development. As a result new technique that was introduced in 1975 and that has become known as agile methodologies. First, the name "agile" came about in February 2001; the advocates of agile methodologies are met and prepared for the manifesto for Agile Software Development. During meeting seventeen process methodologists are discussed and they talk about the future of software development methodologies. During meeting they noticed that they share many characteristics in general. As a result they decide to name theses processes "Agile Alliance". The core of agile methods is to emphasis on people. Agile development style straightforwardly addresses the problems of rapid change [2]. A leading idea in agile development is that the team can be more effective in responding to change. Nowadays, agile software methodologies (lightweight methodologies) are used increasingly in information system projects. Agile methodologies create a huge debate between traditional methodologies followers and agile methodologies followers. The main core of debate appears to focus over the lack of documentation. Many evidence and success stories from working with agile methodologies suggest that agile methods are successful and suitable for many situations and environments. Agile methodologies are based on best practices and their previous success and failures stories.

Project Risks
Information system (IS) development failures are costly, yet studies have shown that they occur with alarming frequency. System development procedures have evolved to help firms address the risk of system failure, and studies focusing on the factors critical to project success have provided useful guidance for future projects. There are many reasons information systems development projects fail - it might even be simpler to list reasons systems do not fail. Here are four critical risks that have been associated with system failure: 1: developers don't understand user requirements; 2: system not feasible under current timeframe and budget; 3: delivered system doesn't conform to design specifications; and 4: system doesn't meet user needs.

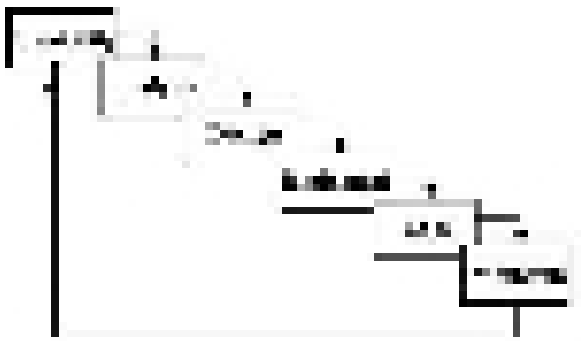

Figure 1

Traditional Approach
The System Development Life Cycle (SDLC) or waterfall method is the longest-lived approach to system development. It works reasonably well for projects that are quite significant in scope, and encompassing several months or years duration. This method is based on a planned series of events, a broad-based organizational approach, and regular evaluation by a steering committee of whether the project remains viable. Criticisms of the SDLC include its long timeline, structured process and inflexibility to changing conditions. This approach minimizes risk 3, at the expense of increases in other risks, and could result in a system that doesn't meet the cost and time schedules or meet user needs.

Agile Approach
Agile development is currently on the main emerging discipline methodologies in software engineering [3].
Nowadays; there is a high-speed changing market which introduces greater choices into the market. Producers of software must contend with issues concerning required and not required

features. What technology to use? How companies can differentiate themselves? Answering these questions is always difficult. In real life and from software and hardware perspective it is well known for everybody that making long term predication is unattainable .Agile development philosophy has it root in the reality of today's markets. The main idea of agile methodologies is to deal with the issues introduced by rapidly changing environment, requirements, tools, and technologies. The basic ideas of agile methodology are introduced through four basic values:

- Individuals and interactions over processes and tools.
- Working software over comprehensive documentation.
- Customer collaboration over contract negotiation.
- Responding to change over following a plan.

Individuals are the first and the last thing in agile methodologies. It is a principle in agile process that people can respond earlier and faster. Also transferring of ideas is more efficient when talking face to face than following procedures in writing and reading documents.

Agile process advised that team members and management have an equal place in project development process. This means that collaboration between people must be continuous with no constraints. But this off course does not mean that technical people take the role of management people .Working software is a main concept. Agile process focus on simplicity, the main idea here is to never produce more than required and never attempting to predict the future. Customer collaboration is a way of doing business according to customer need. The idea here is that the customer must play a major role during design phase. In practice, customer joins the development team .Responding to change is one of the keys. Nowadays; following a plan in software engineering process is not applicable in all situations because of rapid change in all areas of life. Agile methodologies are volatile and more constantly changing.

Timebox Approach

The objective of the time box approach is to focus on the time taken to develop a new system rather than on its functionality. Imagine that you are in a canoe going down a stream, with a treacherous waterfall right up ahead. You have only a limited time to act before danger arrives.

The technique involves setting up specific time intervals, known as time boxes. The approach includes a commitment to release new software at the end of every planned time interval, giving the team a limited time to act before the deadline. If software is not ready for release, it can be scrapped or have a rescheduled release date at the discretion of the project team leader [4]. In effect the project has a "watchdog" ensuring that deadlines are met. This approach can work around the human tendencies of procrastination or perfectionism, either of which can slow down a project considerably. It works quite effectively as a time management tool.

Time box methods work best when you have a fixed schedule and a fixed team size, but the application feature set is variable. It's usually considered most effective to have users/customers prioritize feature choices. It is an iterative process, with specific features addressed in a particular time box, and it is especially useful for systems built around two techniques: prototyping and case-driven design.

This approach is helpful in addressing Risk 2, as developers are constrained to complete some portion of the project within the specified time box. It can also help address "project creep," which is the tendency in large-scale projects for it to take more time and resources than originally planned. If you have been involved in any DIY projects in your home, you can appreciate how this tendency occurs in many areas of life [5,6].

The time box approach can also reduce "scope creep," which is the tendency for projects to require changes in scope requirements. As a project is developed, users often request additional features or design changes, which slow down the process that time boxing is meant to accelerate. The time box approach pushes off some features to future application versions, while focusing on core features within the limited time frame. Risks one and three are not considered in this approach, and may be significant.

Time box software is capable of generating reports for the project team that cross-reference the projects and tasks currently at hand. They can deliver real-time progress reports and run on numerous operating systems. Software also typically includes a built-in web server, time tracking and merging for project participants, backup, search and instant messaging.

Agile Unified Process

Agile Unified Process (AUP) is a simple, easy to understand approach to developing business applications using agile techniques and concepts [7]. It consists of four steps:

-Inception - the project scope is determined and funding and buy-in (agreement to proceed) are obtained.

-Elaboration - new system is designed -construction - working software is built with regular, incremental releases meeting the highest-priority needs of users -transition - new system tested and brought online

The technique has the following characteristics: -simplicity - program coding is done as concisely as possible

Successful Agile Method Framework

In the following section authors will demonstrate success factor of agile methodologies. Also authors will try to build and explain a theoretical framework for successful agile methodologies which can enhance the overall process of developing software using agile methodologies.

- **Employee Factor**

The success of a software development project is often related to people factors. In agile methodologies, software is done "of the people, by the people, and for the people". Organization of people, their interaction, and task reception is critical in agile methodologies. Authors think that organization of people and their interaction is the main factor for the success or failure of agile methodologies. In normal situation agile teams are small (no longer than 10 people). In agile methodologies the center of attention of the team is shifts from the tools and technology to people interaction and collaboration concerning project.

- **Customer factor**

One of the main success factors of agile methodologies is customer collaboration. Author's opinion here is that customer collaboration and high skilled agile team equal working software. The idea here is if you want to conduct customer satisfaction you have to work with educated customer who knows exactly what he want. This required that the customers are available with the software development team. Also the customers must consider themselves a responsible element in the project that can cause success or failure

- **Organization Factor**

Agile is a cultural issue. One of the main challenges most organization face is creating the agile culture. This means that the nature of organization is very important here. For example, agile is not appropriate in bureaucratic organizations. This meant that a dynamic and fast changing organization will find agile methods very suitable for it.

Focus on high-value activities - not every feature will be included, so activities are prioritized and the most important ones are developed first-tool independence and flexibility - the approach can be used with other techniques, methods, or software.

AUP is an approach, not a specific tool or roadmap. As such it can be integrated into an organization's existing methods and techniques as desired.

Organization Factors:

Team's Distribution*:* One of the main aims of any organization is to maximize utilization of their employee. To accomplish this task manager must have appropriate skills to but the right employee his right place.

Commitment: The organization must deliver the final product on time without any delay. This requires that organization must bring an initial version early which allows the organization to get feedback early from the customer.

Creating Collaborative Culture: One of the main tasks of any organization follows agile methodologies in its process of development is to create an excellent collaborative culture. This requires that the organization has to follow some procedures while accomplishing its task. To complete this task the characteristics of employees play an important role.

Planning, Control, Monitor: Planning is a psychological methodology of thinking about the tasks required to create a desired goal. Planning is the main factor of success for any project. Also it includes scheduling, identifying team members and leaders. Planning must be prepared after careful and extensive research. The goal should be realistic and specific. Control means using devices or a group of devices to manage, direct or regulate the behavior of overall system. The function of control is finding the errors and correcting them [8]. Control in management means setting standards, measuring actual performance and taking corrective action. Monitoring means using a collection of information as project progresses. The main aim of monitoring is to improve efficiency and effectiveness of project. Monitoring based on targets and activities planned during the planning phase. Monitoring allows managers to keep track on progresses and provide a useful base for evaluation.

Employee Factors:

Employee Characteristics and Culture: The culture of employees and their personal characteristics are an important role in creating a collaborative environment. It is known that the nature of persons is difficult to change. If the organization has a lot of employees who are not collaborative in their natures or they tend to perform their tasks individually as they are selfish or don't like others to share them their success. Organization must follow a policy which excludes those employees and replaces them with others who like working as a team.

Employee Competence*:* Working as a team doesn't mean omitting competence. The organization policy must encourage positive competence between employees [9]. As an example organization intensives can be done according to the degree of collaboration. When the level of collaboration and communication between employees increases the intensives will increase. In summary If the people on the project are good enough, its means that any process will be accomplished on time. If they are not good enough, no process will repair their inadequacy.

Training*:* When a new member joins the employees' team he has to work with different partner's indifferent locations or positions according to his qualifications. This will give an idea about how work is done and enhance their experience. It must be noted here that agile methodologies in it nature represent a continuous training for all employees since their partners are always changed which means you have the opportunity to learn from another partner.

Communication between Employees: No doubt that if employees deal with each other's without any reservations relating to exchanging their knowledge this will be reflected on the productivity of the organization.

Customer Factors:

Customer Education*:* Authors mean by customer education that the person or the group of people who will deal with the organization team members - who are working on producing the customer product - must have an acceptable level of education which enables them to explain their requirements and needs in a clear form. It's highly recommended (if possible) those people have an information technology background or have the necessary basic information about information technology (IT) [10].

Knowledge of the Problem*:* People who are selected to work with organization team members must know exactly what the problem in their organization is. Their clear knowledge of the

problem can shorten the development time and producing the product.

Knowledge About Constraints And Limitations: Information Technology specialist known that there is always constraints and limitation for every product. Author's recommended that the person or group of people who will deal with organization team members has some basic knowledge about constraints in hardware and software world. This will help producers to justify their Selection of Any Specific Hardware or Software.

Experience In Business Domain: According to the authors they recommend that customers should have basic knowledge about business domain. This knowledge makes them realistic to identify their requirements specifically which help to deal easily.

Conclusion

Agile development is an umbrella concept, encompassing many similar approaches to system development. It includes the concepts of a limited time frame and active user involvement. It can be especially useful for projects that are relatively small in scale or are a subset of a larger project. The judicious use of agile development techniques can empower organizations to address change, manage complexity, and produce applications with a high probability of meeting user and business needs.

References

1. James Newkirk, Introduction to agile processes and extreme programming, Orlando, Florida, ACM, 2005.
2. Tom Demarco, XP is the most important movement in our field today", IEEE computing and control engineering, June/July 2003.
3. W.H. MorkelTheunissen, Derrick G. Kourie and Bruce W. Watson, Standards and Agile Software Development, Proceedings of SAICSIT, Pages 178–188, 2003.
4. Richard Turner, Barry Boehm, People Factors in Software Management: Lessons from Comparing Agile and Plan-Driven Methods, The Journal of Defense Software Engineering, 2003.
5. Steve Sawyer, Information System Development, Communications of the ACM /Vol. 44, No. 11, page 97-102, November 2001.
6. M. Fowler and J. Highsmith. The Agile Manifesto. Software Development Magazine. August. 2001.
7. http://en.wikipedia.org/wiki/Control_(management).
8. The Manifesto for Agile Software Development; http://agilemanifesto.org/.
9. Wolfgang Zuser, Stefan Heil, Thomas Grechenig, Software Quality Development and Assurance in RUP, MSF and XP - A Comparative Study, St Louis, Missouri, USA.ACM, 2005.
10. Adel M. Aladwani, Journal of Management Information Systems/, Vol. 19, No. 1, pp. 185–210, Summer 2002.

Review: Cloud Computing a New Perspective

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Abstract
Cloud computing is Internet-based computing, whereby shared resources, software and information are provided to computers and other devices on-demand. Cloud Computing is a technique of providing "Computing" as a service rather than an application. This paper is a brief review of survey based on "cloud" computing and it tries to address, related research topics, challenges ahead and possible applications in details altogether .We first develop a comprehensive classification for describing cloud computing architecture. Then we use this classification to survey several existing cloud computing services developed by various projects worldwide, such as Google, force.com, amazons, Azure. This new cloud model promotes availability and is composed of five essential characteristics, three service models, and four deployment models.

Keywords: Cloud Computing, Service, Architecture, Deployment, Computing

Introduction

Is it actually word or hype that's been created by CLOUD COMPUTING? But behind the hype, there is really something and cloud computing appears to be a highly disruptive technology, which is gaining momentum. The concept of cloud computing is the upcoming evolutionary level of Distributed computing. In cloud computing we have to address different groundwork like Scalability, virtualization, interoperability, quality of service, fail over mechanism, and Cloud Models (i.e. Public, Community, Hybrid, and Private).The classification of clouds includes different components involved along with the properties and technologies that are used to fulfil the needs and some different services. *XaaS* is a service in which *X* denotes type of service. The emergence of cloud computing will enable new insights into challenging engineering, medical and social issues.
In this paper we try to define the classification and surveys from academic and industry. We also describe the comparison between different cloud service providers and their systems.

Background

As we already said that Cloud Computing is a technique of providing "Computing" as a service rather than an application.
Hence everything is a service (*XaaS*) like:-

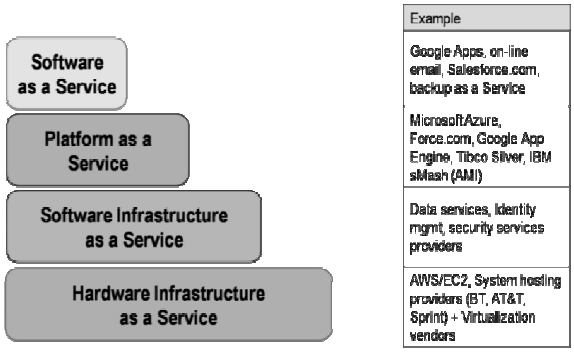
1) SaaS – Software as a service.
2) PaaS – Platform as a service.
3) HaaS – Hardware as a service.
4) DaaS – Database as a service.
5) BaaS – Business as a service.
6) IaaS – Infrastructure as a service.
7) FaaS – Framework as a service.

The users are more conscious about their data, applications, and computing resources as these things will no longer be under their control. So they want such tools for the transparency and mechanism to have an eye on their data and control over it.
We try to discuss the classification on the core terms like architecture, virtualization, interoperability and storage concepts.

Classification

Most classification are created for the vendor's point of view [1] instead of the IT enterprise, the users of service and software. We are creating the classification for the help of academic, program developer and researchers to understand the world of Cloud Computing.

A) Architecture :-



Above figure shows the "Tiered Architecture" of cloud Computing.
This architecture comprises of applications that uses internet access on demand service. All these applications are on demand services which mean that when the user makes a demand for service, the computing starts and collect all necessary resources and then perform the specific task and then, dispose them after the task is completed.
All the above services of cloud have remote access that means the user can connect to the service anywhere in the world. Cloud has a single Access point.
Generally, clouds models can be defined by following types:-

1) **Public Cloud: -** Public cloud applications, storage, and other resources are made available to the general public by a service provider. These services are free or offered on a pay-

per-use model. Generally, public cloud service providers like Amazon AWS, Microsoft and Google own and operate the infrastructure and offer access only via Internet (direct connectivity is not offered).

2) **Private Cloud*:* -** Private cloud is cloud infrastructure operated solely for a single organization, whether managed internally or by a third-party and hosted internally or externally. Undertaking a private cloud project requires a significant level and degree of engagement to virtualize the business environment, and requires the organization to reevaluate decisions about existing resources. When done right, it can have improved business, but every step in the project raises security issues that must be addressed to prevent serious vulnerabilities.

3) **HYBRID CLOUD: -** Hybrid cloud is a composition of two or more clouds (private, community or public) that remain unique entities but are bound together, offering the benefits of multiple deployment models. By utilizing "hybrid cloud" architecture, companies and individuals are able to obtain degrees of fault tolerance combined with locally immediate usability without dependency on internet connectivity. Hybrid cloud architecture requires both on-premises resources and off-site (remote) server-based cloud infrastructure. Hybrid clouds lack the flexibility, security and certainty of in-house applications. Hybrid cloud provides the flexibility of in house applications with the fault tolerance and scalability of cloud based services.

B) **Virtualization: -** Virtualization technology allows servers and storage devices to be shared and utilization be increased. Applications can be easily migrated from one physical server to another. It refers to the abstraction of logical resources in order to improve flexibility, reduce cost and business infrastructure. It can be virtualization of many types like, server virtualization, storage and network virtualization. A server virtualization can be said as the multiple logical representation of a single physical resource. It provides us a advantage to make things more dynamic i.e., we can create, compress or move the data as per our demands.

Hence technique of virtualization is best for cloud computing because it makes the data more sharable, manageable and isolated.

C) **Services: -** Cloud computing providers offer their services according to several fundamental models. Infrastructure as a service (IaaS), platform as a service (PaaS), and software as a service (SaaS) where IaaS is the most basic and each higher model abstracts from the details of the lower models.

1) ***SaaS***: - In the SaaS model, cloud providers install and operate application software in the cloud and cloud users access the software from cloud clients. Cloud users do not manage the cloud infrastructure and platform where the application runs. This eliminates the need to install and run the application on the cloud user's own computers, which simplifies maintenance and support. It uses common resource and a single instance of both the object code of an application as well as database support to multiple customers. It acts as a Application Service Provider (ASP) model. Key providers are: Oracle, Microsoft, IBM etc.

2) ***PaaS:-*** In the PaaS model, cloud providers deliver a computing platform typically including operating system, programming language execution environment, database, and web server. Application developers can develop and run their software solutions on a cloud platform without the cost and complexity of buying and managing the underlying hardware and software layers. If we compare it to the traditional style of application development, this technique can slash development time, offer readymade tools, services and are scalable.

3) ***HaaS:-*** According to Nicolas Carr, "The Idea of buying IT hardware or even an entire data center as a pay-as-you-go subscription service that scales up or down to meet your needs. But as a result of rapid advances in hardware virtualization, IT automation and usage metering and pricing, I think the concept of HaaS may at last ready for Prime Time." Since this service is on cloud so it will help a lot of enterprises as they are not going to purchase the data centers and space.

4) ***IaaS: -*** In the most basic cloud-service model, providers of IaaS offer computers - physical or (more often) virtual machines - and other resources. IaaS clouds often offer additional resources such as images in a virtual-machine image-library, raw (block) and file-based storage, firewalls, load balancers, IP addresses, Virtual Local Area Network (VLANs), and software bundles. A key Benefit of IaaS is the Usage Based Payment scheme. Customers can get a much faster service delivery and time to market. For example: Flexi Scale, Go Grid, and Layered Technologies.

D) ***Security: -*** Cloud computing offers many benefits, but it is vulnerable to threats. Since the popularity of cloud services are increasing day by day, the concerns over the security of the data, infrastructure and virtualization are also a big issue. Corporate Information is not only an asset for company but it also have the information of customers, employee and future planning & details which can be leaked from the cloud service. So the cloud services are to be made so secure that the data is 100% safe and can't be accessed by invalid persons.

E) ***Interoperability: -*** The issue of interoperability is a big deal as the applications should be more portable between the cloud, or to use more numbers of cloud infrastructure. Mostly all clouds are not fully transparent to their users. A solution to different computation problems allows users to choose between different clouds which provide the high level of Interoperability.

F) ***Storage Concept :-*** The main advantage of Cloud services is that while Uploading the data to the cloud, the user doesn't have to worry about How the data is going to be stored. Because User is only working on the front end. Cloud provides the scalability through load balancing techniques and application solutions.

Findings

According to above classification, technical studies and survey, we have some details (includes challenges and opportunities) from different cloud computing systems that will help in development and improvement on existing systems.

- Google App Engine: GAE provides the useful information for people or companies to make web applications without need of infrastructure. Its main feature comprises of automatic scaling and load balancing. These features has advantages like, it removes restrictions to entry level for starters and independent developers. It has transparent scaling for both the scripts and databases. Compared to other scalable hosting services such as Amazon EC2, App Engine provides more infrastructures to make it easy to write scalable applications, but can *only* run a limited range of applications designed for that infrastructure. App Engine's infrastructure removes many of the system administration and development challenges of building applications to scale to hundreds of requests per second and beyond. Google handles deploying code to a cluster, monitoring, failover, and launching application instances as necessary.

  Amazon EC2: Amazon Elastic Cloud. According to the EC2 architecture [2], users can have an eye watch and control on the application as an instance but not as a *service*. EC2 uses Xen virtualization. Each virtual machine, called an "instance", functions as a Virtual Private server. Amazon sizes instances based on "Elastic Compute Units". The performance of otherwise identical virtual machines may vary. To make EC2 more fault-tolerant, Amazon engineered *Availability Zones* that are designed to be insulated from failures in other availability zones. Availability zones do not share the same infrastructure. Applications running in more than one availability zone can achieve higher availability.EC2 provides users with control over the geographical location of instances that allows for latency optimization and high levels of redundancy. For example, to minimize downtime, a user can set up server instances in multiple zones that are insulated from each other for most causes of failure such that one backs up the other.

  Sun Cloud: The main feature of sun cloud is its agile nature, which provide multiple hardware architectures to customize systems for workload and sharing of resources among a large group of customers provided access to centralized infrastructure with lower costs. Sun Cloud delivered enterprise computing power and resources over the Internet, enabling developers, researchers, scientists and businesses to optimize performance, speed time to results, and accelerate innovation without investment in IT infrastructure.

  Common Problems in all [1,2,3] Systems: Multi Tenant architecture is a single instance of the hosted application is capable of servicing all customers. Not all clouds are using virtualization. clouds like GAE and SFDC used completely different technology to create multi tenancy. From the Developer point of view multi tenancy is not an main event. the goal of using a platform is to get the right product done as fast as possible. The biggest concern of current cloud computing system is auditing of the system control and mechanism in terms of user level. Some of the important security aspects of cloud centric computing are secure cloud resource virtualization , security for cloud programming models, binary analysis of software for remote attestation and cloud protection, cloud centric regulatory compliance issues and mechanism plus foundations of cloud centric threat models etc are need to be considered for future cloud work.

Conclusion

Cloud computing is a promising paradigm for delivering IT services as computing utilities. Clouds are designed to provide services to external user; providers need to be compensated for sharing their resources and capabilities. There are many issues regarding the cloud computing. This classification will provide user the idea on current cloud system and challenges. This paper provides information to evaluate and improve existing cloud system.

Bibliography

[1] "Tony Shan, "Cloud Taxonomy and Ontology"". February 2009. Retrieved 2 February 2009.
[2] "Cloud Computing: Clash of the clouds". The Economist. -10-15. Retrieved 2009-11-03, 2009.
[3] "Cloud computing in Telecommunications". Ericsson. Retrieved 16 December 2012.

Wireless Power Transmission Efficiency

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Abstract
In this paper, a wireless power transfer system with magnetically coupled resonators is studied. The idea to use met materials to enhance the coupling coefficient and the transfer efficiency is proposed and analyzed. With numerical calculations of a system with and without met materials we show that the transfer efficiency can be improved with met materials, without payment of fee is granted for nonprofit educational and research purposes provided that all such whole or partial copies include the following: a notice that such copying is by permission of Mitsubishi Electric Research Laboratories, Inc.; an acknowledgment of the authors and individual contributions to the work; and all applicable portions of the copyright notice.

Keywords - Magnetic *Induction, Induced, Transmission*

Introduction

Wireless power or wireless energy transmission is the transmission of electrical energy from a power source to an electrical load without man-made conductors. Wireless transmission is useful in cases where interconnecting wires are inconvenient, hazardous, or impossible. The problem of wireless power transmission differs from that of wireless telecommunications, such as radio, TV. etc. In the latter, the proportion of energy received becomes critical only if it is too low for the signal to be distinguished from the background noise. With wireless power, efficiency is the more significant parameter. A large part of the energy sent out by the generating plant must arrive at the receiving end to make the system economical. The most common form of wireless power transmission is carried out using direct induction followed by resonant magnetic induction. Other methods under consideration are electromagnetic radiation in the form of microwaves or lasers and electrical conduction through natural media.

Electric Energy Transfer

An electric current flowing through a conductor, such as a wire, carries electrical energy. When an electric current passes through a circuit there is an electric field in the dielectric surrounding the conductor; magnetic field lines around the conductor and lines of electric force radially about the conductor.

In a direct current circuit, if the current is continuous, the fields are constant; there is a condition of stress in the space surrounding the conductor, which represents stored electric and magnetic energy, just as a compressed spring or a moving mass represents stored energy. In an alternating current circuit, the fields also alternate; that is, with every half wave of current and of voltage, the magnetic and the electric field start at the conductor and run outwards into space with the speed of light. Where these alternating fields impinge on another conductor voltage and current waves are induced.

Any change in the electrical conditions of the circuit, whether internal or external involves a re-adjustment of the stored magnetic and electric field energy of the circuit, that is, a so-called transient. A transient is of the general character of a condenser discharge through an inductive circuit. The phenomenon of the condenser discharge through an inductive circuit therefore is of the greatest importance to the engineer, as the foremost cause of high-voltage and high-frequency troubles in electric circuits

Electromagnetic induction is proportional to the intensity of the current and voltage in the conductor which produces the fields and to the frequency. The higher the frequency, the more intense induction effect. Energy is transferred from a conductor that produces the fields (the primary) to any conductor on which the fields impinge (the secondary). Part of the energy of the primary conductor passes inductively across space into secondary conductor and the energy decreases rapidly along the primary conductor.[9]A high frequency current does not pass for long distances along a conductor but rapidly transfers its energy by induction to adjacent conductors. Higher induction resulting from the higher frequency is the explanation of the apparent difference in the propagation of high frequency disturbances from the propagation of the low frequency power of alternating current systems. The higher the frequency the more preponderant becomes the inductive effects that transfer energy from circuit to circuit across space. The more rapidly the energy decreases and the current dies out along the circuit, the more local is the Inversely, in the use of electric power for *radio* telecommunications it is only the electric and magnetic fields outside of the conductor, that is far-field electromagnetic radiation, which is of the product of the intensity of the magnetic field and the intensity of the electric field is proportional to the flow of energy or the power, and the power is therefore resolved into a product of the two components i and e, which are chosen proportional respectively to the intensity of the magnetic field and of the electric field. The component called the current is defined as that factor of the electric power which is proportional to the magnetic field, and the other component, called the voltage, is defined as that factor of the electric power which is proportional to the electric field.

Electromagnetic Induction
Energy transfer by electromagnetic induction is typically magnetic but capacitive coupling can also be achieved.

Electrodynamic Induction Method
Main articles: Inductive coupling, Electrodynamic induction, and resonant inductive coupling
The electrodynamic induction wireless transmission technique is near field over distances up to about one-sixth of the wavelength used. Near field energy itself is non-radiative but some radiative losses do occur. In addition there are usually resistive losses. With electrodynamic induction, electric current flowing through a primary coil creates a magnetic field that acts on a secondary coil producing a current within it. Coupling must be tight in order to achieve high efficiency. As the distance from the primary is increased, more and more of the magnetic field misses the secondary. Even over a relatively short range the inductive coupling is grossly inefficient, wasting much of the transmitted energy.
This action of an electrical transformer is the simplest form of wireless power transmission. The primary and secondary circuits of a transformer are not directly connected. Energy transfer takes place through a process known as mutual induction. Principal functions are stepping the primary voltage either up or down and electrical isolation. Mobile phone and electric tooth brush battery chargers, and electrical power distribution transformers are examples of how this principle is used. Induction cookers use this method. The main drawback to this basic form of wireless transmission is short range. The receiver must be directly adjacent to the transmitter or induction unit in order to efficiently couple with it.
The application of resonance increases the transmission range somewhat. When resonant coupling is used, the transmitter and receiver inductors are tuned to the same natural frequency. Performance can be further improved by modifying the drive current from a sinusoidal to a non sinusoidal transient waveform. In this way significant power may be transmitted between two mutually-attuned LC circuits having a relatively low coefficient of coupling. Transmitting and receiving coils are usually single layer solenoids or flat spirals with series capacitors, which, in combination, allow the receiving element to be tuned to the transmitter frequency.
Common uses of resonance-enhanced electrodynamics induction are charging the batteries of portable devices such as laptop computers and cell phones, medical implants and electric vehicles. A localized charging technique selects the appropriate transmitting coil in a multilayer winding array structure. Resonance is used in both the wireless charging pad (the transmitter circuit) and the receiver module (embedded in the load) to maximize energy transfer efficiency. This approach is suitable for universal wireless charging pads for portable electronics such as mobile phones. It has been adopted as part of the Qi wireless charging standard.
It is also used for powering devices having no batteries, such as RFID patches and contactless smartcards, and to couple electrical energy from the primary inductor to the helical resonator of Tesla coil wireless power transmitters.

Electrostatic Induction Method
The illumination of two exhausted tubes by means of a powerful, rapidly alternating electrostatic field created between two vertical metal sheets suspended from the ceiling on insulating cords. This involves the physics of electrostatic induction. Electrostatic induction or capacitive coupling is the passage of electrical energy through a dielectric. In practice it is an electric field gradient or differential capacitance between two or more insulated terminals, plates, electrodes, or nodes that are elevated over a conducting ground plane. The electric field is created by charging the plates with a high potential, high frequency alternating current power supply. The capacitance between two elevated terminals and a powered device form a voltage divider.
The principle of electrostatic induction is applicable to the electrical conduction wireless transmission method.
“In some cases when small amount of energy is required the high elevation of the terminals, and more particularly by the receiving-terminal D', may not be necessary, since, especially when the frequency of the currents is very high, a sufficient amount of energy may be collected at that terminal by *electrostatic induction* from the upper air strata, which are rendered conducting by the active terminal of the transmitter or through which the currents from the same are conveyed."

Electromagnetic Radiation

Far field methods achieve longer ranges, often multiple kilometer ranges, where the distance is much greater than the diameter of the device(s). The main reason for longer ranges with radio wave and optical devices is the fact that electromagnetic radiation in the far-field can be made to match the shape of the receiving area (using high directivity antennas or well-collimated laser beam) thereby delivering almost all emitted power at long ranges. The maximum directivity for antennas is physically limited by diffraction. Beamed power, size, distance and efficiency
The dimensions of the components may be dictated by the distance from transmitter to receiver, the wavelength and the Rayleigh criterion or diffraction limit, used in standard radio frequency antenna design, which also applies to lasers. In addition to the Rayleigh criterion Airy's diffraction limit is also frequently used to determine an approximate spot size at an arbitrary distance from the aperture.
The Rayleigh criterion dictates that any radio wave, microwave or laser beam will spread and become weaker and diffuse over distance; the larger the transmitter antenna or laser aperture compared to the wavelength of radiation, the tighter the beam and the less it will spread as a function of distance (and vice versa). Smaller antennae also suffer from excessive losses due to side lobes. However, the concept of laser aperture considerably differs from an antenna. Typically, a laser aperture much larger than the wavelength induces multi-moded radiation and mostly collimators are used before emitted radiation couples into a fiber or into space.
Ultimately, beam width is physically determined by diffraction due to the dish size in relation to the wavelength of the

electromagnetic radiation used to make the beam. Microwave power beaming can be more efficient than lasers, and is less prone to atmospheric attenuation caused by dust or water vapor losing atmosphere to vaporize the water in contact.
Then the power levels are calculated by combining the above parameters together, and adding in the gains and losses due to the antenna characteristics and the transparency and dispersion of the medium through which the radiation passes. That process is known as calculating a link budget.

Microwave Method
An artist's depiction of a solar satellite that could send electric energy by microwaves to a space vessel or planetary surface.
Power transmission via radio waves can be made more directional, allowing longer distance power beaming, with shorter wavelengths of electromagnetic radiation, typically in the microwave range. A rectenna may be used to convert the microwave energy back into electricity. Rectenna conversion efficiencies exceeding 95% have been realized. Power beaming using microwaves has been proposed for the transmission of energy from orbiting solar power satellites to Earth and the beaming of power to spacecraft leaving orbit has been considered.
Power beaming by microwaves has the difficulty that for most space applications the required aperture sizes are very large due to diffraction limiting antenna directionality. For example, the 1978 NASA Study of solar power satellites required a 1-km diameter transmitting antenna, and a 10 km diameter receiving rectenna, for a microwave beam at 2.45 GHz.[4] These sizes can be somewhat decreased by using shorter wavelengths, although short wavelengths may have difficulties with atmospheric absorption and beam blockage by rain or water droplets. Because of the "thinned array curse," it is not possible to make a narrower beam by combining the beams of several smaller satellites.
For earthbound applications a large area 10 km diameter receiving array allows large total power levels to be used while operating at the low power density suggested for human electromagnetic exposure safety. A human safe power density of 1 mW/cm^2 distributed across a 10 km diameter area corresponds to 750 megawatts total power level. This is the power level found in many modern electric power plants. Following World War II, which saw the development of high-power microwave emitters known as cavity magnetrons, the idea of using microwaves to transmit power was researched. By 1964 a miniature helicopter propelled by microwave power had been demonstrated.
Japanese researcher Hidetsugu Yagi also investigated wireless energy transmission using a directional array antenna that he designed. In February 1926, Yagi and Uda published their first paper on the tuned high-gain directional array now known as the Yagi antenna. While it did not prove to be particularly useful for power transmission, this beam antenna has been widely adopted throughout the broadcasting and wireless telecommunications industries due to its excellent performance characteristics.
Wireless high power transmission using microwaves is well proven. Experiments in the tens of kilowatts have been performed at Goldstone in California in 1975 and more recently (1997) at Grand Bassin on Reunion Island. These methods achieve distances on the order of a kilometer.

Laser Method
With a laser beam centered on its panel of photovoltaic cells, a lightweight model plane makes the first flight of an aircraft powered by a laser beam inside a building at NASA Marshall Space Flight Center.In the case of electromagnetic radiation closer to visible region of spectrum (10s of microns (um) to 10s of nm), power can be transmitted by converting electricity into a laser beam that is then pointed at a solar cell receiver. This mechanism is generally known as "power beaming" because the power is beamed at a receiver that can convert it to usable electrical energy.
Advantages of laser based energy transfer compared with other wireless methods are:
1. Collimated monochromatic wave front propagation allows narrow beam cross-section area for energy transmission over large ranges.
2. Compact size of solid state lasers-photovoltaics semiconductor diodes fit into small products.
3. no radio interference to existing radio communication such as Wi-Fi and cell phones.
4. Control of access; only receivers illuminated by the laser receive power.

Its drawbacks are:
1. Laser radiation is hazardous, even at low power levels it can blind people and animals, and at high power levels it can kill through localized spot heating
2. Conversion to light, such as with a laser, is inefficient
3. Conversion back into electricity is inefficient, with photovoltaic cells achieving 40%–50% efficiency.[22](Note that conversion efficiency is rather higher with monochromatic light than with insolation of solar panels).
4. Atmospheric absorption, and absorption and scattering by clouds, fog, rain, etc., causes losses, which can be as high as 100% loss
5. As with microwave beaming, this method requires a direct line of sight with the target.

Bibliography:

1. A radio transmitter can produce waves having a power of several kilowatts or even megawatts but this energy scatters in all directions. Only a small fraction, less than a millionth part, of the transmitted energy is received. However, this is sufficient to yield the intelligence.
2. G. A. Landis, "Applications for Space Power by Laser Transmission," SPIE Optics, Electro-optics & Laser Conference, Los Angeles CA, 24–28 January 1994; *Laser Power Beaming, SPIE Proceedings Vol. 2121,* 252–255.
3. Corum, K. L. and J. F. Corum, "Nikola Tesla and the Diameter of the Earth: A Discussion of One of the Many Modes of Operation of the Wardenclyffe Tower," 1996
4. General Electric review, Volume 15 By General Electric. "Velocity of Propagation of Electric Field", Charles Proteus Steinmetz
5. 188,000 miles per second
6. Such as an internal change of load, starting and switching operations, and short circuits.

7. Such as the external change due to lightning.
8. Charles Steinmetz (Fellow, A. I. E. E. Chief Consulting Engineer, General Electric Company, Schenectady, N. Y.). "*Condenser Discharge Through a General Gas Circuit*". American Institute of Electrical Engineers., 1922. Transactions of the American Institute of Electrical Engineers. New York: American Institute of Electrical Engineers. Presented at the 10th Midwinter Convention of the A. I. E. E., New York, N. Y., 15–17 February 1922.
9. viz., the dissipation of electric energy by the resistance of the conductor through its conversion into heat;
10. Such as when it gives trouble by induction in telephone circuits or when it reaches such high intensities as to puncture insulation, cause mechanical motion, etc.
11. such as an iron needle.
12. Theory and calculation of transient electric phenomena and oscillations By Charles Proteus Steinmetz
13. Speculation was made as to what the electric wave was, leading to the contradictory deductions that for certain reasons space is considered as a gas of infinitely low density, and for certain others as a solid.
14. Dave Baarman and Joshua Schwannecke (2009-12-00). "Understanding Wireless Power".
15. Steinmetz, Charles Proteus (29 August 2008). *Steinmetz, Dr. Charles Proteus, Elementary Lectures on Electric Discharges, Waves, and Impulses, and Other Transients, 2nd Edition, McGraw-Hill Book Company, Inc., 1914*. Google Books. Retrieved 4 June 2009.
16. "Wireless charging, Adaptor die, Mar 5th 2009". *The Economist*. 7 November 2008. Retrieved 4 June 2009.
17. Buley, Taylor (9 January 2009). "Wireless technologies are starting to power devices, 01.09.09, 06:25 pm EST". *Forbes*. Retrieved 4 June 2009.
18. ^"Alternative Energy, From the unsustainable...to the unlimited". EETimes.com. 21 June 2010.
19. PatentApplication PCT/CN2008/0728855
20. Patent US7164255
21. Norrie, H. S., "Induction Coils: How to make, use, and repair them". Norman H. Schneider, 1907, New York. 4th edition.
22. Electrical experimenter, January 1919. pg. 615
23. Tesla: Man Out of Time, Margaret Cheney., p. 174
24. Experiments with Alternate Currents of Very High Frequency and Their Application to Methods of Artificial Illumination, AIEE, Columbia College, N.Y., 20 May 1891
25. Experiments with Alternate Currents of High Potential and High Frequency, IEE Address, London, February 1892

Floating Images in Air: A Reality or Illusion

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Abstract
Who is not fascinated by 3D technology? And when it comes to 3D projection in the absence of materialistic walls or screen, then it really raise our Goosebumps. We have seen a number of "holographic" displays in sci-fi movies like Star Wars etc. and wondered if it could really happen to have such projections.
This is what I have tried to cover in my research paper. The exciting techniques and methods of achieving it with a detailed discussion of the strengths and weaknesses of various approaches and finally comparing to what extent the projects launched so far in the market resembles with that of what is shown in any science fiction.

Introduction
Midair 3D projection-a phenomenon that fill all of us with a great excitement and curiosity. People interested in this concept all wonder if it could really happen to have what is shown in Sci-Fi movies. The best example being “Princess Leila" scene from Star Wars. So here I present some arguments which say it is a complete illusion versus the products which are already launched in the market falsifying the above arguments.
Let us now look at the arguments which states that one can never have real 3D image projected in air but can have the techniques of approximating such a projection**.**

Holographic Technology
Holography is a technique of producing 3D images. Here images are projected on a glass piece called HOLOGRAM. When viewing through a piece of glass one gets to see a 3D image. This hologram can be used to have an illusion of midair projections i.e., image appearing as if it is projected in air, by making the image to be formed in front or behind the glass piece. Hologram can have a max. area of 1 meter square. So images can be formed about 1 meter in front of the glass. But such type of projections is best suited for a museum-type application. As only two to three people can easily see the image at one time.
One can also project the image stored within the holographic glass's film emulsion. by taking a laser beam and projecting it through the glass into a fog, cloud or other volume, to have midair effect but it won’t be as effective as desired as we will get a shaft of light.

True Volumetric 3d
This approach states that a true three-dimensional image can be made to appear but within a certain limited volume of space. There can be various methods for it. One being-Using two lasers and considering a fixed volume filled with a specific material which illuminates at the intersection point of the two rays. Arguments says that the largest volume of a cube can be about 1.5 cm on each side So there cannot be any technology mature enough to do a full-color, reasonable size representation of a human being

Stereoscopic 3d
This is a technology that we come across often while visiting theaters for a 3D movie. This is marked by the use of special glasses. in which each eye has a different view. The common methods employed for having such views are as under-(a) Anaglyph or color (left eye red, right eye blue or green. (b) Polarized (left eye looks through vertical polarizing film, right eye looks through horizontal polarizing film) (c)Alternating-field (LCD "shutter" glasses block the right eye when a left-eye frame is being displayed, and vice versa) (d) Chromatic displacement (flat holographic "prisms" displace colors so red looks closest and blue farthest away).But again it is not a mid-air projection.

Projection Onto Volume Media
It is a belief among people that if projection needs some screen to hit light on it. Then why not make a screen of a cloud, smoke, water tank or some other semi-translucent medium? But while doing so we get shafts of light as the beam travels through the medium so it can be very well seen that projection a circle through fog produces a cone of light. The tip of the cone being at the projector. Projecting a line produces a triangular plane of light. Again the tip of the triangle being at the projector. And projecting an image of a person produces a fuzzy cone with different bright lines, corresponding to the bright areas of the image. Thus from above facts it can be said that we can have an image only when the projection is hit by a surface (such as a back wall).

Projection Onto Hidden Surfaces
This concept states that when a dark or black scrim (loosely-woven cloth) is hung above an audience in a dark room. and the laser is made to hit the scrim, we get an illusion of a 3D object in space i.e., an image appearing to hang in mid-air, since the scrim cannot be seen. But this is merely an illusion which cannot be called a true 3D.

Simple Projection
This concept works completely on the contrast ratio of a laser. An image can be shown to float in air by using high contrast

ratio say 300:1.This makes the image separated from the background. But again this is merely an illusion. The best example of it is a Planetarium.

Pepper's Ghost

This is another technique in which one uses a pane of glass tilted at a 45 degree angle. An object kept behind the glass and another at the side. By varying the lighting, it is possible to show each separately or to superimpose both of them. This is so called after a stage trick first presented in 1863. There are many more techniques by which an illusion of a 3D midair projection can be created but after all these are only illusions and we want a reality.

Products Launched In The Market Making 3d Images In Air.

1. Heliodisplay (Ottawa-A Chicago Company Io2 Technology

As the word HELIODISPLAY itself signifies an air-based display, this technology uses a projector in which air comes in and is essentially separated, then blown out, and finally reassembles itself back into air. And in the process of being spit out and reassembled it creates a transparent screen against which light can be reflected. It is to be noted here that no lass is required for this. An ordinary light can fulfill the above phenomenon. It projects both still images and videos. It is said to have the maximum image size of about 67.5 centimeters.

1.1 Concept Of Heliodisplay

As already stated Helios display is an air-based display A number of projects have been made on the concept of Helios display since 2001.The system developed by IO2 Technology in 2001 used a projection unit that was focused onto multiple layers of air and dry micron-size atomized particles in mid-air, resulting in a two-dimensional display that appears to float (3d when using 3d content).It allowed for multiple viewing and dual viewing (back and front) when combined with two light sources. Earlier Helios display when connected to a PC by a USB cable, can be made to work as a free-space touch screen, as the PC sees the Helios display as a pointing device, like a mouse. With the supplied software installed, one can use a finger, pen, or another object as cursor control and navigate or interact with simple content The original system used a CMOS camera and IR laser to track the position of a finger in mid-air But now the computers have been replaced by an embedded processor that controls these functions internally for single touch, or multiple touch interactivity without the use of IR laser field A Heliodisplays uses certain amount of water say 80 ml to 120 ml of water per hour for cooling purpose which further depends on screen size and user settings, although the medium is primarily air. It has a tissue paper on the exhaust side of the unit for a 24 hour period without any affect of moisture to it as compared to other mist or fog equipment that relies more on pumping a liquid or vaporizer and thereby affecting the surrounding air(3)

***2.* Tokyo-Based Burton's Aerial 3d Technology.**

This technology is based on a laser system that uses beams of light projected from below to generate plasma excitation in atoms of oxygen and nitrogen present in the air i.e., it ionizes the gas, creating plasma and a colored light emission**.** It currently can create 50,000 points of light per second, giving it a somewhat choppy frame rate of 10-15 fps. Burton is working to improve that to 24-30 fps, comparable to that of basic video.

3. Fogscreen Technology

In the section "Projection onto volume media", it was said that it cannot be possible to have our projection on a screen of a cloud, smoke, water tank or some other semi-translucent medium**.** But this has been proved wrong to a great extent by this technology**.** It is a display system that projects images onto a curtain of fog so they appear to float in the air. It comes with multi-touch capabilities that allow users to manipulate projected images in mid-air. FACTS: Through the use of an infrared camera, its interactive display is able to handle up to 1,500 finger taps simultaneously to accommodate multiple users with 1 cm (0.39 in) accuracy and a time delay of less than 0.2 seconds. The system allows users to manipulate virtual 3D objects and moving images in real time using gestures as well as letting them select menu options and type on an "on screen" keyboard. The software even allows users to draw in the air with their fingers and the 0.2 seconds response time makes interactive mid-air games possible. The Display system supports virtual screens of up to 142 inches (360 cm) in size. Although the images are not of high definition and quality but still it can be a challenge to previous theories.

1.10 Summary

This was a short discussion on the possibilities of projecting 3D images in air. Technology is advancing at a rapid rate trying to prove wrong the previous theories and principles while some still exists. So the conquest persists till we succeed in getting a true picture.

Bibliography:

1. http://www.pangolin.com/resguide03b.htm
2. Tom Spears,I.et al,"New Projectors Put 3D Images in Mid-air",the OTTAWA citizen,Can West News Service,9-14-3.
3. http://en.wikipedia.org/wiki/Heliodisplay
4. PopSciWebTeam,I.et al,"3-D Projection Tech Makes Images Hover in Mid-Air, No Screen Necessary",November 2011.
5. Rakkolainen, I. et al,"How Feasible Are Star Wars Mid-air Displays", Information Visualization, 2007. IV '07. 11th International Conference,pp 935 - 942 , July 2007.

Bluetooth: Protocol and Security Issues

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Abstract
The availability of mobile phones, game controllers, Personal Digital Assistant (PDA) and personal computers has made Bluetooth a popular technology for short range wireless communication. However, as the Bluetooth technology becomes widespread, vulnerabilities in its security protocols are increasing which can be potentially dangerous to the privacy of a user's personal information. The security issues of Bluetooth have been an active area of research for the last few years.

Introduction

With the expansion of the wireless community, mobile devices are becoming more connected, and more susceptible to attacks every day. Bluetooth technology is growing among mobile devices, from cell phones to keyboards. Bluetooth communicates over a common frequency (2.4GHz Industrial- Scientific-Medical radio band) that is free (unlicensed) low-cost, low-power, high-speed (723.2 kbps) and more flexible (allows 2 devices within 10-100 m to share data) than the other competing wireless technologies.

In Bluetooth a trusted relationship between two devices called 'pairing' are formed by exchanging shared secret codes referred to as PINs. A 'master' device has the option of pairing with up to seven 'slave' devices establishing a network called a piconet. Two or more piconets together form a scatternet, which can be used to eliminate Bluetooth range restrictions. A scatternet is formed when the devices act as 'master' or 'slave' devices in multiple piconets at the same time.

The availability of mobile phones, game controllers, Personal Digital Assistant (PDA) and personal computers has made Bluetooth a popular technology for short range wireless communication. However, as the Bluetooth technology becomes widespread, vulnerabilities in its security protocols are increasing which can be potentially dangerous to the privacy of a user's personal information. The security issues of Bluetooth have been an active area of research for the last few years.

Bluetooth Protocol Stacks

A protocol stack is a combination of software/hardware. It defines how the devices should communicate with each other based on the standard. The Bluetooth protocol stack is shown in Fig. 1.

Fig. 1 Bluetooth Protocol Stack

The protocols below the host controller interface (HCI) are built into the Bluetooth microchip and the protocols above the HCI are included in the host device's software package. The HCI ensures a secured communication between the host and the Bluetooth module. The radio layer transmits data in the form of bits by using a radio frequency. Bluetooth transceivers use Gaussian Frequency Shift Keying (GFSK) technique. The baseband layer performs the functions of frequency hopping for interference mitigation, medium access control and forming data packet. In addition, the baseband layer also controls link, channel, error correction and flow control. It establishes two kinds of link depending on the application and operating environment. A synchronous connection oriented (SCO) link is established to emulate circuit switched connections for voice and data connection. While an asynchronous connection link (ACL) is defined for the data bursts. This link also supports broadcasting and data rate control by the master device. The link manager (LM) acts as a liaison between the application and the link controller (LC) on the local device. It is also used for communication with the remote LM via protocol data units (PDU) and the link manager protocol (LMP). The audio protocol is used for a real time two way voice communication. The audio protocol is carefully located in such a way so that the overhead of upper layer protocols does not cause any delays for real-time two way voice connections. The logical link control and adaptation protocol (L2CAP) is a software module that normally resides in the host. It acts as a conduit for data on the asynchronous connection link (ACL) between the baseband and

host applications. The L2CAP is used to ensure both connection oriented and connection less services. Connection oriented service is used for communication between the master to one slave. Connectionless service is used for communication between a master and multiple slaves. The L2CAP can initiate security procedures when a connection oriented or a connectionless connection request is made. The Object Exchange Protocol (OBEX) is used to exchange objects such as calendar notes, business cards and data files between devices based on a client-server model. The telephony control specification (TCS) defines the call control signaling for the establishment/release of speech and data calls between Bluetooth devices. It also provides functionality for exchanging signaling information not related to ongoing calls.

The service discovery protocol (SDP) discovers the services that are available in the RF proximity and determines the characteristic of these available services. SDP is an essential protocol that enables the Bluetooth devices to form an ad hoc network. RFCOMM is a transport protocol used to emulate the RS-232 serial ports. This protocol enables a Bluetooth device to connect with external devices like printers and scanners. The RFCOMM protocol relies on the baseband protocol stack to provide reliable in-sequence delivery of bit stream.

Security Architecture

Bluetooth security configuration depends on the user's Bluetooth device, who decides about the discoverability and connection options.

In general, Bluetooth discoverability and connection options are divided into three 'modes' of operation, which are as follows:

- **Silent***:* The device will never accept any connections. It simply monitors the Bluetooth traffic.

- **Private***:* The device cannot be discovered. A connection will be accepted only if the Bluetooth device address (BD_ADDR) of the device is known to the prospective master. A 48-bit BD_ADDR is normally unique and it refers globally to only one individual Bluetooth device.

- **Public***:* The device can be both discovered and connected to. It is, therefore, called a discoverable device.

  In addition to these modes, there are also four different security modes that a device can implement. These are as follows-

- **Non-Secure***:* The Bluetooth device does not initiate any security measures.
- **Service-Level Enforced Security Mode**: Two Bluetooth devices can establish a non secure ACL. Security procedures are initiated after an L2CAP connection oriented or an L2CAP connection-less channel request is made.
- **Link-Level Enforced Security Mode**: Security procedures are initiated when an ACL link is established and before any channel request is made.

- **Service-Level Enforced Security Mode (Ssp)**: This mode is similar to mode 2, except that only Bluetooth devices using secure simple pairing (SSP) can use it.

There are three main steps in Bluetooth security procedures, which are as follows

- **Authentication**: It involves proving the identity of one Piconet device to another. The objective of the authentication procedure is to determine the client's authorization level. The authentication is verified by checking the link keys. The sender encrypts the Bluetooth Device address of the receiver using the link key and a random number to produce a signed response authentication result (SRES). The SRES is sent to the receiver and the connection is established if the two link keys are equal.

- **Authorization**: It is the process of granting or denying access to a network resource.

- **Optional Encryption**: It is the encoding of information being exchanged between Bluetooth devices in a way that eavesdroppers cannot decode its contents.

The encryption is an essential part of Bluetooth security. The encryption key can vary between 8 and 128 bits. The user does not have access to change the size of the encryption key as the key size must be specified by the manufacturers according to the countries' regulations. A random number must be sent from one device to the other when any two Bluetooth devices wish to start the communication.

The receiving device must also have knowledge of the PIN from the sending devices. With these two sets of information, a link key is generated on both devices. Bluetooth security is based on building a chain of events. None of these events provides any meaningful information to an eavesdropper.

All the events must occur in a specific sequence for the enforcement of secured communication between two Bluetooth enabled devices. Two Bluetooth devices begin pairing with the same PIN code that is used for generating several 128- bit keys. The same PIN code can be used for all Bluetooth enabled devices in a trusted network.

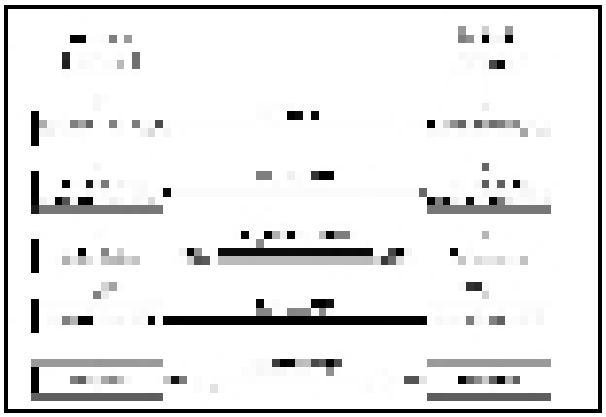

Fig. 2 shows the detailed pairing process of two Bluetooth enabled device.

An initialization key (K_{init}) is generated when two Bluetooth devices meet for the first time and it is used for generating more secured 128-bit keys, which are generated during the next phases of the security chain of events. The K_{init} is derived from a 128-bit pseudorandom number IN_RAND, an L-byte (1 ≤ L ≤16) PIN code, and the BD_ADDR. The K_{init} is produced in both devices using $K_{init} = E_{22}$ (PIN', L', IN_RAND). The PIN code and its length L are modified into two different quantities called PIN' and L' before sending them to the E_{22}function. If the PIN is less than 16 bytes, it is augmented by appending bytes from the device's BD_ADDR until the 'PIN' either reaches a total length of 16 bytes or the entire BD_ADDR is appended, whichever comes first. If one device has a fixed PIN code, the BD_ADDR of the other device is used. If both devices can support a variable PIN code, the BD_ADDR of the device that received the IN_RAND is used. The K_{init} is used to encrypt a 128-bit pseudorandom number (LK_RAND), i.e. LK_RAND K_{init} is exchanged in the next phase of the security chain of events when a link key (a unit key or a combination key) is generated. A unit key (K_A) is produced from the information of only one device (device *A*) using the formula K_A = E21 (BD_ADDRA, RANDA). Device A encrypts the K_A with the K_{init} (i.e. K_A_K_{init}) and sends it to device B. Device B decrypts the K_A with the K_{init} by (K_A_K_{init}) _K_{init}=K_A. Now, the both devices have the same K_A as a link key. Only devices that have limited resources to store several keys, these devices should use the unit key. And the security enforced by the unit key is only a low level of security. Therefore, Bluetooth specifications do not recommend using the unit key anymore. A combination key (K_{AB}) is dependent on two devices and therefore it is derived from the information of both devices. The K_{AB} is produced in both devices using KAB=E21 (BD_ADDR LK_RANDA)__E21(BD_ADDRB, LK_RANDB). It is worth noting to mention that generating the K_{AB} is nothing more than a simple bitwise XOR between two unit keys, i.e. K_{AB}=K_A_K_B. Each device can produce its own unit key and each device also has the BD_ADDR of the other device. Therefore, two devices have to exchange only their respective pseudorandom numbers in order to produce each other's unit keys. Device A encrypts the LK_RANDA with the current key K by LK_RANDA_K, where K can be the K_{init}, the K_A or the K_{AB} that was created earlier. Device A then sends the key to device B. The K is the K_{init} if the devices create a link key for the first time together. The K is the KA if the link key is a unit key, and it is the K_{AB} if the link key is being upgraded to a combination key. Device B decrypts the LK_RANDA with the K, (i.e., LK_RANDA_K _K=LK_RANDA), and can now produce the K_A. Correspondingly, device B encrypts the LK_RANDB with the K (i.e., LK_RANDB_K), and sends it to device A. Device A decrypts the LK_RANDB with the K (i.e., LK_RANDB_K _K=LK_RANDB), and produces the key K_B. Finally, both devices can produce the K_{AB} by using K_A and K_B (i.e., KAB=K_A_K_B). The next phase of the security chain of events is the challenge response authentication in which a claimant's knowledge of a secret link key is checked as illustrated in Fig. 3. During each authentication, a new 128-bit pseudorandom number AU_RAND is exchanged via air in an unencrypted form. Other inputs to the authentication function E1are the BD_ADDR of the claimant and the current link key (K_A or K_{AB}).

Attacks On The Bluetooth Security

1. Mac Spoofing Attack

Among all passive attacks, the most frequently reported attacks are classified as MAC spoofing attacks. When piconets formed through link key generation than MAC spoofing attack occurs. This attack can terminate the exiting connection, manipulate data while in transit. Bluetooth SIG did not provide a good solution to prevent this type of attack. They only advised the users to do the pairing process in private settings. They also suggested that a long, random, and variable PIN numbers should be used.

2. Pin Cracking Attack

These attackers can attempt to acquire IN_RAND, LK_RAND and the initialization key during the entire pairing and authentication processes. The attacker used to list all of the possible permutations combination of the PIN by using IN_RAND and BD_ADDR and then they only need to find the correct initialization key. The proposed solutions for these types of attacks involve different pairing and authentication schemes should involves using a combination of public/private keys.

3. Man-In-The-Middle Attack

Man-in-the-Middle attacks actually involve the modification of data between devices communicating in a Piconet. A Man-in-the-Middle attack usually generates unknown message between

two devices which are in connection & captures the secret. By acting between two devices an attacker can trick two devices into believing they are paired but actually they are paired with attacker the suggested solutions to this kind of attack involve incorporating more Piconet specific Information into the pairing process.

4. Bluejacking Attack

Bluejacking is the process of sending unsolicited messages to Bluetooth-enabled devices. This does not involve taking away data from the device, but nonetheless, it is unsolicited. Bluejacking is usually involves repetitive spam messages can be annoying to the user.

***5*. Bluesnarfing Attack**

Bluesnarfing is a method of hacking into a Bluetooth-enabled mobile phone and copying its entire contact book, calendar or anything else stored in the phone's memory.

By setting the device in non-discoverable a user can minimizes the chance of this kind of attack.

6. Bluebugging Attack

A BlueBugging attack means that an attacker connects to the target device and steals some sensitive information. It means that the attacker can, in addition to stealing information, send text messages to premium numbers. Hence the attacker can initiate phone calls to premium numbers, write to phonebook entries, connect to the Internet, set call forwards, try to slip a Bluetooth virus or worm to the target device.

***7*. Blueprinting Attack**

A BluePrinting attack is used to determine the manufacturer, device model and firmware version of the target device. This can be done by attacking on BD_ADDR of the target device.

***8*. Blueover Attack**

Blueover and its successor Blueover II are derived from Bluetooth. However, as they run on devices such as PDAs or mobile phones and are capable of stealing sensitive information by using a BlueBugging attack. A Blueover attack is done secretly. They also check whether Bluetooth devices are vulnerable or not, but they can be used for attacking against Bluetooth devices as well.

***9*. Off-Line Pin Recovery Attack**

An off-line PIN recovery attack is based on intercepting the IN_RAND value, LK_RAND values, AU_RAND value and SRES value, and after that trying to calculate the correct SRES value by guessing different PIN values until the calculated SRES equals the intercepted SRES and usually SRES are of 32 bits.

10. Brute-Force Attack A brute-force BD_ADDR scanning attack uses a brute-force method only on the last three bytes of a BD_ADDR, because the first three bytes are publicly known and can be set as fixed.

Bluetooth Network Vulnerabilities

Increased usage of Bluetooth devices makes security concerns even more alarming. Hence, Bluetooth security architecture needs a constant upgrading to prevent new unknown threats. Like any other wireless communication system Bluetooth transmission can be deliberately jammed or intercepted. False or modified information could be passed to the devices by the cyber criminals. Security threats in Bluetooth can be divided into three major categories:

- Disclosure threat: The information can leak from the target system to attacker that is not authorized to access the information.
- Integrity threat: The information can be deliberately altered to mislead the recipient.
- Denial of Service (DoS) threat: The users can be blocked to get access to a service by making it either unavailable or severely limiting its availability to an authorized user.

Counter Measures

The following security countermeasures should be implemented to protect devices against the attacks discussed in this paper.

- Set Bluetooth device to non-discoverable by other devices
- Implement pairing with PIN authentication
- Do not use short PINs
- Disable Bluetooth on mobile devices if not needed
- Educate users on the threats against Bluetooth technology

Risk Mitigation

Risk mitigation can be achieved in Bluetooth systems by applying countermeasures to address specific threats and vulnerabilities. It should be noted that the development of improved security comes at a cost—financial expenses related to security equipment, maintenance, and operation, which should also be considered during development of new security features.

The first line of defense is to provide an adequate level of knowledge and understanding for the users of Bluetooth-enabled devices. Users should understand the security policies that address the use of Bluetooth enabled devices and their own responsibilities. The Bluetooth security experts should include awareness based education to support user's understanding and knowledge of Bluetooth security. Policy documents should

include a list of approved uses for Bluetooth, and the type of information that may be transferred over Bluetooth networks.

Conclusion

The security of Bluetooth technology is continuously evolving as the Bluetooth Special Interest Group (SIG) improves on the Bluetooth specification.

Industry is also working to reduce vulnerabilities through upgrades that exist in current software residing on mobile devices, and updating the design of new devices. As with any new technology, security can only be achieved through a consistent visibility of weakness and responsiveness to fixing the vulnerabilities through patches or upgrades.

Bibliography:

[1] "The Bluetooth Blues", available at http://www.information-age.com/article/2001/may/the_bluetooth_blues

[2] Bluetooth SIG, Specification of the Bluetooth System: Volume 2, Profile, Version 1.1, Feb. 22, 2001. available at: https://www.bluetooth.org/About/bluetooth_sig.htm

Grid Interconnection of Renewable Energy Source using Custom Power Device with Power Quality Improvement

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Abstract
This paper present Renewable energy based distribution generation system with Custom power device such as STATCOM, UPQC play a important role in power quality improvement. Power Generation source are facing shortage of fuel and need to reduce emission. Long transmission lines are one of the major causes of power losses. Therefore emphasis has increased on distribution generation system with renewable energy sources. Most of integration of renewable energy system to grid takes place with the aid of power electronics converter. The main purpose of power electronic converter is to integrate with distribution generation with compliance of power quality standards. Custom power devices like STATCOM, UPQC are the latest development of interfacing device between distribution supply and consumer appliance to overcome Voltage/Current disturbance and improve the power quality by compensating the reactive power and harmonic power generated or absorbed by the load.
Keywords:-Power Quality, STATCOM (static synchronous compensator), UPQC (unified power quality conditioner), Renewable Energy Source (RES), Distribution Generation (DG).

Introduction

The increasing demand of Distributed Generation (DG) in recent years, to minimize the gap between the supply and load demand, is introducing some voltage and current disturbance and harmonics due to the generator types and the interfacing power electronics converters. Therefore, quality of power supply has become an important issue with the increasing demand of DG systems either connected to the grid through grid-tie inverters or work in isolated (micro grid) mode. The need for monitoring of power quality in low voltage distribution levels and ways to mitigate the problems are also increasing due to better customer service, reasonably priced meters, telecommunication development, network planning, oper ation and regulation requirements. Solar and Wind are the most promising DG sources and their penetration level to the grid is also on the rise. Although the benefits of DG include voltage support, diversification of power sources, reduction in transmission and distribution losses and improved reliability. Power quality problems are also of growing concern. This paper deals with a grid interconnection with renewable energy source using custom power device and their impact on power quality.

Power Quality Issue (DG)

Approximately 70 to 80% of all power quality related problems can be attributed to faulty connection and wiring. There are various categories of power quality problem such as electromagnetic interference transients, harmonics and low power factor that are related to the source of supply and type of loads. Among the above mentioned categories, harmonics are the most dominant one. According to IEEE standards, harmonics in the power system should be limited by two different methods; one is the limit of harmonic current that a user can inject in to the utility system at the point of common coupling (PCC) and the other is the limit of harmonic voltage that the utility can supply to any customer at the PCC. The voltage variation, flicker, harmonics causes the malfunction of the equipments namely microprocessor based control system, programmable logic controller; adjustable speed drives, flickering of light and screen. It may leads to tripping of contractors, tripping of protection devices, stoppage of sensitive equipments like personal computer, programmable logic control system. Thus it degrades the power quality in the grid.

Power Quality Issues in a Grid Integration of Renewable Energy System.

A. Solar Photovoltaic System

In this system the output of the PV panel depends on the solar intensity and the cloud cover. Therefore the PQ problems not only depend on irradiation but also are based on the overall performance of solar photovoltaic system including PV modules, inverters, filters controlling mechanism etc. Survey studies, shows that the short fluctuation of irradiance and cloud cover play an important role for low voltage distribution grids with high penetration of PV. Therefore special attention should be aid to the voltage profile and the power flow on the line.

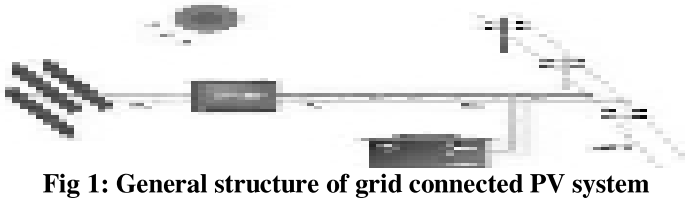


Fig 1: General structure of grid connected PV system

The general block diagram of grid connected PV system is shown in fig (1) and the system can be a single phase or three phases depending on the grid connection requirements In general, a grid connected PV inverter is not able to control the reactive and harmonic currents drawn from non liner loads.

***B.* Wind Energy System**

In a wind energy conversion system, a wind turbine captures the power from wind, which rotates a generator in the huge wind turbine box. Wind turbines can operate with either fix speed or variable speed. For a fix speed wind turbine, the generator is connected to the grid directly. Since the speed is fixed, this kind of wind turbines cannot respond the turbulence of wind speed effectively, which could result in the power swing transmitted to the grid and affects the power quality. For a variable speed wind turbine, the generator is connected to the grid through power electronics equipments. The rotor speed has the possibility to be controlled by those equipments. As a result, the power fluctuations caused by the wind speed variations can be reduced, which improves the power quality comparing with the fix speed wind turbine system. Permanent magnet synchronous generators (PMSG) with wind energy conversion system(WECS) as shown in fig.(2)

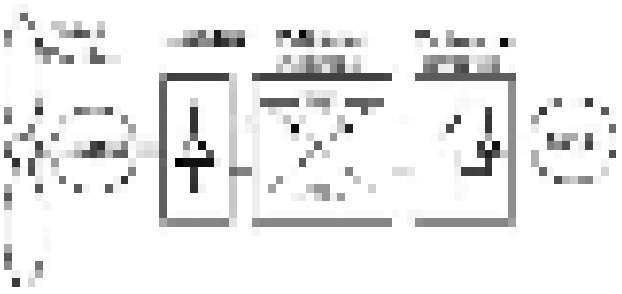


Fig2: PMSG based WECS system with dc boost chopper.

Impact of Power Quality Issues

The impact of Power quality divided into three broad categories: direct, indirect and social. The recent survey which is carried out in European countries and survey reported Power Quality costs due to effect of voltage dips & swells, short interruption, Long interruption, harmonic ,surge & transients, flicker, unbalance, earthing & electromagnetic compability (EMC) problem. At same time it is necessary to consider the impact of DG in term of the cost Power quality. A method to evaluate the dip & interruption cost due to DG into grid has been proposed. Based on operating hours, the frequency PQ events occur & cost of PQ events indicates the positive and negative impact of DG.

Mitigation of PQ Problems

There are two ways to mitigate the power quality problems- either from the customer side or from the utility side. The first approach is called load conditioning, which ensures that the equipment is less sensitive to power disturbances, allowing the operation even under significant voltage distortion. The other solution is to install line conditioning systems that suppress or counteracts the power system disturbances. Several devices including flywheels, super capacitors, other energy storage systems, constant voltage transformers, noise filters, isolation transformers, transient voltage surge suppressors are used for the mitigation of specific PQ problems. Facts devices like DSTATCOM, DVR and UPQC are capable of mitigating multiple PQ problems associated with utility distribution and the end user appliances.

Role of Custom Power Devices

A.UPQC (Unified Power Quality Conditioner)

Implementation of Custom Power Devices (CPD) like UPQC in DG or micro grid systems to improve the power quality is gaining greater importance. UPQC is the integration of series and shunt active filters, connected back-to-back on the dc side, sharing a common DC capacitor as shown in Fig (3). The series component of the UPQC is responsible for mitigation of the supply side disturbances: voltage sags/swells, flicker, voltage unbalance and harmonics. It inserts voltages so as to maintain the load voltages at a desired level; balanced and distortion free. The shunt component is responsible for mitigating the current quality problems caused by the consumer: poor power factor, load harmonic currents, load unbalance etc. It injects currents in the ac system such that the source currents become balanced sinusoids and in phase with the source voltages.

Emphasis has been given on incorporation techniques of UPQC in DG or micro grid system along with their advantages and disadvantages. More DGs such as Photovoltaic or Wind Energy Systems are now penetrating into the grid or micro grid. Again, numbers of nonlinear loads are also increasing. Therefore, current research on capacity enhancement techniques of UPQC to cope up with the expanding DG or micro grid system is also reviewed.

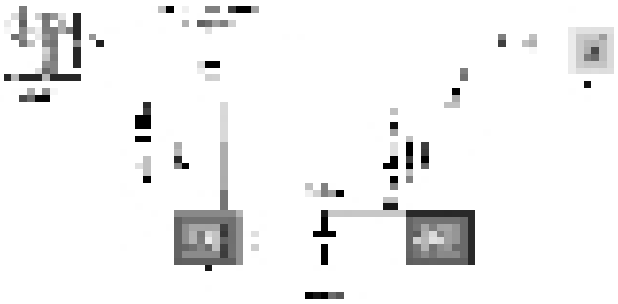


Fig3:- System Configuration of UPFC

B. STATCOM (Static Compensator)

STATCOM is a shunt-connected reactive-power compensation device shown in fig (4) that is capable of generating and/ or absorbing reactive power and in which the output can be varied to control the specific parameters of an electric power system. It is in general solid-state switching converter capable of generating or absorbing independently controllable real and reactive power at its output terminals when it is fed from an

energy source or energy-storage device at its input terminals. Specifically, the STATCOM considered is a voltage-source converter that, from a given input of dc voltage, produces a set of 3-phase ac-output voltages, each in phase with and coupled to the corresponding ac system voltage through a relatively small reactance (which is provided by either an interface reactor or the leakage inductance of a coupling transformer). The dc voltage is provided by an energy-storage capacitor.

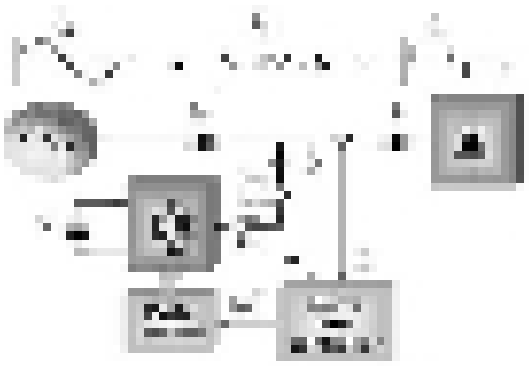
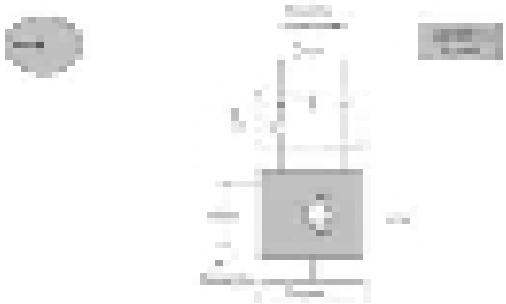


Fig4:-System configuration of STATCOM

A STATCOM can improve power-system performance in such areas as the following:
1. The dynamic voltage control in transmission and distribution systems.
2. The transient stability.
3. The voltage flicker control.
4. The power-oscillation damping in power transmission systems.

As the traditional STATCOM works only in leading and lagging operating mode, its application is therefore limited to reactive power support only. The fluctuating power due to the variation of wind cannot be smoothen by reactive power control using a STATCOM, because it has no active power controllability. To overcome this problem, Battery Energy Storage system (BESS) has been incorporated with STATCOM which has both real and reactive power control ability. The DVR is a series connected facts device to protect sensitive loads from supply side disturbances. It can also act as a series active filter, isolating the source from harmonics generated by loads. It consist of a voltage source PWM converter equipped with a dc capacitor and connected in series with utility supply voltage through a low pass filter and a coupling transformer as shown in fig(5)



Fig(5):- DC Capacitor supported DVR

Conclusion

In this paper we present the role of Facts devices in improving power quality in a grid connected renewable energy system. Recent trends in the power generation and distribution systems show that penetration level of DG into the grid has increased considerably. End users appliances are becoming more sensitive to the power quality conditions. Extensive research on facts devices for the mitigation of PQ problems are also carried out. Facts devices are found to be very capable in integrating solar and wind energy sources to the grid.

References/Bibliography

[1] EI-Samahy, EI-Saadany," The Effect of DG on power Quality in a Deregulated Environment," in *IEEE power Engineering Society General Meeting, pp.2969-2976, 2005.*

[2] R.Billinton and Y.Gao,"Multistate Wind Energy Conversion System models for adequency assessment of generating systems incorporating Wind Energy,"*IEEE Trans.on E.Conv., vol, 23, no.1, pp, 163-169, 2008.*

[3] S.M Halpin, L.L.Grigsby the Electric Power Engineering Handbook, CRC

[4] R.D.Hendrson, .J.Rose,"Harmonics: The Effects on Power Quality And Transformers", IEEE Trans Industry Apply, vol (3), pp528-532, 1994.

[5] S.M Halpin, L.L.Grigsby the Electric Power Engineering Handbook, CRC LLC, PP15.22-23, 2001.

[6] IEEE 1547, Standard for Interconnecting Distributed Resources with Electric power systems, pp8-10, 2003.

[7] G Chicco, J Schlabbach, F Spertino,"Experimental assessment of the waveform distortion in grid connected photovoltaic Installations", Solar Energy, Vol.83,pp 1026-1039, 2009.

[8] Geibel, D., T.Degner, "Improvement of Power quality and Reliability with multifunctional PV-Inverters in distributed energy system", in EPQU 2009.

[9] Mde Alegria,J Andreu,J L Martin,P Ibanez, "Connection requirements for Wind farms: A survey on technical requirements and regulations" Renewable and Sustainable Energy Reviews, vol.11,1858-1872, 2007.

[10] S M Dehghan,M Mohammdian and A Y Varjani," A New variable speed Wind energy Conversion System using Permanent Magnet Synchronous Genenerator and Z source Inverter", IEEE Trans Energy conv, vol 24,714-724, 2009.

[11] A Baggini, Handbook of Power Quality, John wiley&sons Ltd, UK pp 3-15, 2008.

[12] A Ghosh and G Ledwich, Power quality enhancement using custom power devices, Kluwer Academic,2002

[13] S.M.Muyeen, R Takahashi,T Murata, Tamura "Application of STATCOM/BESS for Wind power smoothing and hydrogen generation "Electric power systems Reserch, vol 79,pp365- 373, 2009.

[14] A Ghosh, "Compensation of Distribution System voltage using DVR",IEEE Trans on power delivery, vol 17,pp1030-1036, 2002.

[15] H Fujita, H Akagi," The Unified Power Quality Conditioner', IEEE Trans on power electronics, vol.13, pp.315-322, 1998.

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Nanotechnology: A Perspective

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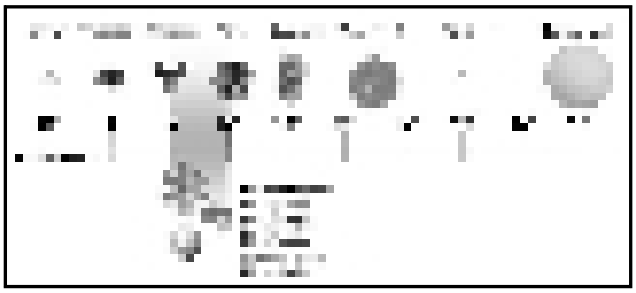
Nanotechnology is combination of Nano and Technology, Nano means very small or "miniature" so it is the technology in miniature form. Nanotechnology is the manipulation of matter on an atomic, molecular, and supramolecular scale; more precisely it is "the manipulation of matter with at least one dimension sized from 1 to 100 nanometers". Nanotechnology covers Food and Beverage, Bio- Technology, Forensic Sciences, Genetics, Space Research, Environment, Industry, Medicine etc. Hence the associated research and applications of Nanotechnology are very diverse, ranging from extensions of conventional device physics to completely new approaches based upon molecular self-assembly, from developing new materials with dimensions on the nano scale to direct control of matter on the atomic scale.

The concept of nanotechnology was first introduced in 1959 by renowned physicist Richard Feynman in his talk "There's Plenty of Room at the Bottom", describing the possibility of synthesis via direct manipulation of atoms focusing about the miniaturization and how it would create smaller and powerful devices; but the term "nano-technology" was first used by Norio Taniguchi in 1974. In 1986 K. Eric Drexler in his book "Engines of Creation: The Coming Era of Nanotechnology" proposed the idea of a nano scale "assembler" which would be able to build a copy of itself and of other items of arbitrary complexity with atomic control. Thus, emergence of nanotechnology as a field occurred in the 1980s through conceptual framework and high-visibility experimental advances like, the invention of the scanning tunneling microscope in 1981 provided visualization of individual atoms and bonds, and was successfully used to manipulate individual atoms in 1989 (1-3).

It's hard to imagine just how small nanotechnology is, here are a few illustrative examples:

One nanometer is a billionth of a meter, or 10^{-9} of a meter.
One nanometer is about 3 atoms long.
A human hair is about 60-80,000 nanometers.
An inch is 25,400,000 nanometers.
A sheet of newspaper is 10^{6} nanometers.
If a marble were a nanometer, then one meter would be the size of the Earth.

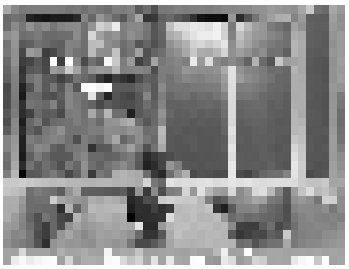


Although modern nano science and nanotechnology are quite new, nano scale materials were used for centuries. Alternate-sized gold and silver particles created colors in the stained glass windows of medieval churches hundreds of years ago. The artists back then just didn't know that the process they used to create these beautiful works of art actually led to changes in the composition of the materials they were working with. Today's scientists and engineers are finding ways to deliberately make materials at the nano scale to take advantage of their enhanced properties such as higher strength, lighter weight, increased control of light spectrum, and greater chemical reactivity than their larger-scale counterparts and a number of applications are already in use and other are getting ready for usable applications

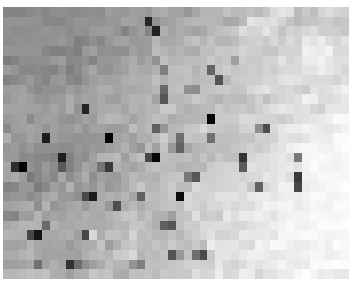
The Benefits So Far

Current commercial applications of Nanotechnology include:

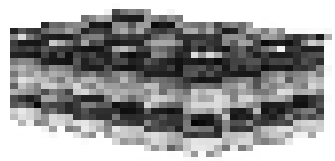
- **Sunscreens** containing nano zinc oxide particles which absorb and reflect UV rays making lotions transparent and smooth along with more appealing to the consumer.



Self cleaning windows coated with a nano material which breaks down dirt when the sun shines on these and during rain instead of forming droplets it will spread water evenly over the panel and wash away the broken down dirt.



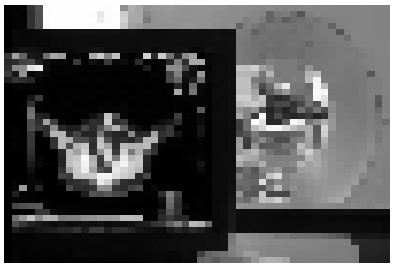
Stain repellent fabrics are made by immersing rolls of woven cotton fabric in liquids containing nanotech fibers which is then annealed in an oven, binding the tiny fibers to the cotton threads making it impermeable to liquid.



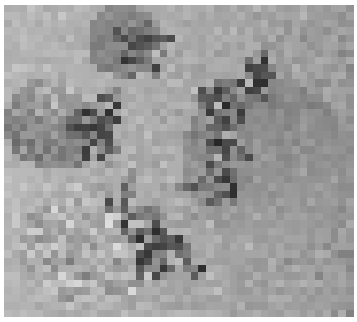
Bouncy tennis balls are coated in nano sized material. A molecular barrier is formed by the tiny particles that trap air molecules making the balls extra bouncy.

Carbon Nano tubes are the stiffest and strongest known fibers and have unique electrical properties. They are Single-Wall, Double Wall and Multi-Walled black nano scale cylindrical tubes of graphitic carbon with numerous applications like, flat screen displays, scanning probe microscopes in brushes for commercial electric motors, and in sensing devices and because of their strength in numerous aerospace and automotive uses, in body armor and tear-resistant cloth fibers and textiles and stronger and lighter sports equipment.

Some Applications Visible At the Horizon:
Fighting Cancer at the Source



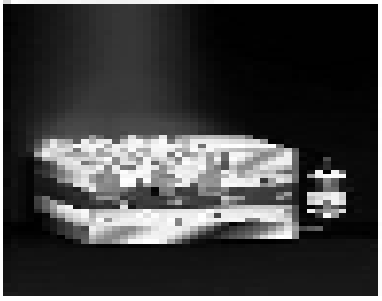
Nano particle treatments can work for diseases beyond just cancer, including bacteria and viruses. At IBM, researchers in California have built degradable nano particles that can glom onto drug-resistant bacterial strains and **rip them open**, draining their contents.



Gene Therapy and Drug Delivery

Nano particles of different shapes and chemical makeup can track down and target specific cells of a chemist's choosing, and perform a variety of tasks. Researchers at Johns Hopkins and Northwestern universities were able to control the shape of the nano particles. The team's animal tests showed that a nano particle's shape can dramatically affect how well it delivers gene therapy.

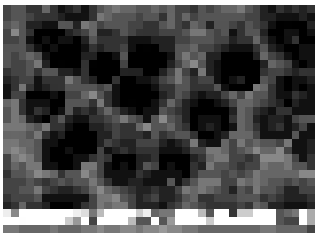
Wireless Nanocrystals Efficiently Radiate Visible Light

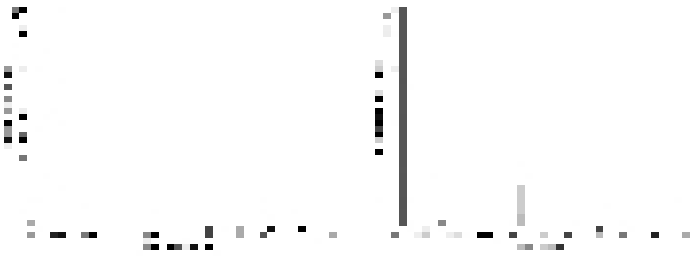


A wireless nano device which functions like a fluorescent light — but potentially far more efficiently — has been developed in a joint project between the National Nuclear Security Administration's Los Alamos and Sandia national laboratories. It efficiently causes nano crystals to emit light when placed on top of a nearby energy source, eliminating the need to put wires directly on the nano crystals.

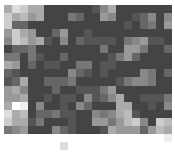
Nano materials are independently synthesized using the basic sciences such as chemistry, physics and, for some nano particles, biology (with the use of bacteria and plants). For instance, some nano materials are now and will in the future be used in the semiconductor industry; they are being used and will be used to improve IC manufacturing, for medicine, molecular biology, food monitoring, bar coding, threat agents monitoring, counterfeit money monitoring, disinfection, environmental monitoring, paints and coating, catalysts for various reactions, agriculture improvements, etc. There are currently enormous amounts of work required before we can harness the good things that can come out of nanotechnology like:

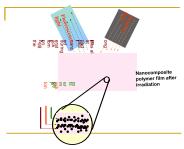
Some research and development efforts which invited accolades related to nano porous polymer membranes designed and characterized for their optical properties, gas and ion separation properties in particular nuclear track etched membranes being developed for gas separation (4-6)

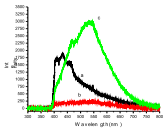


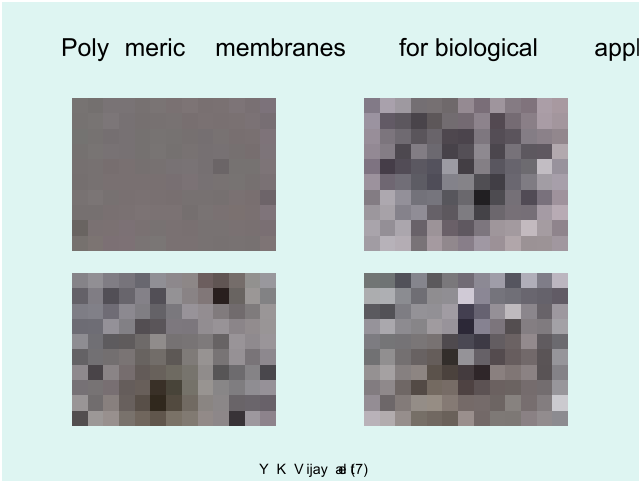


Without membrane **With membrane**









Down the line after five more years a lot more of its commercial

products will be available in the market for commercial use.

- Nano particles (like CNT) will be more applied in synthesizing biopolymers as they can increase the mechanical properties of polymers. Nanotechnology will be useful in cancer therapy.
- The new advances in Nanotechnology will provide the information about how the proteins in a cell work together in networks to orchestrate the chemistry of life. Specific genes and proteins linked to numerous diseases and disorders, including breast cancer, muscle disease, deafness, and blindness may be identified and diagnosed.
- Nano electronics and computer technology will allow the construction of smaller circuits and faster having longer life.
- For the environment and energy, nanometer sized solar cells will provide much of the energy needed around the world and nano materials will increase the efficiency of fuel cells and batteries. While 'green' processing technologies will minimize the generation of undesirable by-product effluents by curbing emissions.
- In health care and medicine biological nano sensors may be developed which will be used for fast and accurate diagnostics moreover artificial muscle and 'lab on a chip' technology may develop more efficient drug discovery processes.

References and Bibliography:

1. A.K. Bandyopadhyay, Nano Materials, New Age International, (2010).
2. G. Cao, Y. Wang, Nanostructures and Nanomaterials, World Scientific (2011).
3. J. J. Ramsden, Nanotechnology: An introduction, Springer (2011).
4. Characterization of nanocomposite polymeric membrane YK Vijay, V Kulshrestha, K Awasthi, NK Acharya, A Jain, Journal of Polymer Research, 2006
5. Modification in microstructure and properties of polymers by 10 keV electron beam YK Vijay, NK Acharya, V Kulshrestha, M Singh, International Journal of Nanoscience, 2007
6. Swift heavy ion irradiation effect on Cu-doped CdS nanocrystals embedded in PMMAS Agrawal, S Srivastava, S Kumar, SS Sharma, Bulletin of Materials Science, 2009
7. Surface modification and synthesis of polymeric membrane for energy and biological applications YK Vijay, M Dhayal, K Awasthi, V Kulshrestha, Journal of Biomedical Nanotechnology, 2006
8. http://en.wikipedia.org/wiki/Applications_of_nanotechnology
9. http://www.nano.gov/you/nanotechnology-benefits
10. http://crnano.org/whatis.htm
11. http://www.futuretimeline.net/subject/nanotechnology.htm

Disclaimer

This article is a review of global development of nanotechnology and allied techniques. Information from many sources has been collected and it may not be possible to acknowledge them all. Authors disclose that except work of Prof. Y. K. Vijay's group all other cited work is collection of other's work.

Designing Single Mode Fibre

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Introduction

In this age of communication technology.the exponentially growing need for newer communication channels,have attracted scientists,engneers and technologies to utilize the optical frequencies (=1015Hz).These offer about 1,00,000 times the channels available at existing microwave frequencies (1010Hz). Two basic requirements viz source and guiding medium have developed to appropiate levels. Lasers of wide range of frequenciesand of varied characteristics are available.The communication links, the optical fibres with losses below 0.2 dB/km are available.The required communication components detectors, trasducers, couplers, duplexes, isolators, phaseshifters etc.have been and are being developed. The days are not far when entire communication system will be taken over by optical frequencies utilizing optical computers. An optical fiber is a flexible, transparent fiber made of a pure glass (silica) not much thicker than a human hair. It functions as a waveguide, or "light pipe", to transmit light between the two ends of the fiber. The field of applied science and engineering concerned with the design and application of optical fibers is known as fiber optics. Telecommunications using fibers as the transmission media is now a major industry. Choosing appropriate fiber parameters is an important issue for a given optical system. Cross-sectional dimensions, material composition, and refractive index profile all influence the losses, dispersion and the nonlinearities of the fiber and must be chosen carefully to achieve a satisfactory tradeoff for a given application. Optical fibers typically include a transparent core surrounded by a transparent cladding material with a lower index of refraction. Light is kept in the core by total internal reflection. This causes the fiber to act as a waveguide. Fibers that support many propagation paths or transverse modes are called multi-mode fibers (MMF), while those that only support a single mode are called single-mode fibers (SMF). Multi-mode fibers generally have a wider core diameter, and are used for short-distance communication links and for applications where high power must be transmitted. Single-mode fibers are used for most communication links longer than 1,050 meters (3,440 ft).

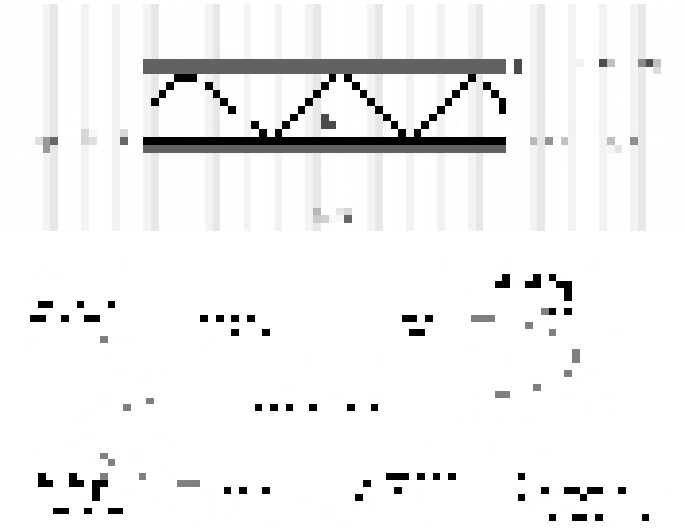
Historical Developments

Guiding of light by refraction, the principle that makes fiber optics possible, was first demonstrated by Daniel Colladon and Jacques Babinet in Paris in the early 1840s. John Tyndall included a demonstration of it in his public lectures in London, 12 years later. Tyndall also wrote about the property of total internal reflection in an introductory book about the nature of light in 1870: "When the light passes from air into water, the refracted ray is bent towards the perpendicular... When the ray passes from water to air it is bent from the perpendicular... If the angle which the ray in water encloses with the perpendicular to the surface be greater than 48 degrees, the ray will not quit the water at all: it will be totally reflected at the surface.... The angle which marks the limit where total reflection begins is called the limiting angle of the medium. For water this angle is 48°27', for flint glass it is 38°41', while for diamond it is 23°42'." Unpigmented human hairs have also been shown to act as an optical fiber.

Practical application the twentieth century. Image transmission through tubes was demonstrated independently by the radio experimenter Clarence Hansell and the television pioneer John Logie Baird in the 1920s. The principle was first used for internal medical examinations by Heinrich Lamm in the following decade. Modern optical fibers, where the glass fiber is coated with a transparent cladding to offer a more suitable refractive index, appeared later in the decade. Harold Hopkins and Narinder Singh Kapany at Imperial College in London achieved low-loss light transmission through a 75 cm long bundle which combined several thousand fibers. Their article titled "A flexible fibrescope, using static scanning" was published in the journal Nature in 1954. The first fiber optic semi-flexible gastroscope was patented by Basil Hirschowitz, C. Wilbur Peters, and Lawrence E. Curtiss, researchers at the University of Michigan, in 1956. In the process of developing the gastroscope, Curtiss produced the first glass-clad fibers; previous optical fibers had relied on air or impractical oils and waxes as the low-index cladding material. NASA used fiber optics in the television cameras sent to the moon. At the time, the use in the cameras was classified confidential, and only those with the right security clearance or those accompanied by someone with the right security clearance were permitted to handle the cameras. The crucial attenuation limit of 20 dB/km was first achieved in 1970, by researchers Robert D. Maurer, Donald Keck, Peter C. Schultz, and Frank Zimar working for American glass maker Corning Glass Works, now Corning Incorporated. They demonstrated a fiber with 17 dB/km attenuation by doping silica glass with titanium. A few years later they produced a fiber with only 4 dB/km attenuation using germanium dioxide as the core dopant. Such low attenuation ushered in optical fiber telecommunication. In 1981, General Electricproduced fused quartz ingots that could be drawn into fiber optic strands 25 miles (40 km) long. Attenuation in modern optical cables is far less than in electrical copper cables, leading to long-haul fiber connections with repeater distances of 70–150 kilometers (43–93 mi). Theerbium-doped fiber amplifier, which reduced the cost of long-distance fiber systems by reducing or eliminating optical-electrical-optical repeaters, was co-developed by teams led byDavid N.

Payne of the University of Southampton and Emmanuel Desurvire at Bell Labs in 1986. Robust modern optical fiber uses glass for both core and sheath, and is therefore less prone to aging. It was invented by Gerhard Bernsee of Schott Glass in Germany in 1973.

A Fiber-Optic Communication System:



Types of Fiber Optics:

We know that the light or the optical signals are guided through the silica glass fibers by total internal reflection. A typical glass fiber consists of a central core glass (µm) surrounded by a cladding made of a glass of slightly lower refractive index than the core's refractive index. The overall diameter of the fiber is about to µm. Cladding is necessary to provide proper light guidance i.e. to retain the light energy within the core as well as to provide high mechanical strength and safety to the core from scratches. Based on the refractive index profile we have types of fibers

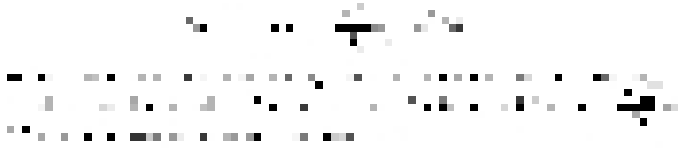
(a) Step-index multimode
(b) Step-index single mode
(c) Graded-index

a) Step index fiber: In the step index fiber, the refractive index of the core is uniform throughout and undergoes an abrupt or step change at the core cladding boundary. The light rays propagating through the fiber are in the form of meridional rays which will cross the fiber axis during every reflection at the core cladding boundary and are propagating ina zig-zag manner as shown in figure a.

b) Graded index fiber: In the graded index fiber, the refractive index of the core is made to vary in the parabolic manner such that the maximum value of refractive index is at the centre of the core. The light rays propagating through it are in the form of skew rays or helical rays which will not cross the fiber axis at any time and are propagating around the fiber axis in a helical (or) spiral manner as shown in figure b.

Based on the number of modes propagating through the fiber, there are multimode fibers and single mode fibers. Mode is the mathematical concept of describing the nature of propagation of electromagnetic waves in a waveguide. Mode means the nature of the electromagnetic field pattern (or) configuration along the light path inside the fiber. In metallic wave-guides there are transverse electric (TE) modes for which $E_z = 0$ but $H_z = 0$ and transverse magnetic (TM) modes for which $H_z = 0$ but $E_z = 0$ when the propagation of microwaves is along the z-axis. In optical fibers, along with TE and TM modes, there are also hybrid modes which have both axial electric and magnetic fields E_z and H_z. The hybrid modes are further classified into EH and HE modes. In EH modes, the axial magnetic field H_z is relatively strong whereas in HE modes, the axial electric field E_z is relatively strong. Based on the linearly polarized nature of light, today these modes are designated as linearly polarized (LP) modes. For example LP mode corresponds to HE mode. LP mode is the combination of HE , TE and TM modes.

(c) Single mode fibers: In a single mode fiber, only one mode (LP mode) can propagate through the fiber (figure 1c). Normally the number of modes propagating through the fiber is proportional to its V-number where



In the case of single mode fiber, V-number 2.405. The single mode fiber has a smaller core diameter (10 µm) and the difference between the refractive indices of the core and the cladding is very small. Fabrication of single mode fibers is very difficult and so the fiber is expensive. Further the launching of light into single mode fibers is also difficult. Generally in the

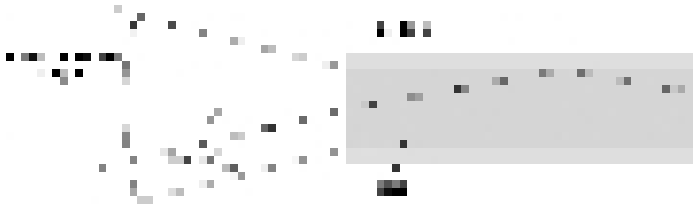
single mode fibers, the transmission loss and dispersion or degradation of the signal are very small. So the single mode fibers are very useful in long distance communication.

(d) Multimode fibers: Multimode fibers allow a large number of modes for the light rays traveling through it. Here the V-number is greater than 2.405. Total number of modes 'N' propagating through a given multimode step index fiber is given by

here d is the diameter of the core of the fiber. For a multimode graded index fiber having parabolic refractive index profile core,

which is half the number supported by a multimode step index fiber. Generally in multimode fibers, the core diameter and the relative refractive index difference are larger than in the single mode fiber. In the case of multimode graded index fiber, signal distortion is very low because of self-focusing effects. Here the light rays travel at different speeds in different paths of the fiber because of the parabolic variation of refractive index of the core. As a result, light rays near the outer edge travel faster than the light rays near the centre of the core. In effect, light rays are continuously refocused as they travel down the fiber and almost all the rays reach the exit end of the fiber at the same time due to the helical path of the light propagation. Launching of light into the fiber and fabrication of the fiber are easy. These fibers are generally used in local area networks.

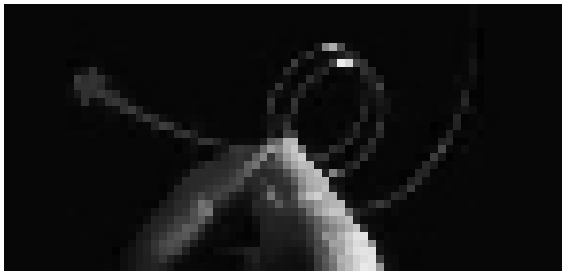
Optical Fiber's Numerical Aperture (Na):



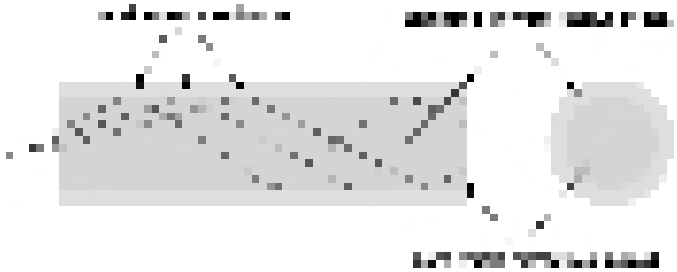
Multimode optical fiber will only propagate light that enters the fiber within a certain cone, known as the acceptance cone of the fiber. The half-angle of this cone is called the acceptance angle, θ_{max}. For step-index multimode fiber, the acceptance angle is determined only by the indices of refraction:

Where n is the refractive index of the medium light is traveling before entering the fiber n_f is the refractive index of the fiber core n_c is the refractive index of the cladding

How Optical Fiber Works:



Optical fibers are based entirely on the principle of total internal reflection. This is explained in the following picture.



Optical fiber is a long, thin strand of very pure glass about the diameter of a human hair. Optical fibers are arranged in bundles called optical cables and used to transmit light signals over long distances.

Fiber Propagation Modes

Scalar Fiber Modes
The designation of Linearly Polarized (LP) Fiber modes is based on the assumption of weak guidance.
Weakly guiding fibers have a small difference between core and cladding refractive index.
Two numbers designate the LP (m, n) modes:
m – azimuthal number
n – orbital number where m = 0, 1, 2, … and n = 1, 2…
Both guided and cladding modes of arbitrary circular symmetric refractive index profile are calculated either by the accurate finite difference method or by the analytical matrix method.

Vector Fiber Modes
The designation of vector fiber modes TE, TM, EH, and HE follows the convention:
TE (0,n) – transverse electric family of modes
TM (0,n) – transverse magnetic family of modes
EH (m, n) – hybrid family of modes
HE (m, n) – hybrid family of modes
where m and n=1, 2…

Mode Field Diameter and Area Importance:
The Mode Field Diameter (MFD) is an important parameter related to the optical field distribution in the fiber. It has been shown that MFD provides useful information about the cabling

performances, such as possible joint, macrobending, and microbending losses.

- Near-field diameter definition
- Far-field diameter definition
- Effective diameter definition

Cutoff Wavelength:

The cutoff wavelength for any mode is defined as the maximum wavelength at which that mode will propagate. The cutoff wavelength ▪ c of LP" is an important specification for a single-mode fiber. The operation wavelength must be greater than the cutoff wavelength of LP▪ to operate the fiber in a single mode regime. ▪ c can be determined analytically for some specified fiber profiles. For a general fiber profile, a highly accurate numerical mode solver should be involved to calculate cutoff wavelength.

***A* "Theoretical" Cutoff Value**

This is the wavelength, above which the given mode cannot propagate, even in short and unperturbed samples of this fiber. This value is calculated using the general numerical mode-solvers of Optimizer. It is defined as the wavelength, above which the Eigen value problem formulated for the current fiber design and for the given mode does not have real solutions.

Fiber Loss Model

The total fiber loss can be divided into material losses and fiber induced losses. Material losses include Rayleigh scattering, ultraviolet (UV), infrared (IR) absorption, and hydroxyl (OH) absorption losses. Material losses are the limiting losses in fibers.

- Rayleigh scattering model
- Ultraviolet absorption model
- OH-radical absorption model
  Lorentzian fit method:
  Gaussian fit method:
- Infrared absorption model

Bending Loss Model

- Macrobending loss model
- Microbending loss model

Splice Loss Model

A splice is the dielectric interface between two optical fibers. For splicing calculations, we assume that the mode field of single-mode fibers is nearly Gaussian. The coupling losses for the splicing connectors can be calculated by evaluating the coupling between two misaligned Gaussian beams.

Fiber Birefrienges Model

The birefringence is defined by the difference between the propagation constants of the polarization Eigenmodes, that is:

(a) Intrinsic Perturbations Birefringence

These include a noncircular core and nonsymmetrical stress fields in the glass around the core region. A noncircular core gives rise to geometric birefringence, whereas a nonsymmetrical stress field creates stress birefringence. These results were obtained by the perturbation theory and applied only for step index fibers.

- Elliptical core birefringence definition
- Internal stress birefringence definition

(b) Extrinsic Perturbations Birefringence

Birefringence can also be created in a fiber when it is subjected to external forces in handling or cabling. Such extrinsic sources of birefringence include lateral stress, fiber bending and fiber twisting. All three of these mechanisms are usually present to some extent in spooled and field-installed telecommunications fiber.

- Lateral stress birefringence definition
- Bending birefringence definition
- Bending under tension birefringence definition
- Bending under tension birefringence definition

Experiment

Object

Designing Single Mode Fiber

In this we will show how to simulate a simple single-mode optical fiber that is optimized for use in the 1310 nm wavelength region.

Theory

Geometry and Parameters

Let us consider a four-layer cylindrical dielectric structure as shown in Figure ▪ ▪ layers are assumed to be lossless, linear, isotropic, homogeneous, and nonmagnetic. A cylindrical coordinate system (,▪ ,▪) with the z-axis coinciding with the axis of the dielectric structure, is chosen for the field analysis. The ith layer has a radius r_i and a refractive index n_i; i -1 2 3 4 , , , . i -1 corresponds to the central core region, while i -2 3 , , and 4 refer to cladding layers. The outer cladding layer (i -4) is assumed to extend to infinity in the radial direction. This assumption is justified for guided modes whose fields decay exponentially in the radial direction.

SOFTWARE
we can design the single mode fiber by the optiwave software:

Installation

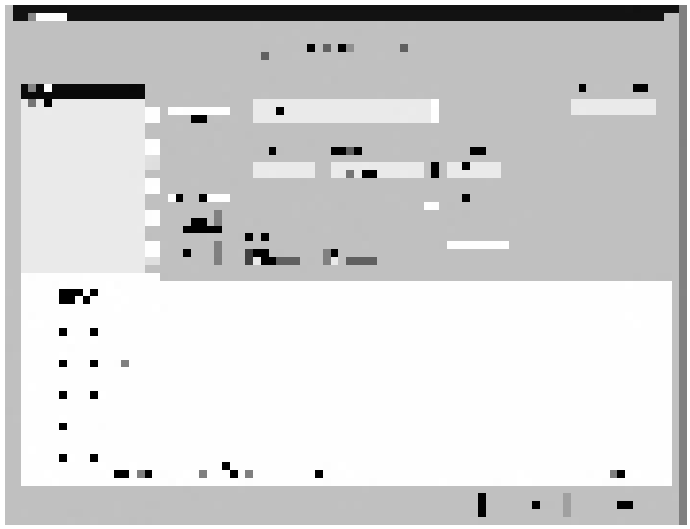
***(A)* Hardware Requirements**
OptiFiber requires the following system configuration:
- Personal computer with the Pentium processor
- 10 MB free hard disk space
- 32 MB of RAM recommended
- Graphic resolution of 1024 x 768, minimum 256 colors

***(B)* Software Requirements**
Optimizer requires one of the following operating systems:
- Microsoft Windows 2000
- Microsoft Windows XP

(C) Installation Procedure
To install Optimizer on Windows 2000/XP:
1. Log on as the Administrator or on an account with Administrator privileges.
2. Insert the Optimizer CD into your CD ROM drive.
3. Press the Start button and select Run.
4. In the Run dialog box, type 'F:\setup.exe,' where 'F' denotes your CD ROM drive.
5. Click the OK button and follow the screen instructions and prompts.
6. Reboot the computer.

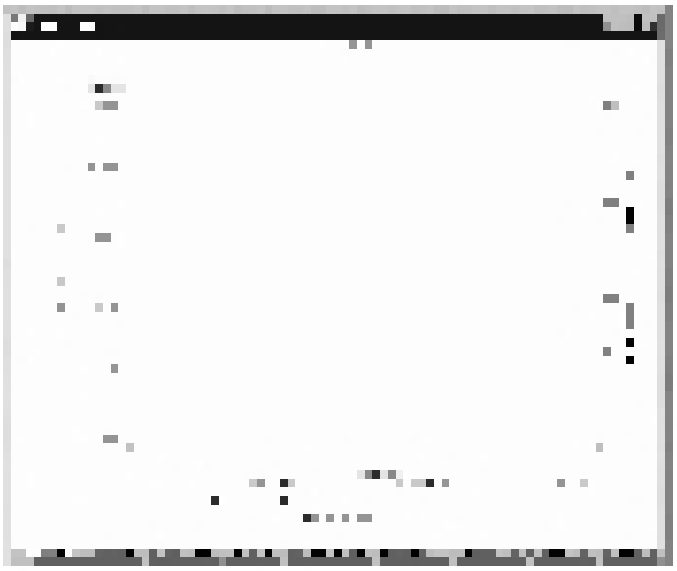
Procedure

Designing Single Mode Fiber:
1. From the "File" menu click "New" to open a new project.
2. Click the "Fiber Profile" icon in the "Navigator" pane.
3. In the "Select Profile Type" dialog box click "Refractive Index Profile"
4. In the "Fiber Profile" dialog box add two regions: "Region 0" and "Region 1"



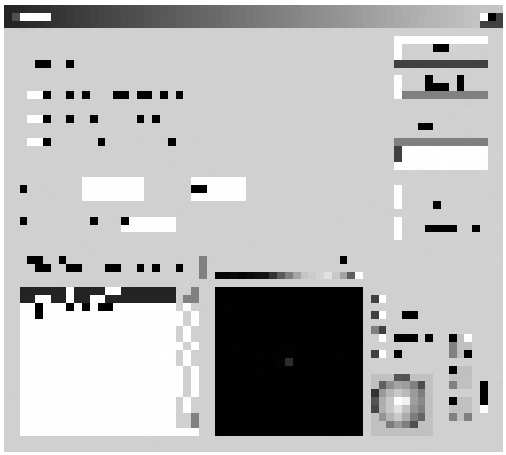
For "Region 0", enter the following data:
Width: 4.15
Profile: constant
Index: 1.45213
Click "Apply"

For "Region 1", enter the following data:
Width: 58.35
Profile: constant
Index: 1.44692
Click "Apply"
These two regions will represent the fiber core and cladding, respectively.
Enter the wavelength value 1.3 microns.
fiber profile should look like the one below:



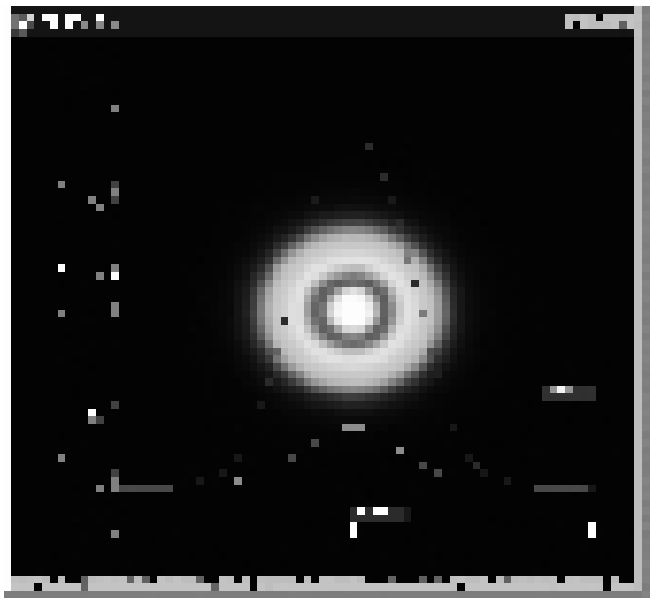
here scale is:
at X axis radial distance(μm)
at Y axis refractive index
Note that both the absolute values of the refr. indices and the normalized difference are shown.

Calculating Fiber Modes



To calculate a fiber profile, follow these steps:

1. Click the "Modes" icon in the "Navigator" pane
2. Select the "LP Modes (Matrix Method)" option
3. Press "Recalculate Modes". The program provides the modal index at the given wavelength and shows a preview of the modal field.
4. In the "Views" window, select the "Mode Field" tab to view the modal field.
5. From the "Graph Tools" toolbar select "X Cut", then click-and-drag the cursor over the graph to inspect the mode field normalized "X-section". The default color for "X Cut" lines is green.
6. From the Graph Tools toolbar select "Y Cut", then click-and-drag the cursor over the graph to inspect the mode field normalized Y-section. The default color for "Y Cut" graph lines is red. When you click-and-drag the left mouse button inside your "Mode Field" view tab with "X Cut" and "Y Cut" active, then the view looks like this:



Calculating Cutoff Wavelength

To calculate the cutoff wavelength, follow these steps:

1. Click the "Cutoff" icon in the "Navigator" pane.
2. Select the "LP Modes (Matrix Method)" option.
3. Press "Recalculate". The program shows guided modes on the list. If only LP 0 1 is supported decrease the wavelength.

4. Select the "LP 1 1 " mode on the list.
5. Press the Calc. "Cutoff" button. The program shows :
   - a "theoretical" cutoff wavelength value of 1.33204 microns.
   - a "ITU-T" compliant cutoff value of 1.231 microns.

Calculating Properties Of Fundamental Mode

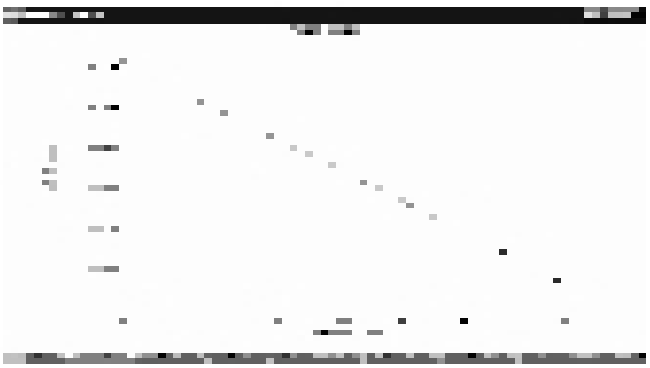
To calculate the properties of the fundamental mode, follow these steps:

1. Click the "Scan Fundamental Mode" icon in the "Navigator" pane.
2. In the "Properties of Fundamental Mode" dialog box, select all available "Calculate" options
3. Leave the defaults for material, bending, and splice loss parameters
4. In the "Scan" section list, select "Wavelength", which is also the default option.
5. In the "Parameter" section, enter "From" = 1.2, "To" = 1.6, "Steps" = 100.
6. Click "Calculate".

Viewing Results

can inspect the output graphs in the Views window by selecting appropriate tabs:

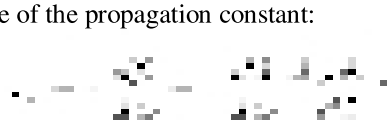
- **"Modal Index" tab**: Plot of the modal index vs.
- the current scanning parameter, i.e. wavelength



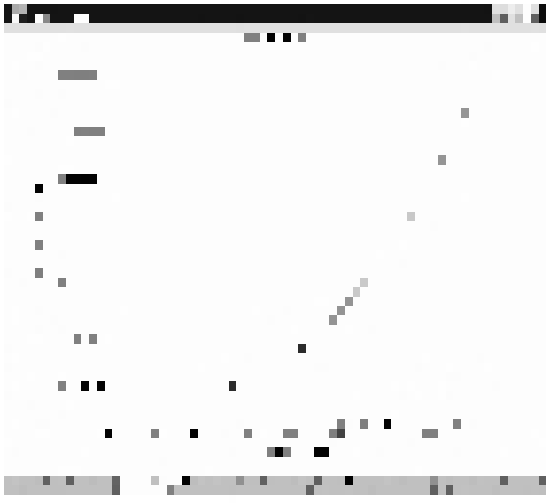
This curve shows that if we increse the wavelength in a fiber the model index decreses.

- **"Group Delay" tab**: Plots the group delay vs. the scanning parameter.

If the refractive index of the fiber material varies with wavelength, thus causing the group velocity to vary,it is classified as material dispersion. The group delay Tg is given by the product of the propagation distance z by the first frequency-derivative of the propagation constant:



- By this formula is also show that the group decay is proportional to the wavelength. And the below curve is shown by software.



This curve show wavelength v/s Group decay.

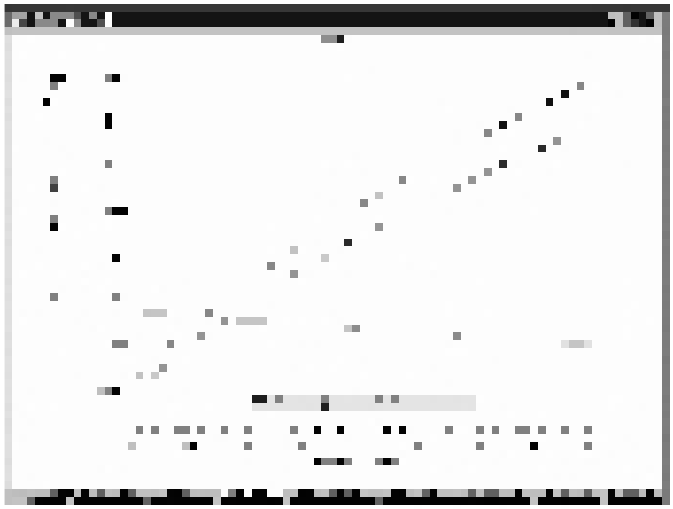
- **"Dispersion" tab**: Plots material, waveguide and total dispersion vs. the scanning parameter. The zero dispersion wavelength and the slope are shown on the graph.

Material dispersion of the fiber
In a fiber, the materials of core and cladding are different. If there are L layers in the fiber cross-section, each layer has different refractive index.

The total material dispersion of a fiber is calculated by:

where the confinement factor of each layer is $_i$. The confinement factor is the portion of total power guided in the i-th layer.
Waveguide dispersion of the fiber
Waveguide dispersion is the result of the wavelength-dependence of the effective refractive index N_{eff} of the fiber mode. First, the mode solver calculates the relation between N_{eff} and wavelength $$, then the waveguide dispersion is calculated by:

Total dispersion of the fiber
The total dispersion is the total effect of material and waveguide dispersion. It is calculated in a similar way as for calculating waveguide dispersion. In this case, the fiber refractive index profile depends on the wavelength. The material dispersion effect should be calculated first. Then the mode solver calculates the mode effective index N_{eff}. The total dispersion of a fiber



In this curve the red line show total dispersion, green line show waveguide dispersion and blue line show material dispersion. Here the zero dispersion wavelength is 1.3μm

- **"Mode Measures" tab**: Plots the near-, far-field, effective mode field diameter and the effective mode area vs. the scanning parameter.

Mode field diameter and area importance
The Mode Field Diameter (MFD) is an important parameter related to the optical field distribution in the fiber. It has been shown that MFD provides useful information about the cabling performances, such as possible joint, macrobending, and microbending losses. The effective area of the fibers has a direct

relation to the nonlinear distortions in long fiber links. Currently OptiFiber calculates the following spatial measures of the modes:

1. Near-Field Diameter Definition

The near-field Mode Field Diameter (near-field MFD) is also known in the literature as the "Petermann I" diameter. It is defined as the diameter at which the near field power falls to $1/e^2$ of its maximum value. It can be calculated by:

where E(r) is the optical mode field distribution.

2. Far-Field Diameter Definition

The far-field Mode Field Diameter (far-field MFD) is also known in the literature as the "Petermann II" diameter. It is defined as the diameter at which the far field power falls to $1/e^2$ of its maximum value. It can be calculated by

where E(r) is the optical mode field distribution, and prime denotes differentiation of a function with respect to its argument.

3. Effective mode area definition

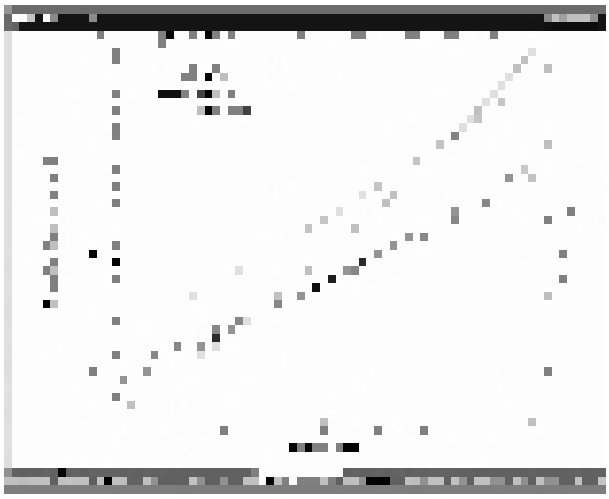
The effective Mode Area (eff. MA) is calculated as

where E(x,y) is the optical mode field distribution.

4. Effective diameter definition

Optimizer calculates also the effective Mode Field Diameter (eff. MFD), defined as :

where E(r) is the optical mode field distribution



here the curve between mode measures and wavelength. and red line show far field, green show near field, blue show effective MFD.

- **"Bending Loss" tab**: Plots the micro and macro bending losses vs. the scanning parameter.

Macro bending loss model

The macro bending loss is a radiative loss when the fiber bend radius is large compared to the fiber diameter. It is defined as usual by P(z) = P(0) exp (- z) where P(0) is the input power and P(z) is the output power at distance z respectively.

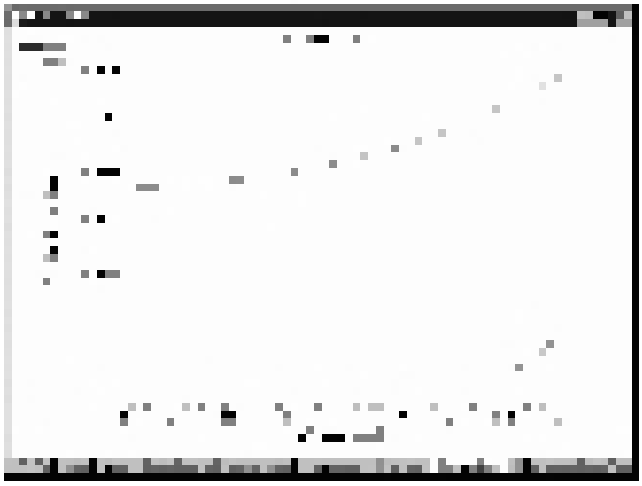
The loss coefficient can be converted to loss in decibels per kilometer units as follows:

Micro bending loss model

Micro bending loss is a radiative loss in fiber resulting from mode coupling caused by random micro bends, which are repetitive small-scale fluctuations in the radius of the curvature of the fiber axis.

An approximate expression for the attenuation coefficient is given by

where A is a constant, d_n is the near field diameter, n_1 is the core refractive index of fiber, k is the free space wavenumber, and p is the exponent in the power law.



Conclusion:
After performing this experiment I learned that uses of this software we can get the same result as the theoritical values.

Bibliography:

(1) Optifiber : optical fiber design software : version 2.0 Optiwave ,7 capella court, ottawa, ontario,K2E 7XI, CANADA
(2) Wikipedia

Optical Properties of Cobalt thin Film as a Switchable Mirror

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Vivekananda Institute of Technology, Jaipur

Abstract
Monolayer thin films of Co prepared using thermal evaporation method at pressure 10-5 torr. The hydrogen gas was introduced in hydrogen chamber, where samples were kept at different pressure from 0 Psi to 40 Psi of H2. The band gap was found to be decrease after hydrogenation of Co thin film. And also the optical transmission was found to be increase & optical absorption decrease with hydrogenation. The relative resistance in the Co thin films was measured at different hydrogen pressures. It was found that the relative resistance varies nonlinearly with increases in hydrogen pressure. The Raman Spectroscopy characterization also observed and found that the intensity is decreased with hydrogen pressure. The variation in optical band with hydrogenation suggested that phase were changes in thin film structure. The prepare structure after hydrogenation shows the switchable behavior with variable optical band gap and surface morphology carried out for these films with and without hydrogenation by using optical microscope.
Keywords: Optical absorption, transmission, energy band gap, surface morphology & resistivity.

Introduction

There is an increasing demand for hydrogen in petroleum refining, petrochemical production and semiconductor processing [1], as well as in renewable energy related applications such as clean fuel for vehicles and fuel cells [2]. This motivates research into new methods for hydrogen generation, separation and purification. Hydrogen, the most abundant element on earth, scores over all renewable fuels regarding reversibility, energy density and compatibility with the environment. The interest in hydrogen as a fuel has grown dramatically. In order for hydrogen to be potentially used, hydrogen storage technologies must be significantly improved if a hydrogen storage based energy system for transport sector is to be established. Many metals and intermetallic compounds are capable of reversibly absorbing large amounts of hydrogen (3, 4). The behavior of hydrogen in metals has attracted scientific attention for many decades (5-7) and is interesting from both basic research and technological points of view. Most of hydrogen's interesting properties relate to the high mobility of the hydrogen atoms, which reaches values similar to those of ions in aqueous solutions. This high mobility exists because the hydrogen atoms occupy interstitial positions in the host lattice and, thus, because of an interstitial diffusion mechanism and the contribution from quantum-mechanical tunneling (8,9). Transition metals are known to accommodate a great amount of hydrogen and have been studied as promising materials for hydrogen storage [10]. The development in metal hydride technology required a detailed study of hydrogen interaction with metals and alloys. For the fabrication of gradient samples B. Dam et al. use a sputtering system with several off-axis sources, which can be tilted towards and away from the substrate. Depending on the tilt angle, the thickness of a particular component increases up to 7-fold over a diameter of a 3 inch wafer. MgyTMx (TM=Ni, Co, Fe) thin films show drastic changes of their optical appearance upon hydrogen uptake at room temperature [10]. Much work has been performed on cobalt hydride, as a model system, because it possesses one of the highest absorptive capacities among the metal-hydrides. The small size of hydrogen atoms permits dense hydrogen packing in metal hosts that have a high affinity to hydrogen, i.e., a large negative heat of solution for hydrogen. In metal hydrides, hydrogen density can be even greater than in liquid hydrogen (11, 12). This has led to the application of metal hydrides for energy storage (13). Metal hydride technologies have reached more practical and applied stages in recent years. The hydriding / dehydriding kinetics of metal hydrides are relevant to areas of design and applications of various metal hydride devices, especially in energy conversion devices such as heat pumps, refrigerators, automobiles, power generators, batteries and thermal energy storage units [14,15]. The Raman Effect in solids is due to inelastic scattering of light by the crystal vibrations (the latter are referred to as phonons or optical modes). The incident light exchanges a quantum of energy with the crystal via the creation or annihilation of phonons. As a result, the scattered light loses or gains an energy quantum depending on whether a phonon was created or annihilated. In Raman spectroscopy, the shift of the energy of the scattered light is measured: Thus a characteristic value of the vibrational energy of a given solid may be obtained. The characteristic Raman energy, known as the Raman frequency, may be modified from its ideal value (corresponding to high quality material) by, among other factors, stress, temperature, structural defects, and impurities. Thus Raman spectroscopy may yield valuable information on the material characteristics and quality.[17] Adachi et al. studied the effect of hydrogen absorption on the electrical resistivity of LaNi5, [24] and LaCo5, films and observed that the resistivity increases with hydrogenation. The increase in resistivity of the film was due to the acceptance of electrons from the conduction band of LaNi5, and LaCo5, by hydrogen, when hydride anions are formed [25]. We are discussing in this paper about the optical transmission, absorption, resistivity and surface

morphology of Co monolayer thin films with and without hydrogenation.

Experimental

The samples were prepared by thermal evaporation method using vacuum coating unit. The HIND HIGH VACUUM unit was used for this purpose and vacuum chamber contains pressure of the order of 10-5 torr. Co powder (99.998%) pure is placed into boat in the vacuum chamber. The glass substrate was placed in the substrate holder above the boat carrying materials. The thin films of Co (214.36nm) were prepared by in situ evaporation and monolayer structure was prepared. The hydrogen introduce in hydrogen chamber at different pressure to see the effect of hydrogen on optical properties and surface morphology of these films. The UVvis transmission & absorption spectra of thin films were taken at room temperature in the wavelength region of 300800 nm with the help of Hitachi-330 spectrophotometer. The thicknesses of thin films were measured by gravimetric method. The d.c. resistance of thin films measured by the two point probe method with help of a digital multi-meter of input impedance of 10 M Ohm. The optical micrographs of thin films at different pressures of hydrogen in reflection mode were taken with the help of LABOMED microscope. The electron microscopic grid was used as reference for scaling the micrographs. It is a circular grid having 3mm diameter and there are thousand very small squares in 7.06 mm2 area. The side of a small square is magnified under microscope at various magnifications, i.e. 10, 40 and 100. The micrographs are stored in computer through standard software (Pixel View). The scale on micrographs can be determined on comparing with electron microscopic grid. The measuring scale is attached with the eyepiece having an accuracy of 0.1 micrometer. In the present work we have used 40 magnifications for optical micrographs.

Results and Discussions

All properties are found to depend on the amount of hydrogen in sample. Structurally, as prepared films show only one crystalline phase and hydrogen induces a reversible phase transformation. Figure1. Shows the variation of optical transmission with hydrogen pressure. It was found that optical transmission increase in Co thin film with hydrogen pressure upto 40 psi. D.M. Borsa et al [19] also shows that in Mg-Ti (100nm) thin film the optical transmission increase gradually with increasing amount of hydrogen in sample. The hydrogen uptake in Co thin films is fast and induces a gradual change in optical appearance for thin films. Also the optical band gap of these films calculated by using Tauce relation [16] h = A (Eg-h)1/2 Where Eg is the optical band gap; A an constant, and absorption coefficient. For investigated samples, the values of optical energy band gap have been calculated using optical band gap spectra. The determination of Eg from the spectra seems to be more appropriate. According to above relation, the (h)2=f(h) dependences are linear. Consequently, the optical band gap, Eg(eV), can be determined by extrapolating the linear portions of mentioned dependences to (h)2=0. Figure 2. shows the variation of band gap with hydrogen pressure . It was found that optical band gap decrease with hydrogenation in Co thin film. It may due to hydrogen accumulation at interface responsible for it. The variation in optical band due to hydrogenation suggested phase changes from metal to semiconductor. The theoretical calculations observed by [28,29] Suggested that MgH2 under goes various phase transitions as a function of pressure. The Similar results in case of yttrium hydride measured by Borgschulte et al [30] and suggested that this system exhibits three thermodynamic phases. The structural phase transitions are accompanied by changes in the electronic structure, which are affecting the optical properties of the material. Pure yttrium is a shiny metal. The Dihydride YH2 is also metallic, but has a weak transparency at a photon energy around 1.9 eV, YH3 is a insulator with a band gap of 2.66 eV. The similar results in case of Co thin films observed by us. The band of Co thin films with hydrogen pressure various from 2.32 to 1.97 eV. Hence we can say that Co thin film changes phase from metallic to semi conducting with hydrogen pressure.

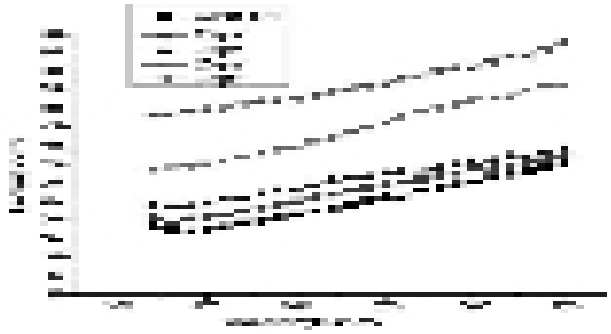

Figure 1.The optical transmission spectra of CO monolayer with and without H_2.

In Figure 3. the Raman spectra shows the variation in intensity versus wave number. In this spectra intensity at Raman peaks decreases with hydrogen pressure and also decreasing in broading of peaks was observed that suggesting that hydrogenation may change the phase or make the bonding with metal interstitial as well as surfacial. In case of Si crystalline hydrogen absorption peaks observed by N.fukata et al [18] and suggested that Raman lines hydrogen molecules observed at 590 cm-1, the similar results one can see in our spectra and

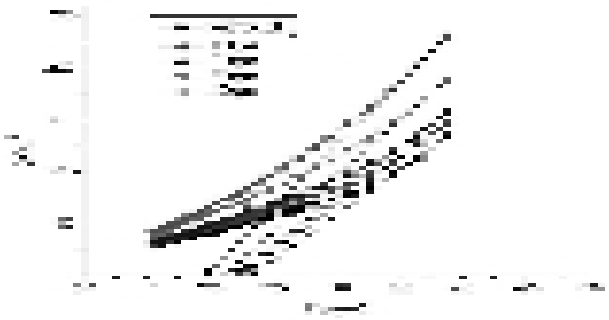

Figure 2.The optical band gap spectra of CO monolayer with and without H_2.

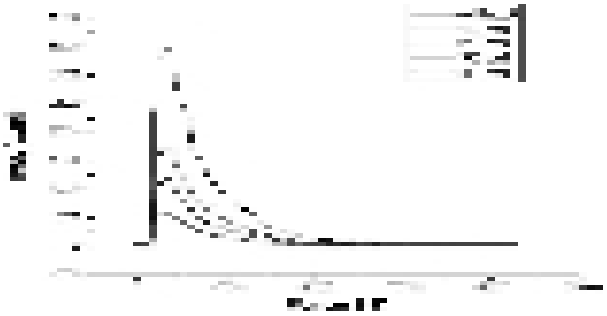

Figure 3.The Raman spectra of CO monolayer with and without H_2.

Figure 4. shows the variation of optical absorption with hydrogen pressure. It was found that optical absorption decrease in Co thin film with hydrogenation. Upon absorbing hydrogen, a switchable mirror transforms from a shiny metal to a transparent semiconductor. The same behavior was later observed in Mg-alloyed rare-earth hydrides [26] and MgNi hydrides[27]. Figure 5 shows that resistance ratio (RH/R0) increases with hydrogen pressure, due to the net effect of hydrogen absorption with pressure, where R0 is the resistance before hydrogen absorption and in RH is the resistance of the sample after hydrogen absorption. The resistance ratio increases with hydrogen pressure and finally reaches the equilibrium position. It can also be observed that resistivity increases with hydrogen pressure. It is suggested that resistivity increases as hydrogen takes electrons from the conduction bands of each of the samples during the hydrogen absorption process. This is similar to an earlier work by Singh et al. [21-23]. The increase in resistivity ratio with increasing hydrogen pressure means that hydrogen takes more electrons from the conduction band of the intermetallic compound and accelerates the hydrogen absorption capacity of samples. The increasing behavior of electrical resistivity has been observed by Singh et al. [20] for rare penta-nickelide thin films and it was suggested that the increase in resistivity was due to the enhancement in the absorption of hydrogen due to a large number of voids per unit volume in the amorphous structures. The effect of hydrogen pressure on electrical resistivity was measured in order to analyze the kinetics for hydrogen absorption. Since the resistivity ratio is proportional to hydrogen concentration [21].

Figure 4.The optical absorption spectra of CO monolayer with and without H_2.

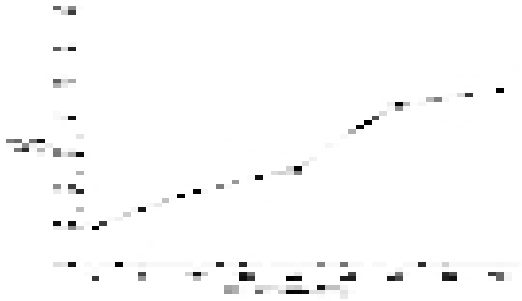

Figure 5.The Variation of Relative Resistance with Hydrogen Pressure in CO monolayer.

We also examine the surface morphology for both cases of films in Figure [6a-6c] with and without hydrogenation the color of thin film changes from dark yellow to light yellow with hydrogenation. These switchable properties have been observed in Mg-Ti thin film. The hydrogen in thin films induces a gradual change in optical appearance for all nanocrystalline thin films. The color of fully hydrogenated films changes from dark gray to yellowish with increasing amount of hydrogen [19].

(6a)

(6b)

(6c)

Figure 6. The optical micrographs of CO monolayer with and without H_2

Conclusion

Hydrogen gas tailored the optical properties of Co thin films. The optical transmission found to be increase and optical absorption decrease with hydrogenation. The band gap found to be decrease with hydrogen pressure. The resistance increases with hydrogen pressure, due to the net effect of hydrogen absorption with pressure and also observed the color of thin film changes from dark yellow to light yellow with hydrogenation. The Raman Spectroscopy characterization also observed and found that the intensity at raman peaks decreases with hydrogen pressure and also decreasing in broading of peaks was observed that suggesting that hydrogenation may change the phase. The prepare structure after hydrogenation shows the switchable behavior with variable optical band gap.

References

1. Ramachandran R, Menon RK. An overview of industrial uses of hydrogen. Int J Hydrogen Energy 1998;23:593.
2. Veziroglu TN. Hydrogen energy system as a permanent solution to global energy-environment problems. Chem Ind 1999;53:383.
3. R. K. Singh, M.V. Lototsky and O.N. Srivastava Int. J. Hydrogen Energy 32, 2971-2976 (2007).
4. S. K. Singh, A. K. Singh, and O. N. Srivastava, Int. J. Hydrogen Energy 10, 523 (1985).
5. Fukai Y. 1993. The Metal-Hydrogen System. Berlin/Heidelberg/New York: Springer. 1st ed. 2a. Fukai Y. 2005. The Metal-Hydrogen System. Berlin/Heidelberg/New York: Springer. 2nd ed.
6. Alefeld G, V¨olkl J, eds. 1978. Topics in Applied Physics. Vol. 28: Hydrogen in Metals I. Berlin/Heidelberg/New York: Springer-Verlag.
7. Wipf H, Barnes RG, Dantzer P, Grabert H, Ross DK, et al., eds. 1997. Topics in Applied Physics. Vol. 73: Hydrogen in Metals III. Berlin/Heidelberg/NewYork: Springer-Verlag.
8. Alefeld G, V¨olkl J, eds. 1978. Topics in Applied Physics. Vol. 29: Hydrogen in Metals II. Berlin/Heidelberg/New York: Springer-Verlag.
9. Richter D, Hempelmann R, Bowman RC Jr. 1992. Dynamics of hydrogen in intermetallic hydrides. In Hydrogen in Intermetallic CompoundsII, ed. L.Schlapbach, 65:97159. Berlin/ Heidelberg/New York: Springer.
10. B. Dam, A.C.Lokhorst, M.C.R. Heijna J. of Alloys and Compounds 356-357(2003)526-529.
11. Latroche M. 2004. Structural and thermodynamic properties of metallic hydrides used for energy storage. J. Phys.Chem. Solids 65:51722.
12. Akiba E. 1999. Hydrogen-absorbing alloys. Curr. Opin. Solid State Mater. Sci. 4:26772.
13. Wiswall R.1978.Hydrogen storage in metals,29:20142.Berlin/Heidelberg/New York: Springer.
14. S. Suds, Int. J. Hydrogen Energy 12, 323 (1987).
15. P. D. Goodell, G. D. Sandrock and E. L. Huston, J. less common Metals 73, I35 (1980).
16. P.P.Sahay, S.Tewari and R.K.Nath Cryst. Res. Technol. 42, No.7,723-729(2007).
17. Annu. Rev. Mater. Sei. 1996. 26:551-79.
18. N.Fukata, S.Sasaki and K. Murakami Physical review B, Vol.56 No.11 (1997)6642.
19. D.M. Borsa et al Physical review B 75 , 205408 (2007).
20. S. K. Singh, A. K. Singh, and 0. N. Srivastava, Inf. J. Hydrogen Energy 10, 523 (1985).
21. M. Singh, Y. K. Vijay and I. P. Jain, Int. J. Hydrogen Energy 16, 485 (1991); ibid 16, 101 (1991).
22. M. Singh, Y. K. Vijay and 1. P. Jain, Int. J. Hydrogen Energy 16, 477 (1991).
23. M. Singh, Y. K. Vijay and I. P. Jain, Int. J. Hydrogen Energy 17, 29 (1992).
1. 24. G. Adachi, K. Niki, H. Nagai and J. Schiokawe, J. less common Metals 88, 213 (1983).
25. H. Sakaguchi,Y.Nagai, N. Taniguchi and J. Schiokawa, J. less common metals 135, 137 (1987).
26. P. van der Sluis, M. Ouwerkerk, and P. A. Duine, Appl. Phys. Lett. 70, 3356(1997).
27. T. J. Richardson, J. L. Slack, R. D. Armitage and M. D. Rubin, Appl. Phys. Lett. 78, 3047 (2001)
28. J.P. Bastide , B. Bonnetot, J.M. Letoffe, and P. Claudy, Mater. Res. Bull. 15, 1215 (1980).
29. M.Bortz, B.Bertheville, G.Bottger and K. Yvon, J. Alloys Compd. 287, L4 (1999)
30. A.Borgschulte, R.J.Westerwaal , J.H.Rector, B.Dam and R.Griessen Physical Review B 70, 155414 (2004)

Chalcogenide Glassy Semiconductors

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Introduction

Chalcogenide glasses possess electrical and optical band gap of 1-3 e V and accordinglingly they can be regarded as amorphous semiconductors .The gap decreases in the sequence the enhanced metallic character. On the other hand polyethylene and SiO_2 are insulator with energy gaps of 5-10 e V and accordingly these are transparent at visible wavelengths .As a semiconductor , the overall property of chalcogenide can be grasped that is with the change from organic semiconductors such as polyvinyl-carbazole , chalcogenide , hydrogenated silicon films , to crystalline semiconductors , the electronics mobility becomes higher and a faster response is available .The material also becomes more rigid .Instead , material prize seem to increase with this sequence , which may reflect their typical preparation methods , coating ,evaporation ,glow discharge , and crystal – growth techniques respectively.

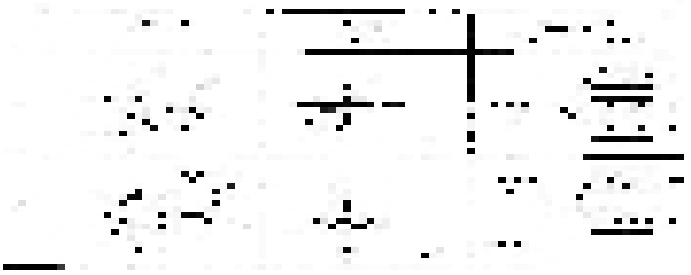

Fig 1.1

As exemplified in fig1.1 the electronic structure of a chalcogenide glass is essentially the same as that of that of the corresponding crystal .That is covalent glasses with chalcogenide coordination number of 2, the top of the valence band is composed of lone pair p- electrons of chalcogenide atoms, and the bottom of the conduction band composed of anti-bonding states of covalent bonds. The band gap energy is similar (10 %) to that in the corresponding crystal

Due to this nature of the valence band , dramatic effects of pressure upon electronics properties appear .Hydrostatic compression preferentially contracts the intermolecular distance of 0.5 nm and then the overlapping between lone-pair p-electron is enhanced .As result, the valence band broadens, and the band gap decreases remarkably .Electrically , however ,glasses exhibits smaller conduct ivies than the corresponding crystals .This is because the electronic mobility is suppressed by band tail and gap states, which are manifestations of disordered structures .Specifically ,sulfide glasses such as AS_2S_3 and Ge S behave as insulators, the conductivity being smaller than 10^{-15} S cm^{-1}.On the other hand , carrier density of intrinsic semiconductor is assumed to be similar to that in the corresponding it is crystal.

Fig 1.2..

Optically as shown in above figure1.2 chalcogenide glasses are transparent between red (or near IR) and IR regions the short wave length cut- off is determined by electronic excitation and the long-wave length limit by atomic vibration, this feature is common in semiconductors and insulators.

Photo electrical properties of chalcogenide glasses have been studied extensively, probably because of their unique photoconductive applications .Specifically, amorphous selenium films deposited onto substrates held at 50-60 ° C are highly photoconductive and the characteristics have been investigated extensively. Among many features examined, the one that is markedly different from that in conventional crystalline semiconductors is the existence of a non-photo conducting spectral gap

As shown in figure, the photoconductive spectral edges in amorphous selenium are blue-shifted by more than 0.5 e V from optical absorption edges .In addition, avalanche multiplication of photo created carriers has been demonstrated in amorphous selenium .This phenomenon appears to be anomalous, since the disordered structure is assumed which can cause impact generation of other carriers .Chalcogenide glasses are known to exhibits prominent non-linear optical effects. If compare some non linear parameters of As_2S_3 and SiO_2 by a factor of 10^2

Photo Induced Phenomenon

The phenomenon can be grouped into three categories

(1) Photon mode - It is mode in which the photo electronics excitation directly induces atomic structural changes;

(2)Photo thermal- mode it is mode in which photo electronics excitation indices some structural changes with the aid of thermal activation
(3)Heat mode - It is mode in which the temperature rise induced by optical absorption is essential
Interestingly, these three kinds of phenomena are likely to appear in selenium, sulphides and tellurides respectively .The best known heat-mode phenomenon may be the optical phase-change, or the so-called optical Ovonic effect .This phenomenon appears in tellurium compounds which undergo thermal crystallization .A light pulse heat the film sample above the crystallization temperature and, as a result, a transformation from amorphous to crystalline phase occurs. In some material, this change is reversible .This is a more intense light pulse heats the sample above the melting temperature and a successive temperature quenching can reproduce the original amorphous structure.
As for the photon –mode phenomena reversible photo darkening and related change have been extensively studied .Here light illumination induces a red shift of the optical absorption edges ,so that the sample becomes darker , while the red shift which is consistent with the expectation obtained from the kramers-kronig relation .Sample volume , elastic and chemical properties also change with illumination and recover with annealing .As for the light , band gap illumination has been assumed to be effective. However this explanation demonstrate that sub gap light with the photon energy lying in the tail region also produce some changes which can be more prominent than those induced by band gap light
The photo darkening phenomenon continues to attract extensive interest, since this is a simple bulk phenomenon which is characteristic of the chalcogenide glass .That is it does not appear in the corresponding crystal .Some structural studied have demonstrated that the amorphous structure becomes more disordered with illumination However , it is difficult to elucidated
Macroscopically untreated glasses are generally isotropic while illumination with linearly polarized light can add some anisotropy such as dischrosim birefringence and axial strain .Even un polarized light can indices anisotropy if the light irradiates a side surface of a sample.
In addition, the anisotropic direction can be altered by illumination with other polarized light.
Further more the anisotropy can be erased by illumination with un polarized or circularly polarized light or by annealing .However, at lower temperature, the photo induced anisotropy appears less efficient and, accordingly, this phenomenon can be understood to be induced by a photo thermal process. In amorphous selenium oriented crystals can be produced by illumination with polarized light. So-called photo-doping is photo thermal reaction Consider a bi layer structure consisting of silver and AsS2 film. When this bi layer is exposed to light sliver film dissolved rapidly into the As S2.For instance if the silver films 10 nm in thickness and the exposure is provided from the semitransparent silver slide using a 100 W ultra high pressure mercury lamp , the silver film will dissolve within a few minutes Since the reaction becomes slower if the sample is illuminated at lower temperature , this can be regarded as a photo-thermal phenomenon .However it should be mentioned that temperature rise induced by illumination is not essential .

Applications
Four kind of applications are commercially available or practically utilized .These rely upon the unique feature of chalcogenide glasses quasi stability , photo conductive properties ,infrared transparency and ionic conduction. The first is the phase change phenomenon used in erasable high-density optical memories .The product utilizes semiconductor lasers and chalcogenide films such as GeSbTe with a thickness of 15 nm. The reflectivity change between amorphous and crystalline phases is monitored with a weak light beam. The present memory capacity is about 5 GB/disk, which is still increasing
The second category is photo conductive application such as photo receptors in copying machines and X-ray imaging plates .In A photo conductive target in vidicions, avalanche multiplication in amorphous selenium films is employed, which substantially enhances the light sensitivity so that star images can be taken
The third application is purely optical .That is , since the chalcogenide glass is transparent an IR regions ,it can be utilized for IR optical components such as lenses and windows .It can also be utilized for IR transmitting optical fibers
Lastly, chalcogenide glasses containing group I element such as silver are used as high –sensitivity ionic sensors. Some lithium containing glasses can be utilized as solid electrolytes in all-solid batteries
The modern technological applications of chalcogenide glasses are widespread specifically as mould able infrared optics including lenses, and infrared optical fibers as these materials transmit across the full range of the infrared regime of the electromagnetic spectrum. The physical properties of chalcogenide glasses (High refractive index, low phonon energy) also make them ideal for incorporation into laser and other active devices when doped with rare earth ions. Some chalcogenide materials experience thermally driven amorphous crystalline phase changes, enabling the encoding of binary information on thin films of chalcogenides, forming the basis of rewritable optical discs [1] and non-volatile memory devices such as PRAM. Examples of such phase change materials are GeSbTe and AgInSbTe. In optical discs, the phase change layer is usually sandwiched between dielectric layers of ZnS-SiO_2, sometimes with a layer of a crystallization promoting film. Other less common such materials are InSe, SbSe, SbTe, InSbSe, InSbTe, GeSbSe, GeSbTeSe, and AgInSbSeTe.[2]

References
1. J.Dressner aand Stringfellow ,J Phys.chem.solid 29 (1968) 303
2. J.P.Denufville in Amorphous and liquid semiconductors ,edited by J.Stuke and W.Brenig (Taylor and franncis,London)P.135

Plumeridich acid and other Iridoids from Plumeria dichotoma

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ABSTRACT
Two new iridoids, plumeridich acid (13-dehydroxy-15-O-demethyl allamandicin) and plumerone (13-dehydroxy-15-deoxy allamandicin), along with plumericin, isoplumericin, allamandin and plumieride were isolated from the stem bark of *Plumeria dichotoma.* Their structures were elucidated by ^{1}H NMR, ^{13}C NMR and Mass spectral studies and compared with authentic samples.
Keywords: Plumeria dichotoma*: Apocynaceae: Iridoids: Plumeridich acid: Plumerone

Introduction

As part of our collaborative research with Roswell Park Cancer Institute, Buffalo, New York, for the isolation, characterization, and biological evaluation of the extracts of various medicinal plants, the stem bark of *Plumeria dichotoma*, of American origin, was selected for investigation. Plants of the genus *Plumeria* are grown as ornamental plant in Rajasthan, India. It is a small genus of ten species native to tropical and subtropical America which mainly consists of deciduous shrubs and trees. Extensive previous phytochemical work on *Plumeria* species in various laboratories have afforded a variety of iridoids and triterpenoids, which are widely used as medicines for the treatment of several diseases [7]. *Plumeria bicolor* [4]. *Allamanda* [8] and *Nerium* are the most common genera which contain iridoids. *Plumeria* is related to the Oleander, *Nerium oleander*, and both possess poisonous, milky sap. The genus is reported to exhibit antifertility [6] anticancer [5]

These medicinal properties of the genus motivated us to carry out systematic phytochemical analysis of *Plumeria dichotoma*. This paper describes the isolation and characterization of two new iridoids from the stem bark of *Plumeria dichotoma*, along with the four known compounds, plumericin, isoplumericin, allamandin and plumieride. The structures of the known compounds were confirmed by comparing their spectral data with reported values in the literature. This is our first study to report the isolation and characterization of plumeridich acid and plumerone obtained from *Plumeria dichotoma*.

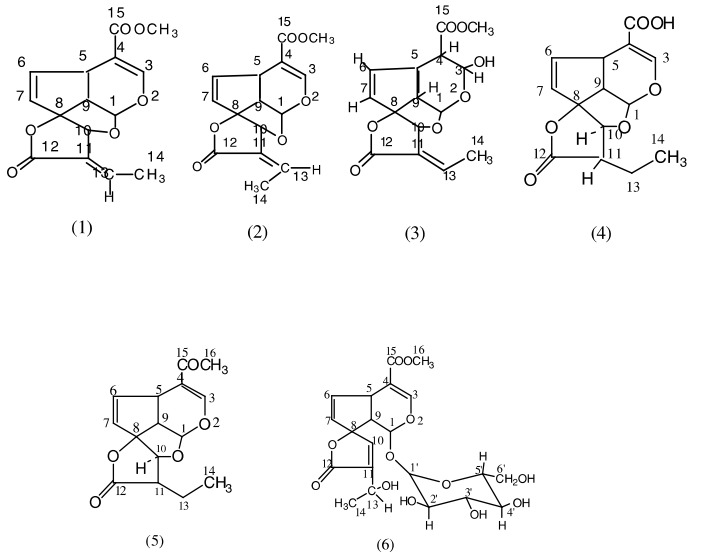

Fig.1 Structures of the iridoids isolated from *Plumeria dichotoma*

Results And Discussion

The stem bark of *P. dichotoma* was powdered and extracted with ethanol. The extract was filtered hot and the solvent was removed under reduced pressure. The solvent free extract was redissolved in chloroform and then treated with acetonitrile to remove fats. The fat free chloroform soluble portion was concentrated under reduced pressure and chromatographed over silica gel column, where two compounds **1** and **2** were isolated and characterized. The chloroform insoluble portion was also subjected to column and compounds **3** to **6** were isolated.

Plumeridich acid (**new compound**) (**4**) was obtained as light brown crystals. On the basis of mass, ^{1}H NMR and ^{13}C NMR spectral studies, the molecular formula of compound (**4**) was calculated as $C_{14}H_{14}O_6$. The ^{1}H NMR spectrum (▪ ppm, $CDCl_3$) showed signals of six methine protons 5.59 (1H, *d*, *J* = 5.85 Hz, H-1), 3.99 (1H, *td*, *J* = 2.01, 9.72 Hz, H-5), 3.48 (1H, *m*, H-9), 4.41 (1H, *s* , H-10), 2.77 (1H, *m*, H-11), three protons on olefinic carbons 7.54 (1H, *s*, H-3), 6.09 (1H, *dd*, *J* = 2.19, 7.68 Hz, H-6), 5.66 (1H, *dd*, *J* = 2.01, 7.50 Hz, H-7), one methylene proton 1.87 (1H, *m*, H-13), 1.67 (1H, *m,* H-13) and three protons on a methyl carbon 1.11 (3H, *t*, *J* = 7.50 Hz, H-14). The ^{13}C NMR spectrum (▪ ppm, $CDCl_3$) showed two ketonic carbons at 176.72 (C-12), 170.97 (C-15) along with four olefinic carbons 154.39 (C-3),

106.17 (C-4), 126.22 (C-6), 141.42 (C-7), one quaternary carbon[107.87 (C-8), five methine carbons 101.50 (C-1), 37.60 (C-5), 53.73 (C-9), 86.76 (C-10), 48.78 (C-11), methylene carbon 22.70 (C-13) and one methyl carbons at 11.92 (C-14).

Plumerone (**new compound**) (**5**) was obtained as a white solid. The mass spectrum showed molecular ion peak at m/z 276 which established its molecular formula as $C_{15}H_{16}O_5$. In the proton NMR spectrum (▪ ppm, $CDCl_3$) a singlet at 7.55 was assigned for one proton present at C–3 position. A double doublet at 6.10 (J = 7.50, 2.22 Hz) was established for a proton located at C–6 position. The double doublet at 5.67 (J = 2.19 Hz) was established for an olefinic proton at C–7 position. The protons present at C–1 and C–10 positions were assigned as a doublet at 5.61 (J = 5.85 Hz) and a singlet at 4.41 respectively. A triple doublet and a multiplet was observed at 3.98 (J = 9.69, 2.01 Hz) and 3.47, confirmed the presence of the protons present at C–5 and C–9 respectively. The proton present at C–11 position showed a multiplet at 2.77. The three protons of acetyl group showed a singlet at 2.17. The two methylene protons at C-13 position were observed at 1.87 and 1.67 as separate multiplets. A triplet at 1.11 for three protons was assigned for the methyl group at C–14 position. The ^{13}C NMR spectrum (▪ ppm, $CDCl_3$) showed two signals at 205.41 and 30.95 were assigned for C–15 and C–16 respectively. Signals at 154.56, 106.14, 128.34 and 141.16 indicates the presence of olefinic carbon atoms i.e. C–3, C–4, C–6 and C–7 respectively. A signal at 176.67 was assigned for carbonyl carbon atom (C–12). The other signals were observed at 101.51 (C–1), 37.57 (C–5), 107.69 (C-8), 53.73 (C–9), 86.80 (C–10), 48.79 (C–11), 22.72 (C–13) and 11.92 (C–14).

Plumericin (**1**) was obtained as white crystals. The mass spectra showed molecular ion peaks corresponding to the molecular formula $C_{15}H_{14}O_6$. The ^1H NMR spectrum (▪ ppm, $CDCl_3$) showed signals of four protons 5.56 (1H, *d*, *J* = 5.85 Hz, H-1), 4.02 (1H, *td*, *J* = 9.33, 2.19 Hz, H-5), 3.44 (1H, *m*, H-9), 5.11 (1H, *s* , H-10), four protons on olefinic carbons 7.44 (1H, *s*, H-3), 6.06 (1H, *dd*, *J* = 7.05, 2.19 Hz, H-6), 5.65 (1H, *dd*, *J* = 7.68, 2.19 Hz, H-7), 7.17 (1H, *dq*, *J* = 8.40, 1.11 Hz, H-13), three protons on methoxy carbon [▪ 3.77 (3H, *s*, H-16)] and three protons on a methyl carbon 2.09 (3H, *d*, *J* = 7.11 Hz, H-14). The ^{13}C NMR spectrum (▪ ppm, $CDCl_3$) showed two ketonic carbons at 168.22 (C-12), 166.69 (C-15), along with six olefinic carbons 152.74 (C-3), 104.61 (C-4), 127.42 (C-6), 141.10 (C-7), 126.38 (C-11), 145.34 (C-13), one quaternary carbon 109.35 (C-8)], four methine carbons [▪ 102.29 (C-1), 38.40 (C-5), 51.69 (C-9), 80.30 (C-10) and two methyl carbons at 16.12 (C-14) and 53.70 (C-16).

Isoplumericin (**2**) was obtained as white crystals. On the basis of mass spectral studies, the molecular formula of isoplumericin was found to be $C_{15}H_{14}O_6$. The ^1H NMR spectrum (▪ ppm, $CDCl_3$) showed signals of four protons 5.57 (1H, *d*, *J* = 5.85 Hz, H-1), 3.92 (1H, *td*, *J* = 9.33, 2.19 Hz, H-5), 3.35 (1H, *m*, H-9), 4.79 (1H, *s* , H-10), four protons on olefinic carbons 7.36 (1H, *s*, H-3), 5.98 (1H, *dd*, *J* = 7.60, 2.40 Hz, H-6), 5.50 (1H, *d*, *J* = 6.00 Hz, H-7), 6.77 (1H, *dq*, *J* = 8.40, 1.11 Hz, H-13), three protons on methoxy carbon [▪ 3.69 (3H, *s*, H-16)] and three protons on a methyl carbon 2.35 (3H, *d*, *J* = 7.11 Hz, H-14). The ^{13}C NMR spectrum (▪ ppm, $CDCl_3$) showed two ketonic carbons at 168.20 (C-12), 167.12 (C-15) along with six olefinic carbons 152.65 (C-3), 103.44 (C-4), 126.13 (C-6), 141.13 (C-7), 126.12 (C-11), 148.18 (C-13), one quaternary carbon 109.30 (C-8)], four methine carbons 101.73 (C-1), 38.24 (C-5), 51.63 (C-9), 83.77 (C-10) and two methyl carbons at [▪ 14.78 (C-14) and 53.70 (C-16).

The ^1H NMR spectra of plumericin and isoplumericin showed difference in chemical shift of C-14 methyl group. In plumericin, the methyl group at C-14 position appears at ▪ 2.09 (high shielding) due to close proximity with oxygen atom of pentacyclic ring, while methyl protons at C-14 in isoplumericin appears at ▪ 2.35 due to deshielding as compared to plumericin.

Allamandin (**3**) was obtained as white shining crystals. On the basis of mass spectral studies, its molecular formula was found to be $C_{15}H_{16}O_7$. The ^1H NMR spectrum (▪ ppm, DMSO-d_6) showed signals of six protons 5.67 (1H, *d*, *J* = 4.23 Hz, H-1), 5.34 (1H, *d*, *J* = 8.22 Hz, H-3), 2.59 (1H, *d*, *J* = 1.83 Hz, H-4), 3.55 (1H, *m*, H-5), 2.76 (1H, *dd*, *J* = 8.25, 4.02 Hz, H-9), 5.13 (1H, *s* , H-10), three protons on olefinic carbons 6.06 (1H, *d*, *J* = 5.67 Hz, H-6), 5.83 (1H, *d*, *J* = 5.31 Hz, H-7), 7.09 (1H, *q*, *J* = 7.14 Hz, H-13), three protons on methoxy carbon 3.76 (3H, *s*, H-16)] and three protons on a methyl carbon [▪ 2.06 (3H, *d*, *J* = 7.14 Hz, H-14). The ^{13}C NMR spectrum (▪ ppm, DMSO-d_6) showed two ketonic carbons at 171.96 (C-12), 168.10 (C-15) along with four olefinic carbons 130.68 (C-6), 138.71 (C-7), 128.11 (C-11), 144.40 (C-13), one quaternary carbon 102.52 (C-8), six methine carbons 98.20 (C-1), 91.20 (C-3), 46.20 (C-4), 42.23 (C-5), 53.31 (C-9), 79.73 (C-10) and two methyl carbons at 15.95 (C-14) and 52.18 (C-16).

Plumieride (**6**) was obtained as a white solid. The mass spectrometry showed molecular ion peak corresponding to the molecular formula $C_{21}H_{26}O_{12}$. The ^1H NMR spectrum (▪ ppm, DMSO-d_6) showed signals of four methine protons 5.25 (1H, *d*, *J* = 1.6 Hz, H-1), 4.82 (1H, *td*, *J* = 2.00, 9.71 Hz, H-5), 2.83 (1H, *m*, H-9), four protons on olefinic carbons 7.47 (1H, *s*, H-3), 6.39 (1H, *dd*, *J* = 2.18, 7.69 Hz, H-6), 5.54 (1H, *dd*, *J* = 2.00, 7.51 Hz, H-7), 7.25 (1H, *s*, H-10), one methine proton with a hydroxyl group 4.45 (1H, *q*, H-13) and three proton on a methyl carbon 1.28 (3H, *d*, *J* = 6.40 Hz, H-14). The ^1H NMR spectrum also showed the presence of glucose moiety by the appearance of signals at 3.05 (1H, *s*, H-2'), 3.26 (1H, *s*, H-4'), 3.42 (1H, *s*, H-3'), 3.16 (1H, *d*, *J* = Hz, H-5'), 4.54 (1H, *d*, *J* = 4.54 Hz, H-1'), 3.82 (1H, *dd*, *J* = Hz, H-6'). The ^{13}C NMR spectrum (▪ ppm, DMSO-d_6) showed two ketonic carbons at 170.55 (C-12), 166.21 (C-15) along with six olefinic carbons 155.25 (C-3), 109.11 (C-4), 129.34 (C-6), 139.64 (C-7), 148.38 (C-10), 137.39 (C-11, one quaternary carbon at 95.87 (C-8), three methine carbons 92.50 (C-1), 40.32 (C-5) and 48.64 (C-9), a methine carbon with a hydroxyl group was observed at 61.21 (C-13), two methyl carbons at 22.33 (C-14 and 52.00 (C-16). The presence of glucose moiety was confirmed by the characteristic absorption at 98.33 (C-1') for anomeric carbon, 77.11 (C-2'), 77.21 (C-3'), 73.06 (C-4'), 78.11 (C-5'), 61.25 (C-6').

Experimental

General Procedures

Melting points were determined in soft glass capillaries in an electrothermal melting point apparatus and are uncorrected. Column chromatography was performed on silica gel (60-120 Mesh) and TLC on Merck's silica gel $60F_{254}$ precoated Glass plates. IR spectra were recorded on NICOLET MEGNA FTIR-550 spectrometer using KBr pellets. ^{1}H NMR and ^{13}C NMR were recorded on Bruker spectrometer (300 MHz) in DMSO-d_6/$CDCl_3$ as solvent and TMS as internal standard. FAB Mass spectra were recorded on JEOL SX 102/BA-6000 mass spectrometer.

Plant Material

The stem bark of the plant *P. dichotoma* was collected from the campus of the University of Rajasthan, Jaipur, India. The authenticity of the plant was confirmed by Prof. Navjyot Sarna, Department of Botany, University of Rajasthan, Jaipur, India, by comparison to a sample at the herbarium of the Department of Botany.

Extraction And Isolation

The shade-dried stem bark (1.5 Kg) was finely powdered and extracted with ethanol. The extract was concentrated under reduced pressure where a semi solid brown mass was obtained. The solvent free extract was further dissolved in chloroform and treated with MeCN to remove fats. The fat free chloroform soluble portion was concentrated under reduced pressure and chromatographed over silica gel column, where two compounds **1** and **2** were isolated and characterized. The chloroform insoluble portion was also subjected to column and compounds **3** to **6** were isolated.

PLUMERIDICH ACID (13-DEHYDROXY-15-O-DEMETHYL ALLAMANDICIN) (NEW COMPOUND)

$C_{14}H_{14}O_6$. M.p.: 240-241^{0}C. Rf = 0.73 (10% MeOH in $CHCl_3$). IR (max, KBr, cm^{-1}): 2630, 1760, 1686, 1640, 1300. MS (m/z): 278 $[M]^+$. ^{1}H NMR(ppm, $CDCl_3$): 5.59 (1H, d, J = 5.85 Hz, H-1), 3.99 (1H, td, J = 2.01, 9.72 Hz, H-5), 3.48 (1H, m, H-9), 4.41 (1H, s , H-10), 2.77 (1H, m, H-11)], [7.54 (1H, s, H-3), 6.09 (1H, dd, J = 2.19, 7.68 Hz, H-6), 5.66 (1H, dd, J = 2.01, 7.50 Hz, H-7), 1.87 (1H, m, H-13), 1.67 (1H, m, H-13), 1.11 (3H, t, J = 7.50 Hz, H-14). ^{13}C NMR (ppm, $CDCl_3$): 101.50 (C-1), 154.39 (C-3), 106.17 (C-4), 37.60 (C-5), 126.22 (C-6), 141.42 (C-7), 107.87 (C-8), 53.73 (C-9), 86.76 (C-10), 48.78 (C-11), 176.72 (C-12), 22.70 (C-13), 11.92 (C-14), 170.97 (C-15)

Plumerone (13-Dehydroxy-15-Deoxy Allamandicin) (New Compound)

$C_{15}H_{16}O_5$. MS(m/z): 276 $[M]^+$. M.p.: 243^{0}C. Rf = 0.68 [$CHCl_3$:MeOH (4.5:5)] IR(KBr,cm^{-1}):2940,1770,1690,1190and1080.MS (m/z):276$[M]^+$. ^{1}H NMR(ppm, $CDCl_3$) :5.61 (d, 1H, C–1), 7.55 (s, 1H, C–3), 3.98 (td, 1H, C–5), 6.10 (dd, 1H, C–6), 5.67 (dd, 1H, C–7), 3.47 (m, 1H, C–9), 4.41 (s, 1H, C–10), 2.77 (m, 1H, C–11), 1.87 (m, 1H, C–13), 1.67 (m,1H,C–13),1.11(t,3H,C–14),2.17(s,3H,C–16). ^{13}C NMR (ppm, $CDCl_3$) :101.51 (C–1), 154.56 (C–3), 106.14 (C–4), 37.57 (C–5), 128.34 (C–6), 141.16 (C–7), 107.69 (C–8), 53.73 (C–9), 86.80 (C–10), 48.79 (C–11), 176.67 (C–12), 22.72 (C–13), 11.92 (C–14), 205.41 (C–15), 30.95 (C–16).

Plumericin

$C_{15}H_{14}O_6$. M.p.: 210-211 ^{0}C. R_f = 0.69 (4% MeOH in C_6H_6). IR $_{max}^{KBr}$ cm^{-1}: 3075, 2950, 2925, 1750, 1700, 1650. MS (m/z): 290 $[M]^+$, 218 (base peak). ^{1}H NMR (ppm, $CDCl_3$): 5.56 (1H, *d*, *J* = 5.85 Hz, H-1), 4.02 (1H, *td*, *J* = 9.33, 2.19 Hz, H-5), 3.44 (1H, *m*, H-9), 5.11 (1H, *s* , H-10)], [7.44 (1H, *s*, H-3), 6.06 (1H, *dd*, *J* = 7.05, 2.19 Hz, H-6), 5.65 (1H, *dd*, *J* = 7.68, 2.19 Hz, H-7), 7.17 (1H, *dq*, *J* = 8.40, 1.11 Hz, H-13), 3.77 (3H, *s*, H-16), 2.09 (3H, *d*, *J* = 7.11 Hz, H-14). ^{13}C NMR (ppm, $CDCl_3$): 102.29 (C-1), 152.74 (C-3), 104.61 (C-4), 38.40 (C-5), 127.42 (C-6), 141.10 (C-7), 109.35 (C-8), 51.69 (C-9), 80.30 (C-10), 126.38 (C-11), 168.22 (C-12), 145.34 (C-13), 16.12 (C-14), 166.69 (C-15), 53.70 (C-16)

Isoplumericin

$C_{15}H_{14}O_6$. M.p.: 198-200 ^{0}C. R_f = 0.68 (4% MeOH in C_6H_6). IR $_{max}^{KBr}$ Cm^{-1}: 3075, 2945, 2930, 1750, 1705, 1640. MS (m/z): 290 $[M]^+$, 218 (base peak). ^{1}H NMR(ppm, $CDCl_3$): 5.57 (1H, *d*, *J* = 5.85 Hz, H-1), 3.92 (1H, *td*, *J* = 9.33, 2.19 Hz, H-5), 3.35 (1H, *m*, H-9), 4.79 (1H, *s* , H-10), 7.36 (1H, *s*, H-3), 5.98 (1H, *dd*, *J* = 7.60, 2.40 Hz, H-6), 5.50 (1H, *d*, *J* = 6.00 Hz, H-7), 6.77 (1H, *dq*, *J* = 8.40, 1.11 Hz, H-13), 3.69 (3H, *s*, H-16), 2.35 (3H, *d*, *J* = 7.11 Hz, H-14). ^{13}C NMR (ppm, $CDCl_3$): 101.73 (C-1), 152.65 (C-3), 103.44 (C-4), 38.24 (C-5), 126.13 (C-6), 141.13 (C-7), 109.30 (C-8), 51.63 (C-9), 83.77 (C-10), 126.12 (C-11), 168.20 (C-12), 14.78 (C-14), 167.12 (C-15), 53.70 (C-16)

Allamandin

$C_{15}H_{16}O_7$. M.p.: 220-221 ^{0}C. R_f = 0.82 (30% MeOH in C_6H_6). IR $_{max}^{KBr}$ Cm^{-1}: 3350, 2950, 2900, 1740, 1690. MS (m/z): 308 $[M]^+$, 290 (base peak). ^{1}H NMR(ppm, DMSO-d_6): 5.67 (1H, *d*, *J* = 4.23 Hz, H-1), 5.34 (1H, *d*, *J* = 8.22 Hz, H-3), 2.59 (1H, *d*, *J* = 1.83 Hz, H-4), 3.55 (1H, *m*, H-5), 2.76 (1H, *dd*, *J* = 8.25, 4.02 Hz, H-9), 5.13 (1H, *s* , H-10), 6.06 (1H, *d*, *J* = 5.67 Hz, H-6), 5.83 (1H, *d*, *J* = 5.31 Hz, H-7), 7.09 (1H, *q*, *J* = 7.14 Hz, H-13), 3.76 (3H, *s*, H-16), 2.06 (3H, *d*, *J* = 7.14 Hz, H-14). ^{13}C NMR (ppm, $CDCl_3$): 98.20 (C-1), 91.20 (C-3), 46.20 (C-4), 42.23 (C-5), 130.68 (C-6), 138.71 (C-7), 102.52 (C-8), 53.51 (C-9), 79.73 (C-10), 128.11 (C-11), 171.96 (C-12), 144.40 (C-13), 15.95 (C-14), 168.10 (C-15), 52.18 (C-16)

Plumieride

$C_{21}H_{26}O_{12}$. M.p.: 183-184 ^{0}C. IR $_{max}^{KBr}$ Cm^{-1}: 3350-3220, 1750, 1650, 1040. MS (m/z): 471 $[M^+H]$, 470 $[M]^+$. ^{1}H NMR(ppm, $CDCl_3$): 5.25 (1H, *d*, *J* = 1.6 Hz, H-1), 4.82 (1H, *td*, *J* = 2.00, 9.71 Hz, H-5), 2.83 (1H, *m*, H-9), 7.47 (1H, *s*, H-3), 6.39 (1H, *dd*, *J* = 2.18, 7.69 Hz, H-6), 5.54 (1H, *dd*, *J* = 2.00, 7.51 Hz, H-7), 7.25 (1H, *s*, H-10), 4.45 (1H, *q*, H-13),1.28 (3H, *d*, *J* = 6.40 Hz, H-14), 3.05 (1H, *s*, H-2'), 3.26 (1H, *s*, H-4'), 3.42 (1H, *s*, H-3'), 3.16 (1H, *d*, *J* = Hz, H-5'), 4.54 (1H, *d*, *J* = 4.54 Hz, H-1'), 3.82 (1H, *dd*, *J* = Hz, H-6'). ^{13}C NMR (ppm, DMSO-d_6): 92.50

(C-1), 155.25 (C-3), 109.11 (C-4), 40.32 (C-5), 129.34 (C-6), 139.64 (C-7), 95.87 (C-8), 48.64 (C-9), 148.38 (C-10), 137.39 (C-11), 170.55 (C-12), 61.21 (C-13), 22.33 (C-14), 166.21 (C-15), 52.00 (C-16), 98.33 (C-1'), 77.11 (C-2'), 77.21 (C-3'), 73.06 (C-4'), 78.11 (C-5'), 61.25 (C-6')

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References

1. Abdel-Kader M.S., Wisse J., Evans R., Vander Werff H.,1997. Bioactive iridoids and a new lignan from *Allamanda cathartica* and *Himatanthus fallax* from the suriname rain forest. J Nat Prod 60, 1294-1297.

2. Coppen J.J.W., Cobb A.L., 1983. The occurrence of iridoids in *Plumeria* and *Allamanda*. Phytochemistry 22,125.

3. Coppen J.J.W., 1983. iridoids with algicidal properties from *Allamanda cathartica*. Phytochemistry 22,179-182.

4. Dobhal M.P., Hasan A.M., Sharma M.C., Joshi B.C., 1999. Ferulic acid esters from *Plumeria bicolor*. Phytochemistry 51, 319-321.

5. Dobhal M.P., Li G., Gryshuk A., Graham A., Bhatanagar A.K., Khaja S.D., Joshi Y.C., Sharma M.C., Oseroff A., Pandey R.K., 2004. Structural modifications of Plumieride isolated from *Plumeria bicolor* and the effect of these modifications on invitro anticancer activity. J Org Chem 69, 6165

6. Gupta R.S., Bhatnager A.K., Joshi Y.C., Sharma R., Sharma A., 2004. Effects of plumieride, an iridoid on spermatogenesis in male albino rats. Phytomedicine 11,169.

7. Kardono L.B.S., Tsauri S., Padmawinata K., Pezzuto J.M., Kinghorn A.D., 1990. Cytotoxic constitution of the bark of *Plumeria rubra* collected in Indonesia. J Nat Prod 53, 1447-1455.

8. Kupchan S.M., Dessertine A.L., Balaylock B.T., Bryan R.F., 1974. Isolation and structural elucidation of allamandin, an antileukemic iridoid lactone from *Allamanda cathartica*. J Org Chem 39, 2477-2482.

Chemical Constituents and Biological Activities of Plants from the Genus Plumeria - a small Review

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Introduction

The genus Plumeria belongs to the family Apocynaceae and comprises of eleven species distributed mainly in India, Indonesia, Philippines and South Africa. Various species of this plant are used as medicine for the cure of several diseases. A number of active principles, mainly iridoids and triterpenoids, have been reported from Plumeria species, and these could be a promising bio resource for the development of potential drugs and value-added products. Plant species of this genus have also been used as antifungal [1], anti-inflammatory [2], antileukemic, anticancer [3-7], anti-HIV [8, 9], antimicrobial and cytotoxic [10-12] agents. In this review, phytochemical progress and spectral data of the compounds isolated from the genus Plumeria over the past decades are being described along with their biological activities.

Chemical Constituents

The reported chemical constituents from genus Plumeria so far, include triterpenoids [13-15], ferulic acid esters [17], iridoids [8, 18-20] and flavones [29]. Their structure, name, and NMR data (^{1}H NMR and ^{13}C NMR) have been summarized in the Table.

2.1. Triterpenoids. From the leaves of Plumeria obtusa a known triterpene, 27-p-E-coumaroyloxyursolic acid **1** has been isolated, along with two triterpenes **2, 3** from Plumeria rubra. The leaves of Plumeria obtusa also afforded two pentacyclic triterpenoids, coumarobtusanoic acid **4** and coumarobtusane **7**, whose structures were established as 27-p-E-coumaroyloxy-2 ,3 -dihydroxyurs-28-oic acid and 27-p-E-coumaroyloxy-2 ,3 -dihydroxyursane respectively. Six new triterpenoids **5, 6, 8-11** were also isolated from fresh leaves and stem bark of Plumeria obtusa.

2.2. Ferulic Acid Esters. Two ferulic acid derivatives, 34-hydroxy tetratriacontanyl ferulate **12** and 34-O-acetyl tetratriacontanyl ferulate **13**, were isolated from the stem bark of Plumeria bicolor.

2.3. Iridoids. Thirty five iridoids **14-48** were isolated from the genus Plumeria. Some of them were reported to have biological activities.

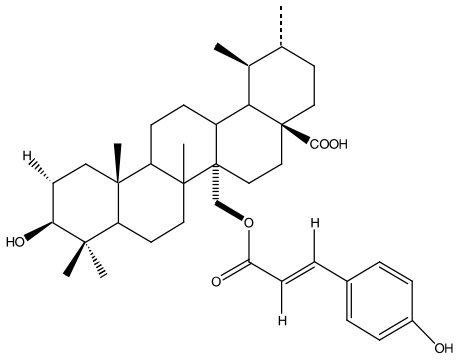
2.4. Flavones. A novel flavan-3-ol glycoside, plumerubroside **49** was isolated from the stem bark of Plumeria rubra and its structure was elucidated as (2R,3S)-3,4"-dihydroxy-7,3',5 -trimethoxy-5-O- -D-glucopyranoside.

Biological Activities

1. Anticancer Activity. Plumieride was isolated as one of the major components from the biologically active methanolic extract of the bark of Plumeria bicolor. For investigating the effect of substituents on cytotoxic activity it was modified into a series of compounds. The in vitro cytotoxicity [3] was determined in radiation-induced fibrosarcoma (RIF) tumour cell lines by MTT assay method. The modified analogues were found to be more effective than the parent molecule.

2. Anti-inflammatory Activity. The methanolic extract of Plumeria acuminata [2] exhibited significant anti-inflammatory activity on the tested experimental models. The extract (500 mg/kg bw) exhibited maximum anti-inflammatory effect i.e., 30.51, 47.06, 34.48 and 32.50% ($P < 0.001$) at the end of 3 hrs with carrageenan, dextran, histamine and serotonin respectively. Administration of methanolic extract of Plumeria acuminata (500 mg/kg bw) and indomethacin (10 mg/kg bw) significantly reduced the formation of granuloma tissue induced by cotton pellet method at a rate of 45.06 and 51.57% respectively. The effect produced by the extract was comparable to that of indomethacin a prototype of a nonsteroidal anti-inflammatory agent. The results obtained in this study indicated that the methanol extract of Plumeria acuminata possess potent anti-inflammatory activity in both acute and chronic models.

3. Biocatalytic Activity. The enzymatic properties of Plumeria rubra latex [18] were measured, showing a high activity in both hydrolysis and synthesis reactions, and compared to the biocatalytic behaviour of babaco latex.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HO
O
H
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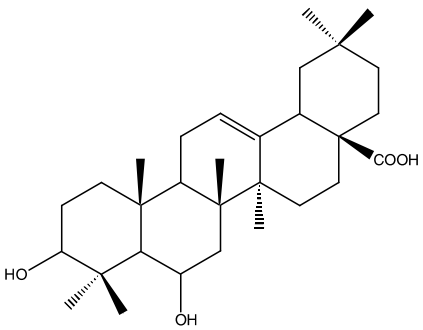
H
OH

(**1**)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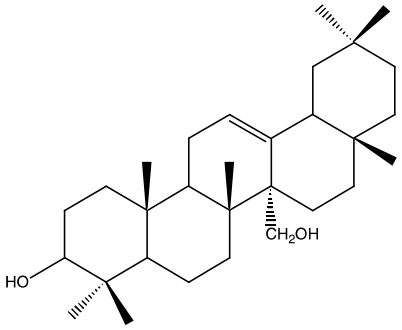
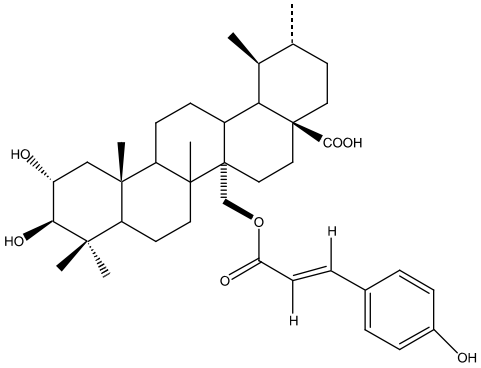
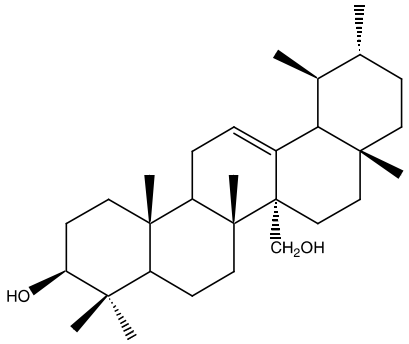

CH2OH
HO

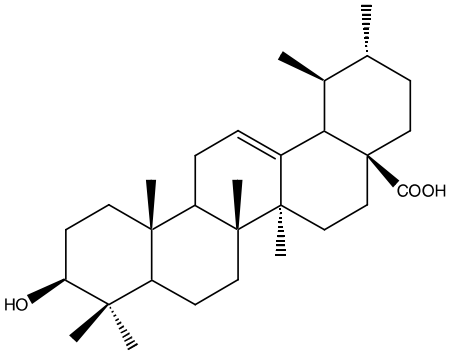
(**3**)


COOH
HO
HO
O
H
O
H
OH

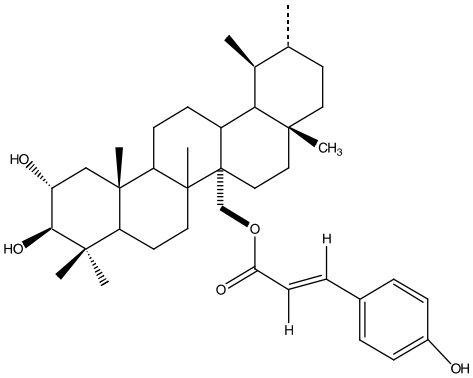
(**4**)


CH2OH
HO

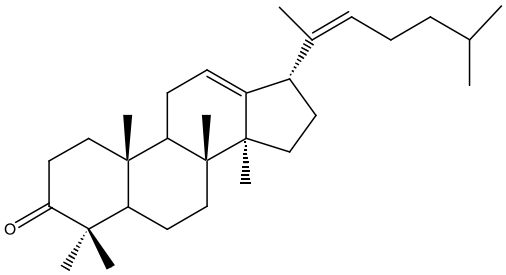
(**5**)


COOH
HO

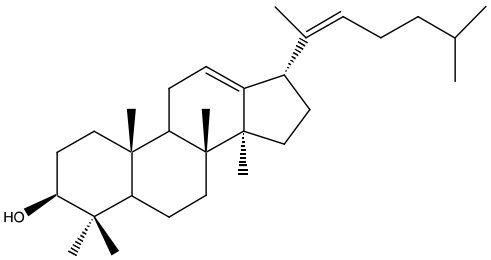
(**6**)


CH3
HO
HO
O
H
O
H
OH

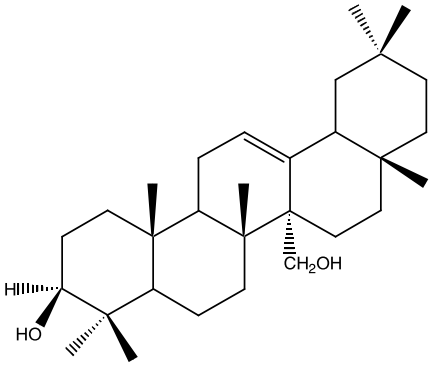
(**7**)


O

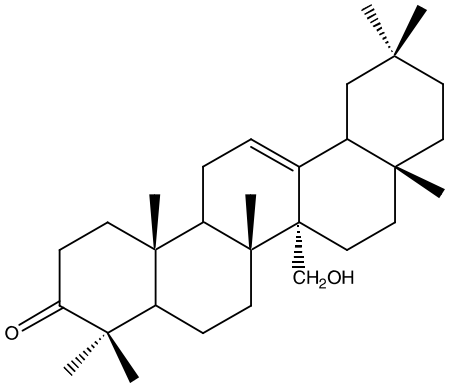
(**8**)


HO

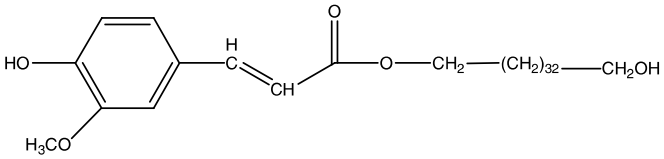
(**9**)


HO
CH2OH

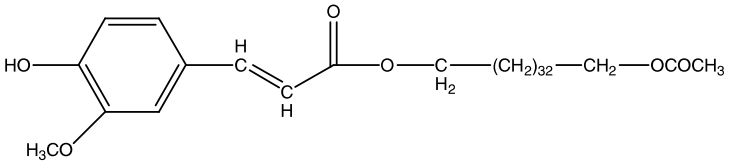
(**10**)


O
CH2OH

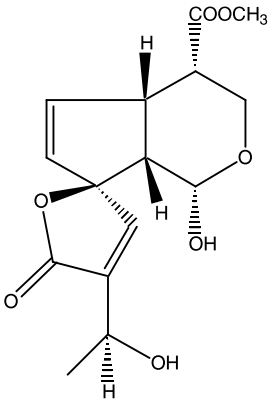
(**11**)


HO
H3CO
H
C
CH
O
O
CH2
(CH2)32
CH2OH

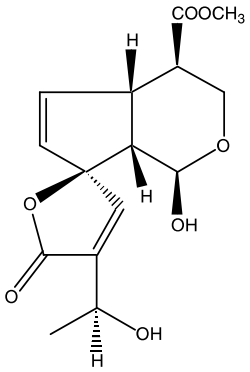
(**12**)


HO
H3CO
H
C
C
H
O
O
C
H2
(CH2)32
CH2
OCOCH3

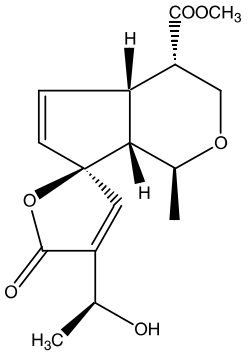
(**13**)



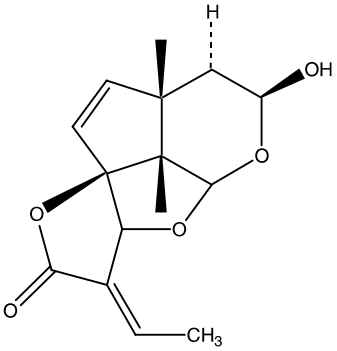
(**14**)



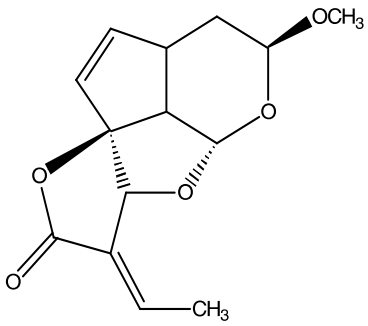
(**15**)



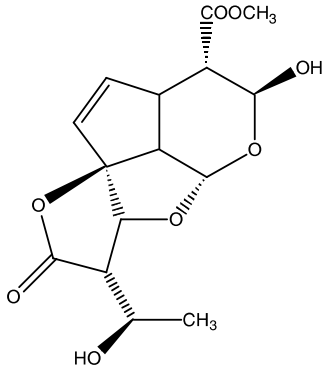
(**16**)



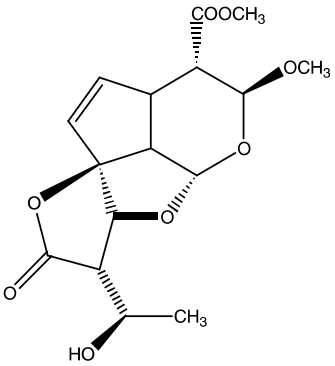
(**17**)



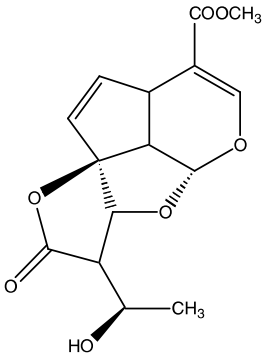
(**18**)



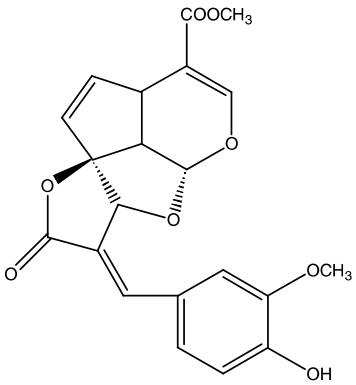
(**19**)



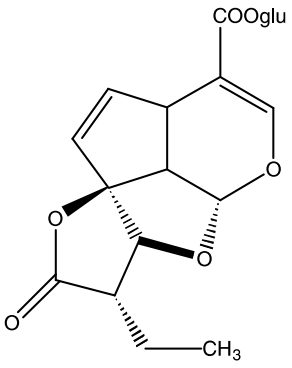
(**20**)



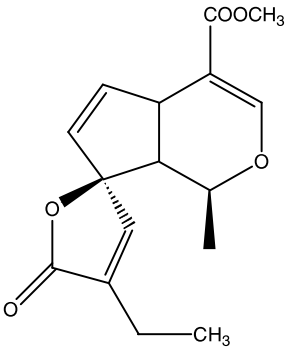
(**21**)



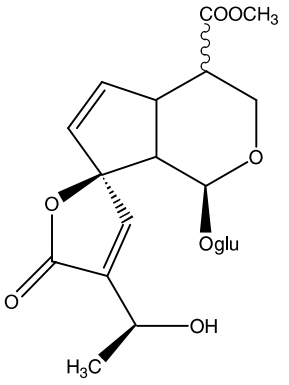
(**22**)



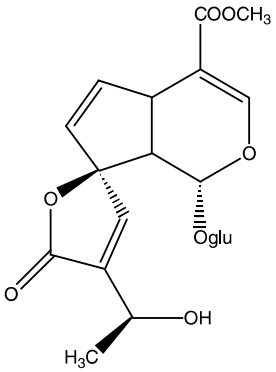
(**23**)



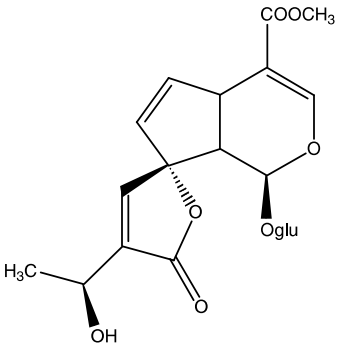
(**24**)



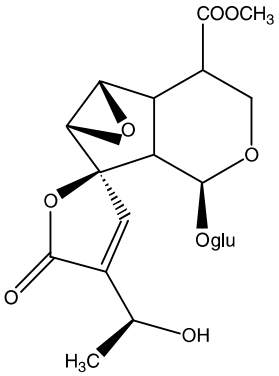
(**25**)



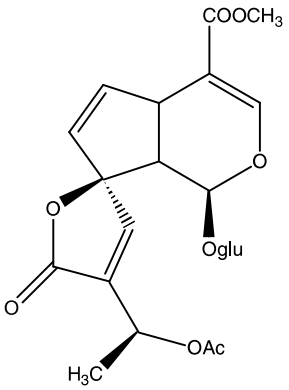
(**26**)



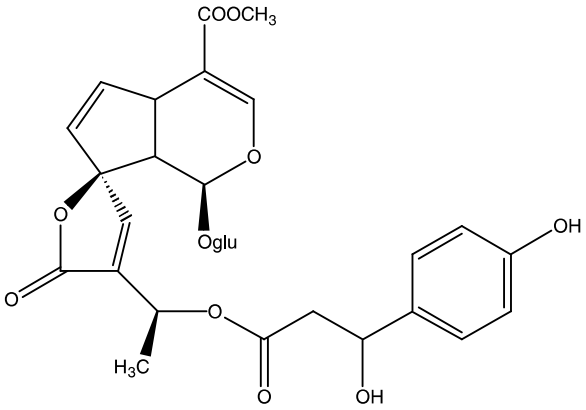
(**27**)



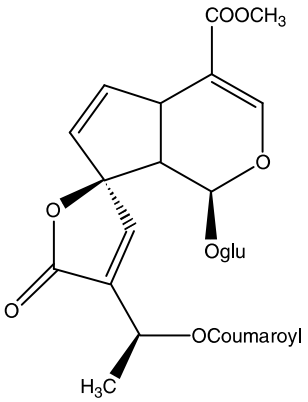
(**28**)



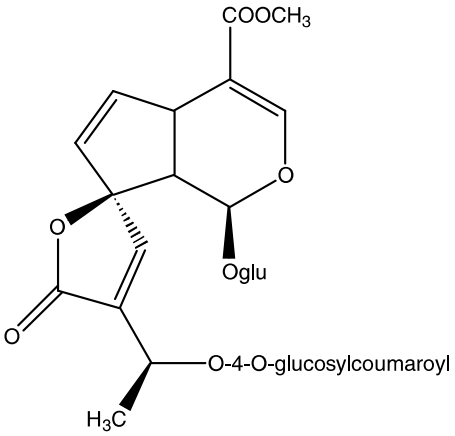
(**29**)



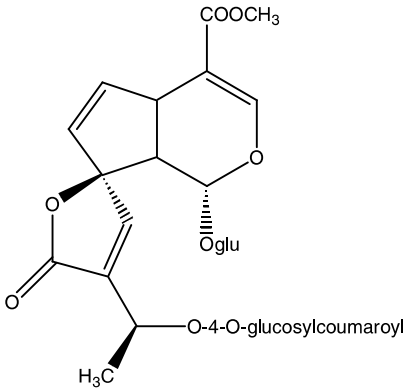
(**30**)



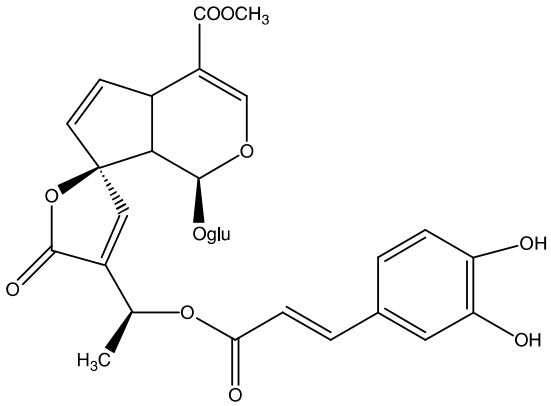
(**31**)



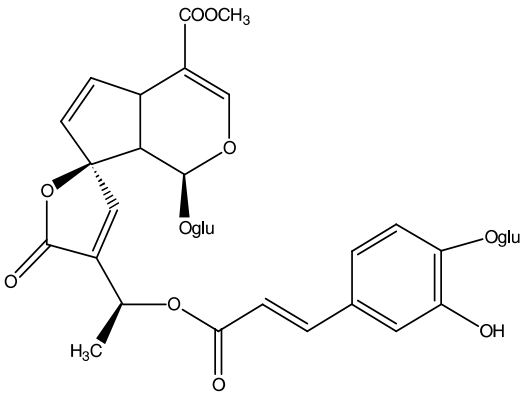
(**32**)



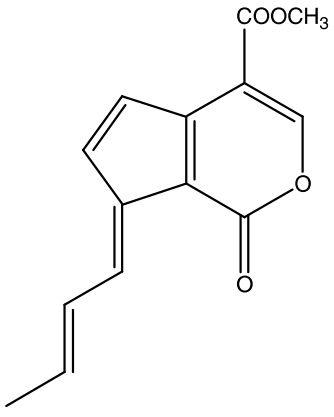
(**33**)



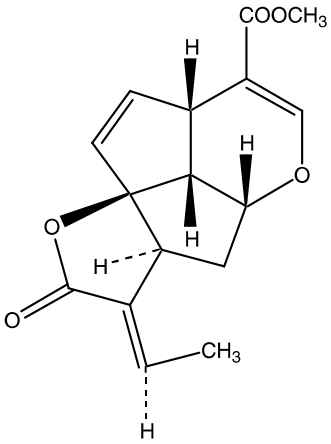
(**34**)



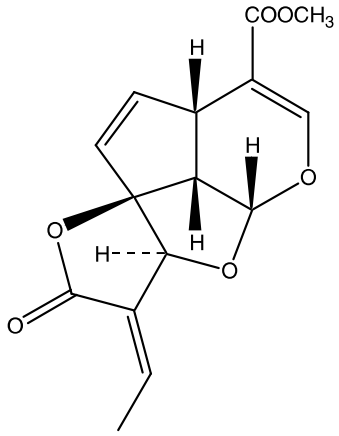
(**35**)



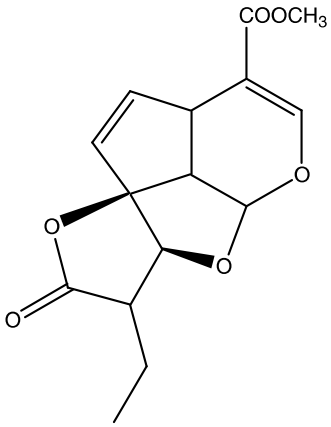
(**36**)



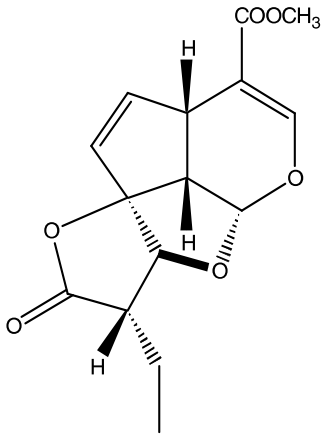
(**37**)



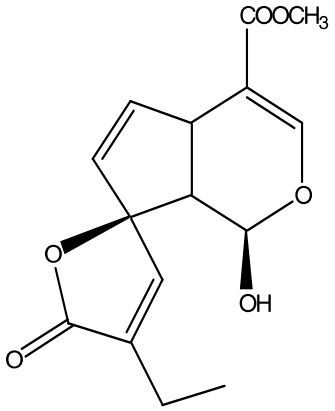
(**38**)



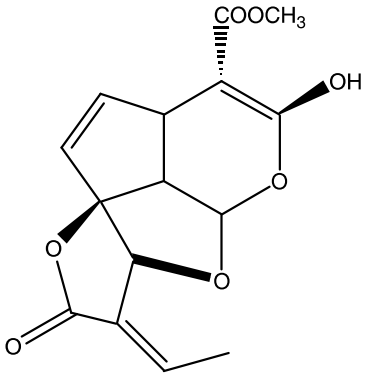
(**39**)



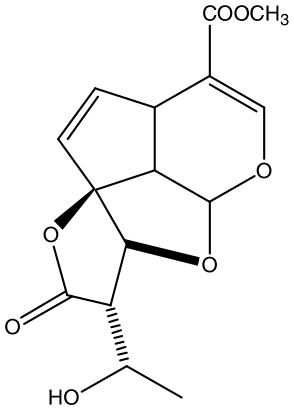
(**40**)



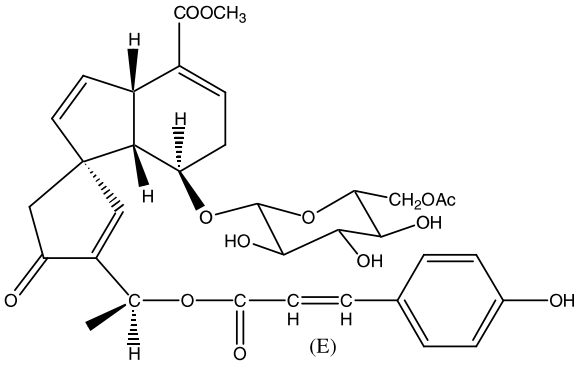
(**41**)



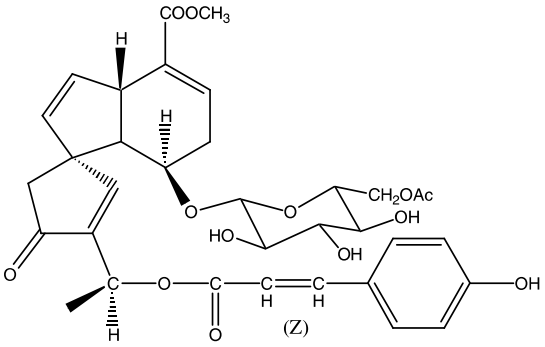
(**42**)



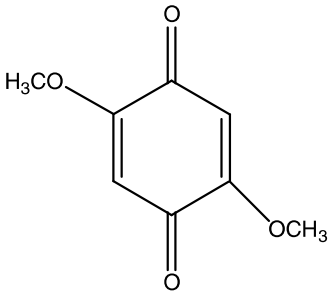
(**43**)



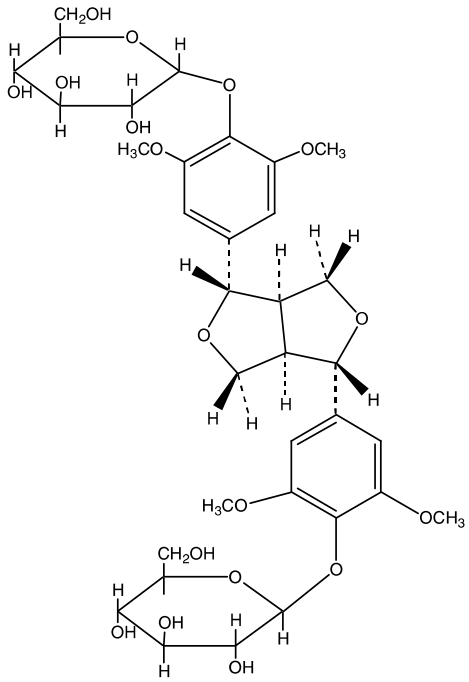
(**44**)



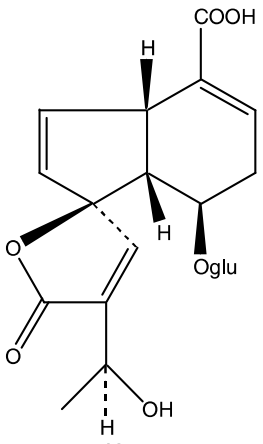
(**45**)



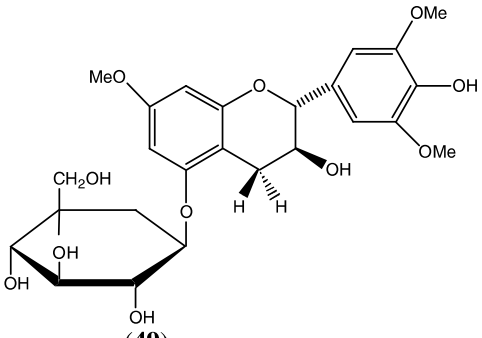
(**46**)



(**47**)



(**48**)



(**49**)

Conclusion

The genus Plumeria is widespread all over the world, and many species of this genus have been used by local citizens as traditional herbal medicines. Extensive phytochemical investigation on this genus has been carried out, and components isolated from this genus exhibited significant bioactivities. In the future, much more phytochemical and biological studies should be carried out on this genus in order to disclose their active principles and mechanisms of action of active components.

Table. Chemical Constituents of Plants from the Genus Plumeria

No.	Compound class, name and NMR data	Ref.
	Triterpenoids	
1	27-p-E-coumaroyloxyursolic acid	[13]
	^{1}H NMR: ▪ 0.93(d,H-30,7.1), 0.98(s,H-24), 0.99(s,H-25), 1.00(s,H-23), 1.05(s,H-26), 1.19(d,H-29,7.2) 2.60(d,H-18,11.6), 3.38(dd,H-3,7.8,8.0), 4.54(d,H-27b,13.0), 4.73(d,H-27a,13.0), 5.46 (brs,H-12), 6.67(d,H-2',15.9), 7.13(d,H-6'/H-8',8.5), 7.60(d,H-5'/H-9",8.5), 7.96(d,H-3 ,15.9)	
	^{13}C NMR: 37.4(C-1), 28.1(C-2), 78.1(C-3), 38.5(C-4), 56.0(C-5), 18.9(C-6), 33.2(C-7), 39.8 (C-8), 48.2(C-9), 38.5(C-10), 23.8(C-11), 125.6(C-12), 134.6(C-13), 47.2(C-14), 28.3 (C-15), 24.1(C-16), 48.2(C-17), 53.3(C-18), 39.4(C-19), 39.1(C-20), 30.7(C-21), 37.4 (C-22), 29.3(C-23), 16.0(C-24), 16.6(C-25), 16.9(C-26), 66.2(C-27), 179.9(C-28), 17.0(C-29), 21.4(C-30), 167.2(C-1"), 115.6(C-2), 145.2(C-3"), 134.6(C-4), 130.6 (C-5"), 116.9(C-6"), 161.5(C-7"), 116.9(C-8'), 130.6(C-9")	
2	6 -Hydroxy-3-epi-oleanolic acid	[14]
	^{1}H NMR: ▪ 0.80, 0.85, 0.87, 0.89, 0.96, 1.01, 1.12(3H, each s, Me), 3.40 (t,H-3,2.6), 3.60 (ddd,10.0,4.4), 5.24 (t,H-12,3.6)	
	^{13}C NMR: ▪ 38.1(C-1), 29.3(C-2), 76.1(C-3), 38.4(C-4), 56.7(C-5), 69.5(C-6), 36.2(C-7), 40.0 (C-8), 46.8(C-9), 35.7(C-10), 24.4(C-11), 126.2(C-12), 141.5(C-13), 42.8(C-14), 29.2 (C-15), 25.4(C-16), 48.3(C-17), 54.4(C-18), 34.2(C-19), 39.2(C-20), 31.8(C-21), 36.5 (C-22), 29.3(C-23), 21.6(C-24), 17.6(C-25), 17.5(C-26), 24.7(C-27), 182.0(C-28), 33.5(C-29), 24.1(C-30)	
3	3 ,27-dihydroxy-olean-12-ene	[14]
	^{1}H NMR: ▪ 0.78, 0.94, 0.95, 0.98, 0.99, 1.01, 1.24 (3H, each s, Me), 3.30(t,H-3,2.8), 3.65(q,H-27,10.9), 5.13(m,H-12)	
	^{13}C NMR: ▪ 38.8(C-1), 27.3(C-2), 77.2(C-3), 40.0(C-4), 55.2(C-5), 18.3(C-6), 32.9(C-7), 38.0 (C-8), 47.8(C-9), 36.9(C-10), 23.4(C-11), 125.1(C-12), 138.8(C-13), 42.1(C-14), 23.5 (C-15), 26.0(C-16), 32.7(C-17), 47.7(C-18), 46.0(C-19), 31.5(C-20), 35.2(C-21), 37.6 (C-22), 28.2(C-23), 21.3(C-24), 15.6(C-25), 16.8(C-26), 70.0(C-27), 27.8(C-28), 33.0(C-29), 23.2(C-30)	
4	27-p-E-coumaroyloxy-2 ,3▪-dihydroxyurs-28-oic acid	[13]
	^{1}H NMR: 0.97(d,H-30,5.8), 0.98(s,H-25), 0.99(s,H-24), 1.00(s,H-23), 1.05(s,H-26), 1.10(d,H-29,6.3) 3.38(d,H-3,10.2), 4.06(ddd,H-2,10.2,10.2,4.6), 4.55(d,H-27b,12.5), 4.71(d,H-27a,12.5), 6.67(d,H-2",15.8), 7.12(d,H-6"/H-8",8.6), 7.59(d,H-5'/H-9',8.6), 7.97(d,H-3",15.8)	
	^{13}C NMR: ▪ 46.5(C-1), 68.6(C-2), 83.9(C-3), 39.1(C-4), 55.9(C-5), 18.9(C-6), 33.6(C-7), 39.6 (C-8), 48.2(C-9), 38.5(C-10), 23.8(C-11), 28.1(C-12), 39.1(C-13), 42.0(C-14), 28.7 (C-15), 24.2(C-16), 48.2(C-17), 48.3(C-18), 39.6(C-19), 39.5(C-20), 31.1(C-21), 37.4 (C-22), 28.3(C-23), 17.0(C-24), 16.9(C-25), 17.5(C-26), 66.2(C-27), 179.9(C-28),	

16.6(C-29), 21.4(C-30), 167.2(C-1'), 116.0(C-2'), 145.2(C-3), 133.6(C-4), 130.6(C-5) 116.8(C-6"), 161.5(C-7"), 116.8(C-8"), 130.6(C-9")

Table (cont.)

No.	Compound class, name and NMR data	Ref.
5	Obtusol	[15]

^{1}H NMR: ', 0.72(dd,H-5,11.5,1.5), 0.77(s,H-25), 0.80(d,H-29,6.0), 0.92(d,H-30,6.0), 0.93(s,H-26), 0.97(s,H-23), 0.98(s,H-24), 0.99(H-20), 1.09(s,H-28), 1.23(H-15), 1.23(H-2), 1.24(dd,H-9,5.0,4.0), 1.38(H-6),1.40(H-7), 1.51(H-22), 1.60(H-21), 1.60(m,H-19), 1.64(H-1), 1.73(td,H11b), 1.89(H-16),1.90(dt,H11a), 2.22(m,H-18), 3.18(d,H-27b,11.0), 3.20(dd,H-3,11.0,5.0), 3.51(d,H-27a,11.0), 5.12(t,H-12,3.5)

^{13}C NMR: 38.89(C-1), 29.72(C-2), 79.08(C-3), 39.44(C-4), 54.15(C-5), 18.40(C-6), 32.92(C-7), 40.14(C-8), 47.79(C-9), 36.98(C-10), 26.09(C-11), 125.13(C-12), 138.84(C-13), 38.0 (C-14),30.69(C-15), 23.43(C-16), 42.17(C-17), 55.32(C-18), 39.49(C-19), 38.83(C-20), 27.34(C-21), 35.23(C-22), 28.18(C-23), 16.84(C-24), 15.72(C-25), 15.64(C-26), 69.95 (C-27),17.37(C-28), 21.33(C-29), 23.37(C-30)

6 Zamanic Acid [15]

^{1}H NMR: 0.69, 0.83, 0.84, 0.86, 0.92, 0.97(s, C-methyls), 2.28(d,H-18,10.9), 3.16(dd,H-3 ,11.0,5.0), 4.15(dd,H-30b,12.5,3.1),4.31(dd,H-30a,12.5,5.4), 5.56(t,H-12,3.6), 6.2(d,H-2 ,16.0), 6.86 (d,H-6" and H-8",8.8), 7.40(d,H-5'and H-9',8.8), 7.64 (H-3",16.0)

7 27-p-E-coumaroyloxy-2 ,3 -dihydroxyursane [13]

^{1}H NMR: 0.97(s,H-24), 0.98(s,H-25), 1.00(s,H-28), 1.03(s,H-23), 1.05(d,H-30,6.4), 1.08(s,H26), 1.18(d,H-29,6.6), 3.39(d,H-3,10.2), 4.05(ddd,H-2,10.2,10.2,4.6), 4.54(d,H-27b,12.5), 4.72(d, H-27a,12.5), 6.55(d,H-2",15.8), 7.10(d,H-6"/H-8",8.6), 7.58(d,H-5"/H-9 ,8.6), 7.95(d,H-3",15.8)

^{13}C NMR: 45.6(C-1), 68.6(C-2), 83.9(C-3), 39.1(C-4), 55.9(C-5), 18.9(C-6), 33.2(C-7), 39.8(C-8), 48.0(C-9), 38.5(C-10), 23.9(C-11), 29.3(C-12), 39.4(C-13), 42.1(C-14), 30.0(C-15), 24.1(C-16), 34.2(C-17), 49.2(C-18), 39.6(C-19), 39.5(C-20), 31.1(C-21), 37.4(C-22), 28.3(C-23), 17.6(C-24), 16.9(C-25), 17.5(C-26), 66.2(C-27), 18.9(C-28), 15.8(C-29), 21.4(C-30), 167.2(C-1'), 115.7(C-2), 145.2(C-3), 134.6(C-4"), 130.4(C-5), 116.9(C-6), 161.5(C-7'), 116.9(C-8"), 130.4(C-9")

8 Dammara-12,20(22)Z-dien-3-one [16]

^{1}H NMR: 0.82(s,H-18), 0.83(d,H-26,6.9), 0.84(s,H-19a/b), 0.85(d,H-27a,6.5), 0.86(s,H-28), 0.87 (s,H-29), 0.88(s,H-30), 1.62(d,H-21a/b,1.2), 2.27(m,H-23), 2.32(m,H-2b), 2.48(m,H-2a), 5.17(t,H-12,3.8), 5.40(qt,H-22a/b,6.9,1.2)

^{13}C NMR: 39.8(C-1), 34.1(C-2), 216.5(C-3), 47.3(C-4), 55.3(C-5), 22.7(C-6), 31.9(C-7), 38.8(C-8), 46.0(C-9), 36.6(C-10), 24.4(C-11), 118.1(C-12), 158.0(C-13), 55.4(C-14), 24.7(C-15), 29.1(C-16), 51.21(C-17), 14.1(C-18), 15.9(C-19), 142.5(C-20), 22.68(C-21), 129.7(C-22), 23.7(C-23), 39.3(C-24), 27.9(C-25), 22.61(C-26), 22.5(C-27), 32.6(C-28), 19.73(C-29), 16.8(C-30)

9 Dammara-12,20(22)Z-dien-3 -ol [16]

^{1}H NMR: 0.78(s,H-18), 0.82(s,H-19a/b), 0.83(d,H-26,7.2), 0.85(s,H-30), 0.88(s,H-29), 0.93 (d,H-27a,7.2),0.98(s,H-28), 1.67(t,H-21a/b,1.2), 3.21(dd,H-3 ,10.5,4.9), 5.10(t,H-12,3.6), 5.39(qt,H-22a/b,7.0,1.2)

Table (cont.)

No.	Compound class, name and NMR data	Ref.
10	Olean-12-en-3 ,27-diol	[16]

^{1}H NMR: 0.50(m,H-5), 0.72(s,H-25), 0.78(s,H-24), 0.89(s,H-26), 0.91(s,H-30), 0.96(s,H-23), 0.98 (s,H-29), 1.06(s,H-27b), 1.21(m,H-15), 1.21(m,H-2a), 1.21(m,H-2b), 1.34(m,H-7a/b), 1.35(m,H-21a/b), 1.41(m,H-6), 1.49(m,H-9), 1.49(m, H-19a/b), 1.51(m,H-22a/b), 1.60 (m,H-1), 1.83(dd,H-18,14.0,3.7), 1.85(m,H-16), 1.89(m,H-11), 2.01(m,H-11b), 3.15(d, H-27b,11.0), 3.20(dd,H-3 ,10.5,4.8), 3.52(d,H-27a,11.0), 5.09(t,H-12,3.5)

^{13}C NMR: 38.8(C-1), 29.6(C-2), 79.1(C-3), 38.7(C-4), 55.2(C-5), 18.3(C-6), 38.7(C-7), 39.4(C-8), 47.6(C-9), 36.8(C-10), 25.9(C-11), 125.0(C-12), 138.7(C-13), 37.9(C-14), 30.6(C-15), 23.3(C-16), 42.0(C-17), 47.6(C-18), 46.4(C-19), 31.9(C-20), 34.0(C-21), 35.2(C-22), 28.1(C-23), 15.6(C-24), 15.6(C-25), 16.7(C-26), 69.8(C-27), 23.3(C-28), 33.2(C-29), 21.3(C-30)

11 27-hydroxyolean-12-en-3-one [16]

^{1}H NMR: 0.79(s,H-25),0.84(s,H-24), 0.86(s,H-26), 0.93(s,H-30), 0.96(s,H-23), 0.98(s,H-29), 1.08 (s,H-28), 1.87(dd,H-18,12.8,4.8), 2.27(m,H-2b), 2.36(m, H-2a), 3.26(d,H-27b,11.0), 3.38(d, H-27a,11.0), 5.40 (t,H-12,3.3)

Ferulic Acid Esters

12 34-hydroxy tetratriacontanyl ferulate [17]

^{1}H NMR: 3.67(t,H-34,6.5), 3.90(s,-OCH_3), 4.17(t,H-1,6.5), 5.80(s, -OH), 6.28(d,H-8',16), 6.90 (d,H-5',8),7.01(d,H-2'), 7.05(dd,H-6',8,2), 7.59(d,H-7',16)

^{13}C NMR: 127.11(C-1'), 109.44(C-2'), 146.75(C-3'), 147.90(C-4), 115.79(C-5'), 122.89(C-6'), 144.44(C-7'), 115.79(C-8'), 167.71(C-9'), 64.53(C-1), 62.99(C-34), 55.90(-OCH_3)

13 34-o-acetyl tetratriacontanyl ferulate [17]

^{1}H NMR: 2.01(s,H-2''), 3.90(s,-OCH_3), 4.03(t,H-34), 4.17(t,H-1), 5.80(s, -OH), 6.28(d,H-8'), 6.90(d,H-5'), 7.01(d,H-2'), 7.05(dd,H-6'), 7.59(d,H-7')

^{13}C NMR: 127.11(C-1'), 109.44(C-2'), 146.75(C-3), 147.90(C-4'), 115.79(C-5), 122.89(C-6), 144.44(C-7'), 115.79(C-8'), 167.71(C-9'), 64.53(C-1), 64.47(C-34), 171.88(C-1''), 21.11(C-2'')

Iridoids

14 -Allamcidin [8] [18]

^{1}H NMR: 5.80(d,H-1,9), 3.80(m,H-3), 2.80(m,H-4), 3.32(m,H-5), 6.17(dd,H-6,6,2), 5.54(dd,H-7,6,1), 2.44(dd,H-9,11,9), 7.03(d,H-10,2), 5.58(dq,H-13,6,2), 1.49(d,H-14,6), 3.74(COOMe), 2.08(OAc)

^{13}C NMR: 93.6(C-1), 62.0(C-2), 44.8(C-4), 44.6(C-5), 131.4(C-6), 139.5(C-7), 97.2(C-8), 49.8 (C-9), 149.1(C-10), 135.1(C-11), 171.6(C-12), 65.5(C-13), 19.4(C-14), 170.4(C-15), 52.2(OMe), 20.8, 20.7 (O=CMe), 169.8, 169.2(O=CMe)

Table (cont.)

No.	Compound class, name and NMR data	Ref.
15	-Allamcidin	[8] [18]

^{1}H NMR: 6.42(d,H-1,3), 3.94(dd,H-3,13,4), 3.49(dd,H-3,13,1), 2.82(m,H-4), 3.56(m,H-5), 6.38 (dd,H-6,6,2), 5.61(dd,H-7,6,1), 2.48(dd,H-9,11,3), 7.01(d,H-10,2), 5.64(dq,H-13,6,2), 1.48(d,H-14,6), 3.73(COOMe), 2.09(OAc)
^{13}C NMR: 89.6(C-1), 57.2(C-2), 44.4(C-4), 38.3(C-5), 131.5(C-6), 139.5(C-7), 97.5(C-8), 48.3 (C-9), 149.3(C-10), 135.1(C-11), 171.6(C-12), 65.5(C-13), 19.6(C-14), 170.3(C-15), 52.2(OMe), 20.8, 20.5 (O=CMe), 169.8, 169.2(O=CMe)

16	Plumeridine	[22]

^{1}H NMR: 5.33(d,H-1,4), 7.47(d,H-3,2), 3.94(bq,H-5,8), 6.38(td,H-6,6,2), 5.33(d,H-7,6), 3.10 (q,H-9,8,4), 7.29(d,H-10,1), 4.82(bq,H-13,7,1), 1.47(d,H-14,7), 3.53(OMe)

17	Allamcin	[8] [18]

^{1}H NMR: 5.54(d,H-1,5), 4.94(dd,H-3,8,5), 1.98(m,H-4), 3.28(m,H-5), 6.04(dd,H-6,6,2), 5.82 (dd,H-7,6,2), 2.90(dd,H-9,8,5), 5.03(bs,H-10), 6.94(dq,H-13,7,2), 1.97(d,H-14,7)
^{13}C NMR: 98.5(C-1), 89.6(C-3), 30.0(C-4), 38.4(C-5), 129.1(C-6), 142.0(C-7), 103.3(C-8), 51.2 (C-9), 78.7(C-10), 128.3(C-11), 167.9(C-12), 143.2(C-13), 15.5(C-14)

18	3-o-Methylallamcin	[18]

^{1}H NMR: 5.71(d,H-1,4), 4.77(dd,H-3,8,6), 2.30-1.50(m,H-4), 3.17(m,H-5), 5.98(dd,H-6,5,2), 5.88 (dd,H-7,5,2),2.98(dd,H-9,9,4), 5.29(bs,H-10), 7.07(dq,H-13,7,2), 1.88(d,H-14,7), 3.37(OMe)
^{13}C NMR: 98.3(C-1), 99.0(C-3), 28.8(C-4), 39.1(C-5), 130.2(C-6), 142.2(C-7), 103.6(C-8), 53.3 (C-9), 80.2(C-10), 129.3(C-11), 168.6(C-12), 143.7(C-13), 15.7(C-14), 55.0(OMe)

19	Allamancin	[18]

^{1}H NMR: 5.67(d,H-1,4), 5.40(d,H-3,8), 2.78(dd,H-4,8,5), 3.58(m,H-5), 5.93(m,H-6,H-7), 3.07 (dd,H-9,8,4), 4.83(d,H-10,2), 2.73(t,H-11,2), 4.45(m,H-13), 1.38(d,H-14,6), 3.79(COOMe)
^{13}C NMR: 98.7(C-1), 91.6(C-3), 47.0(C-4), 43.0(C-5), 132.4(C-6), 138.2(C-7), 105.0(C-8), 53.7 (C-9), 83.4(C-10), 56.1(C-11), 177.4(C-12), 66.1(C-13), 22.3(C-14), 172.8(C-15), 52.1(OMe)

20	3-o-Methylallamancin	[18]

^{1}H NMR: 5.54(d,H-1,4), 4.99(d,H-3,8), 2.74(dd,H-4,8,4), 3.52(m,H-5), 5.90(m,H-6,H-7), 3.04 (dd,H-9,8,4),4.83(d,H-10,2), 2.77(d,H-11,2), 4.48(m,H-13), 1.39(d,H-14,6), 3.79 (COOMe), 3.43(OMe)
^{13}C NMR: 98.6(C-1), 99.1(C-3), 45.2(C-4), 42.6(C-5), 132.6(C-6), 137.9(C-7), 104.8(C-8), 53.6 (C-9), 83.7(C-10), 56.1(C-11), 177.3(C-12), 66.2(C-13), 22.3(C-14), 172.1(C-15), 52.2(COOMe), 55.5(OMe)

Table (cont.)

No.	Compound class, name and NMR data	Ref.
21	Isoallamandicin	[18]

^{1}H NMR: ▪ 5.58(d,H-1,6), 7.42(s,H-3), 3.97(dt,H-5,9,2), 6.12(dd,H-6,5,2), 5.66(dd,H-7,5,2), 3.43 (dd,H-9,9,6), 4.58(d,H-10,6), 2.78(dd,H-11,9,6), 4.27(m,H-13), 1.39(d,H-14,6), 3.78(COOMe)
^{13}C NMR: ▪ 102.0(C-1), 152.8(C-3), 108.1(C-4), 38.1(C-5), 126.2(C-6), 141.4(C-7), 105.9(C-8), 53.5(C-9), 84.0(C-10), 51.6(C-11), 175.9(C-12), 64.4(C-13), 22.2(C-14), 166.7(C-15), 51.3(OMe)

22 Oruwacin [23]

^{1}H NMR: ▪ 5.63(d,H-1,6), 7.45(s,H-3), 4.06(ddd,H-5,9,2,2), 5.61(dd,H-6,6,2), 6.02(dd,H-7,6,2), 3.55 (dd,H-9,9,6),5.21(bs,H-10), 7.75(bs,H-13), 6.97(d,H-2',2.5), 3.78(OMe), 3.92(ArOMe), 6.1(brs,-OH)
^{13}C NMR: ▪ 104.4(C-1), 147.2(C-3), 112.7(C-4), 38.7(C-5), 115.2(C-6), 141.0(C-7), 102.4(C-8), 51.7(C-9), 82.3(C-10), 144.8(C-11), 169.9(C-12), 120.3(C-13), 126.4(C-1'), 126.5 (C-2"), 152.9(C-3"), 149.2(C-4"), 127.0(C-5"), 126.0(C-6"), 54.3(OMe), 166.6(C=O), 56.1(ArOMe)

23 Plumenoside [24]

^{1}H NMR: ▪ 5.71(d,H-1,6), 7.73(s,H-3), 3.93(td,H-5,10,2), 6.14(dd,H-6,5,2), 5.70(dd,H-7,5,2), 3.48 (dd,H-9,10,6), 4.52(s,H-10), 2.92(t,H-11,8), 1.79, 1.64(m's,H-13), 0.99(t,H-14,7), 6.47 (d,H-1",8), 4.23(dd,H-2',9,8),4.33(t,H-3",9), 4.36(t,H-4',9), 4.10(m,H-5"), 4.50 (dd,H-6",12,2), 4.40(dd,H-6',12,5)
^{13}C NMR: ▪ 101.8(C-1), 154.0(C-3), 108.4(C-4), 38.2(C-5), 141.4(C-6), 126.9(C-7), 106.3(C-8), 53.7(C-9), 87.0(C-10), 49.0(C-11), 176.7(C-12), 22.8(C-13), 11.8(C-14), 165.5(C=O), 95.9(C-1"), 74.2(C-2'), 78.6(C-3'), 71.1(C-4'), 79.4(C-5'), 62.2(C-6')

24 13-Deoxyplumieride [24]

^{1}H NMR: ▪ 5.64(d,H-1,5), 7.65(d,H-3,1), 3.98(bd,H-5,7), 6.46(dd,H-6,5,2), 5.45(dd,H-7,5,2), 3.07 (dd,H-9,7,5), 7.41(t,H-10,1), 2.21(m,H-13),1.10(t,H-14,7), 3.64(OMe), 5.34(d,H-1',8), 3.99 (dd,H-2",9,8),4.23(t,H-3',9), 4.27(t,H-4"), 3.90(m,H-5"), 4.43(dd,H-6',12,2), 4.33(dd,H-6",12,5)
^{13}C NMR: ▪ 93.8(C-1), 151.9(C-3), 109.7(C-4), 39.8(C-5), 140.5(C-6), 130.6(C-7), 96.3(C-8), 50.0(C-9), 148.3(C-10), 135.0(C-11), 172.4(C-12), 18.9(C-13), 11.8(C-14), 166.7(C=O), 51.2(OMe), 100.6(C-1"), 74.7(C-2"), 78.2(C-3'), 71.3(C-4"), 78.8(C-5'), 62.3(C-6')

25 Allamcidin B ▪-D-glucoside [18]

^{1}H NMR: ▪ 5.83(d,H-1,3), 4.58(dd,H-3,13,4), 2.69(m,H-4), 6.42(dd,H-6,6,2), 5.63(dd,H-7,6,1), 2.80 (dd,H-9,10,3),7.74(d,H-10,2), 5.05(dq,H-13,6,2), 1.67(d,H-14,6), 3.83(COOMe), 5.02(d,H-1',8)
^{13}C NMR: ▪ 98.1(C-1), 56.0(C-3), 44.3(C-4), 38.3(C-5), 131.7(C-6), 141.3(C-7), 97.5(C-8), 50.0(C-9), 148.3(C-10), 140.0(C-11), 171.8(C-12), 62.9(C-13), 23.3(C-14), 170.9(C-15), 51.9(OMe), 104.7(C-1"), 75.0(C-2"), 78.8(C-3'), 71.0(C-4"), 78.6(C-5'), 62.4(C-6")

Table (cont.)

No.	Compound class, name and NMR data	Ref.

26 1 -Plumieride [24]

^{1}H NMR: ▪ 5.68(d,H-1,4), 7.60(d,H-3,1), 3.97(ddd,H-5,8,3,2), 6.47(dd,H-6,6,3), 5.49(dd,H-7,6,2), 3.17(dd,H-9,8,4),7.81(d,H-10,1), 4.96(q,H-13,6), 1.63(d,H-14,6), 3.62(OMe), 5.25(d,H-1 ,8), 4.06(dd,H-2",9,8), 4.21(t,H-3',9), 4.32(t,H-4",9), 3.85(m,H-5'), 4.36(bs,H-6')
^{13}C NMR: ▪ 93.7(C-1), 151.7(C-3), 109.9(C-4), 39.5(C-5), 140.1(C-6), 129.7(C-7), 96.3(C-8), 49.9(C-9), 148.7(C-10), 139.0(C-11), 171.2(C-12), 62.8(C-13), 22.9(C-14), 166.6(C=O),

51.1(OMe), 100.7(C-1˝), 74.6(C-2˝), 78.2(C-3˝), 70.9(C-4), 78.7(C-5˝), 62.2(C-6˝)

27 8-Isoplumieride [24]

^{1}H NMR: ˝ 5.84(d,H-1,1), 7.66(d,H-3,1), 3.80(ddd,H-5,8,3,1), 6.68(dd,H-6,5,3), 5.58(dd,H-7,5,1), 3.25(dd,H-9,8,1),7.50(d,H-10,1), 4.97(dq,H-13,7,1), 1.67(H-14,7), 3.57(OMe), 5.21(d,H-1 ,8), 4.00(dd,H-2˝,9,8),4.19(t,H-3˝,9), 4.24(t,H-4˝,9), 3.84(m,H-5˝), 4.40(dd,H-6 ,12,2), 4.27(dd, H-6˝,12,5)

^{13}C NMR: ˝ 92.6(C-1), 151.7(C-3), 108.3(C-4), 38.3(C-5), 141.3(C-6), 128.6(C-7), 94.9(C-8), 46.2(C-9), 149.3(C-10), 140.9(C-11), 171.5(C-12), 62.9(C-13), 22.6(C-14), 166.8(C=O), 51.0(OMe), 101.1(C-1˝), 74.7(C-2˝), 78.3(C-3˝), 71.3(C-4), 78.4(C-5˝), 62.7(C-6˝)

28 Plumiepoxide [18]

^{1}H NMR: ˝ 5.87(bs,H-1), 7.71(d,H-3,1), 3.47(d,H-6,2), 4.24(d,H-7,2), 3.22(dd,H-9,9,1), 7.48(d,H-10,2), 4.95(dq,H-13,6,2), 1.59(d,H-14,6), 3.60(COOMe), 5.18(d,H-1˝,8)

^{13}C NMR: ˝ 93.0(C-1), 153.5(C-3), 106.7(C-4), 32.3(C-5), 57.1(C-6), 58.7(C-7), 91.3(C-8), 43.1(C-9), 146.0(C-10), 141.9(C-11), 170.7(C-12), 62.8(C-13), 22.9(C-14), 166.3(C-15), 51.3(OMe), 100.8(C-1˝), 74.4(C-2˝), 78.5(C-3˝), 70.7(C-4), 78.2(C-5˝), 61.8(C-6˝)

29 13-o-Acetylplumieride [18]

^{1}H NMR: ˝ 5.57(d,H-1,6), 7.61(d,H-3,2), 6.43(dd,H-6,5,2), 5.37(dd,H-7,5,2), 2.99(t,H-9,6), 7.91 (d,H-10,2), 5.88(dq,H-13,7,2), 1.50(d,H-14,7), 3.64(OMe), 2.06(OAc), 5.37(d,H-1˝,8)

^{13}C NMR: ˝ 93.6(C-1), 152.2(C-3), 109.3(C-4), 40.4(C-5), 128.3(C-6), 141.9(C-7), 96.7(C-8), 50.3(C-9), 150.6(C-10), 133.3(C-11), 170.2(C-12), 65.2(C-13), 19.1(C-14), 166.7(C-15), 51.3(OMe), 21.0(O=CMe), 170.2(O=CMe), 100.3(C-1˝), 74.7(C-2˝), 78.8(C-3), 71.3(C-4˝), 78.0(C-5˝), 62.3(C-6˝)

30 Allaneroside [25]

^{1}H NMR: ˝ 5.25(d,H-1,5), 7.51(d,H-3,1.6), 3.62(m,H-5), 6.46(dd,H-6,5.6,2.5), 5.46(dd,H-7,5.5,2.2), 2.92(dd,H-9,7.5,4.9),7.42(d,H-10,1.2), 5.60(dq,H-13,6,1.5), 1.42(d,H-14,6.5), 3.75(COOMe), 2.88(dd,H- ,15.5,8.7), 2.69(dd, H- ,15.5,5.4), 4.99(dd,H- ,8.7,5.4), 7.20(d,H-2 ˝,8.6), 6.75(d, H-3˝˝,8.6), 3.2-4.0(sugar protons)

^{13}C NMR: ˝ 93.9(C-1), 152.6(C-3), 110.8(C-4), 40.5(C-5), 129.5(C-6), 141.8(C-7), 98.1(C-8), 50.6(C-9), 152.0(C-10), 134.4(C-11), 171.9(C-12), 66.3(C-13), 19.5(C-14), 168.4(C=O), 52.0(COOMe), 99.7(C-1˝), 74.6(C-2˝), 77.7(C-3˝), 71.4(C-4), 78.4(C-5˝), 62.7(C-6˝), 171.9 (C=O), 44.9(C-), 71.5(C-), 135.4(C-1˝˝), 116.2(C-2˝˝), 128.3(C-3˝˝), 158.1(C-4˝˝)

Table (cont.)

No.	Compound class, name and NMR data	Ref.

31 Plumieride coumarate [19][30]

^{1}H NMR: ˝ 5.16(d,H-1,5), 7.65(H-3), 3.9(H-5), 6.35(dd,H-6,5,2.5), 5.55(H-7), 2.80(dd,H-9,7,5), 7.65 (H-10), 5.55(H-13), 4.53(d,H-1˝,7), 3.33-3.0(H-2˝-H-5˝), 3.9(H-6˝), 1.42(d,H-14,cis,6.5), 1.46(d, H-14,trans,6.5), 3.68(OMe), 5.74(d,H- ,cis,13), 6.33(d,H- ,trans,16), 6.70(H- ,cis), 7.65 (H- ,trans), 7.64(H-2˝˝), 6.73(d,H-3˝˝,8.5)

32 Protoplumericin A [26]

^{1}H NMR: ˝ 5.63(d,H-1,6), 7.66(d,H-3,2), 6.48(dd,H-6,5,2), 5.43(dd,H-7,5,2), 3.03(dd,H-9,7,6), 8.03

(d,H-10,2), 3.61(COOMe), 6.09(dq,H-13,6,2), 1.62(d,H-14,7), 5.29(d,H-1',6), 4.60-3.80 (sugar protons), 6.69(d,H- ,16), 7.96(d,H- ,16), 7.60(d,H-2'',7), 7.33(d,H-3'',7)

^{13}C NMR: , 93.7(C-1), 152.1(C-3), 109.3(C-4), 40.3(C-5), 141.7(C-6), 150.8(C-7), 96.7(C-8), 50.2 (C-9), 128.4(C-10), 133.6(C-11), 170.2(C-12), 65.1(C-13), 19.3(C-14), 166.6(C-15), 51.2(COOMe),166.2(COOMe), 100.5(C-1'), 101.6(C-1''), 74.8(C-2',C-2 ''), 78.2(C-3'), 78.4(C-3''), 71.7(C-4',C-4''), 78.9(C-5',C-5''), 62.2(C-6',C-6''), 116.2(C-), 145.3(C-), 128.4(C-1''), 130.3(C-2''), 117.0(C-3''), 160.2(C-4'')

33 1 -Protoplumericin A [24]

^{1}H NMR: , 5.66(d,H-1,5), 7.60(d,H-3,1), 3.97(td,H-5,8,2), 6.48(dd,H-6,5,2), 5.47(dd,H-7,5,2), 3.05(dd, H-9,7,5), 7.88(d,H-10,1), 6.08(dq,H-13,7,1), 1.66(d,H-14,7), 3.63(OMe), 5.33(d,H-1',8), 5.62(d,H-1'',8'), 6.67 (d,H- ,16), 7.94(d,H- ,16), 7.61(d,H-2'',8), 7.29(d,H-3'',8)

^{13}C NMR: , 93.6(C-1), 152.0(C-3), 109.6(C-4), 40.0(C-5), 141.3(C-6), 128.6(C-7), 96.6(C-8), 50.4 (C-9), 151.3(C-10), 133.6(C-11), 170.3(C-12), 65.0(C-13), 19.2(C-14), 166.6(COOMe), 51.2(OMe), 100.6, 101.7(C-1',C-1''), 74.8, 74.7(C-2',C-2''), 78.4(C-3',C-3''), 71.2(C-4 , C-4''), 78.9(C-5',C-5''), 62.3(C-6',C-6''), 166.4(C=O), 116.3(C-), 145.3(C-), 128.9 (C-1''), 130.4(C-2''), 117.1(C-3''), 160.2(C-4'')

34 13-o-Caffeoylplumieride [24]

^{1}H NMR: , 5.62(d,H-1,6), 7.63(d,H-3,1), 3.99(td,H-5,7,2), 6.43(dd,H-6,5,2), 5.38(dd,H-7,5,2), 3.04(dd, H-9,7,6), 7.97(s,H-10), 6.07(q,H-13,6), 1.61(d,H-14,6), 3.63(OMe), 5.39(d,H-1 ,8), 4.05(dd, H-2',9,8), 4.26(t,H-3',9),4.31(t,H-4',9), 4.52(dd,H-6',12,2), 4.39(dd,H-6',12,5), 6.68(d,H- ,16), 8.02(d,H- ,16), 7.61(d,H-2'',1), 7.19(d,H-5'',8), 7.17(dd,H-6'',8,1)

^{13}C NMR: , 93.8(C-1), 152.1(C-3), 109.5(C-4), 40.3(C-5), 141.6(C-6), 128.5(C-7), 96.7(C-8), 50.3 (C-9), 150.7(C-10), 133.9(C-11), 170.2(C-12), 64.9(C-13), 19.5(C-14), 166.6(COOMe), 51.2(COOMe), 100.6(C-1'), 74.8(C-2'), 78.2(C-3'), 71.5(C-4'), 79.0(C-5), 62.5(C-6), 166.5(C=O), 116.6(C-), 146.7(C-), 126.8(C-1''), 114.4(C-2 '), 150.6(C-3''), 147.6(C-4''), 116.0(C-5''), 122.2(C-6'')

35 Protoplumericin B [18]

^{1}H NMR: , 5.60(d,H-1,6), 7.60(d,H-3,2), 6.43(dd,H-6,6,2), 5.40(dd,H-7,6,2), 3.04(dd,H-9,9,6), 7.97(d, H-10,1), 6.06(dq,H-13,6,1), 1.62(d,H-14,6), 3.64(OMe), 5.36(d,H-1',8), 5.55(d,H-1'',8), 6.68(d,H- ,16), 7.94(d,H- ,16),7.54(d,H-2'',2), 7.47(d,H-5'',8), 7.07(dd,H-6 ',8,2)

Table (cont.)

No.	Compound class, name and NMR data	Ref.

^{13}C NMR: , 93.7(C-1), 152.1(C-3), 109.4(C-4), 40.3(C-5), 128.4(C-6), 141.6(C-7), 96.7(C-8), 50.3 (C-9), 148.8(C-10), 133.6(C-11), 170.2(C-12), 65.1(C-13), 19.4(C-14), 166.6(COOMe), 51.2(COOMe), 166.2(C''=O), 100.5, 103.4(C-1',C-1 ''), 74.7(C-2',C-2''), 79.0(C-3 ,C-3 ''), 71.0, 71.3(C-4',C-4''), 78.2, 78.3(C-5',C-5''), 62.1, 62.4(C-6 ,C-6 ''), 116.6(C-), 145.8 (C-), 130.2(C-1''), 116.6(C-2''), 149.4(C-3''), 149.4(C-4''), 118.1(C-5 '), 121.1(C-6'')

36 Fulvoplumierin [27]

^{1}H NMR: 8.28(s,H-3), 7.22(d,H-6,5.5), 7.34(dd,H-7,5.5,1.5), 7.95(dd,H-10,12,1.5), 6.84(dd,H-11,15,12), 6.67(dq,H-13,15,7), 2.00(d,H-14,7), 3.81(OMe)

^{13}C NMR: , 164.20(C-1), 156.48(C-3), 113.28(C-4), 150.20(C-5), 130.35(C-6), 127.34(C-7), 136.83 (C-8), 109.93(C-9), 143.34(C-10), 129.57(C-11), 145.45(C-13), 19.52(C-14), 157.48(C-15), 52.02(OMe)

37 Plumericin [28]

^{1}H NMR: ¸ 4.52(d,H-1), 2.63(s,H-3), 6.08(td,H-5), 4.03(dd,H-6), 4.45(dd,H-7), 6.66(dd,H-9), 4.98 (brs,H-10), 2.9(dq,H-13), 7.98(d,H-14), 6.30(COOMe)

38 Isoplumericin [28]

^{1}H NMR: ¸ 7.75(d), 6.66(dd), 6.30(s), 6.08(td), 4.98(brs), 4.52(d), 4.45(dd), 4.03(dd), 3.279q), 2.63(s)

39 ¹-Dihydro Plumericinic Acid [28]

^{1}H NMR: ¸ 7.44(s), 6.18(dd), 5.80(dd), 4.41(s), 3.98, 3.40, 1.75, 1.10(t)

40 Dihydroplumericin [28]

^{1}H NMR: ¸ 7.43(s), 6.08(dd), 5.66(dd), 5.58(d), 4.40(s), 3.96(td), 3.76(s), 3.43(dd), 2.74(dd), 1.76(m), 1.10(t)

41 Allamdin [7]

^{1}H NMR: ¸ 5.00(dd,H-1), 2.62(d,H-3), 6.20(m,H-5), 3.63(dd,H-6), 4.66(dd,H-7), 7.03(dd,H-9), 3.29 (t,H-10), 7.74(dq,H-13), 8.88(t,H-14), 6.30(s,-OH)

42 Allamandin [7]

^{1}H NMR: ¸ 4.49(d,H-1), 3.72(d,H-3), 7.11(dd,H-4), 6.43(m,H-5), 4.03(dd,H-6), 4.14(dd,H-7), 6.93 (dd,H-9), 4.88(d,H-10), 2.78(dq,H-13), 8.00(d,H14), 6.30(s,COOMe)

Table (cont.)

No.	Compound class, name and NMR data	Ref.

43 Allamandicin [7]

^{1}H NMR: ¸ 4.56(d,H-1), 2.65(s,H-3), 6.12(td,H-5), 4.14(dd,H-6), 4.32(dd,H-7), 6.69(dd,H-9), 5.34 (s,H10), 7.32(d,H-11), 5.61(m,H-13), 8.65(d,H-14), 6.30(s,-OH)

44 6˝-o-Acetylplumieride-p-E-coumarate [20]

^{1}H NMR: ¸ 5.07(d,H-1,5.7), 7.52(s,H-3), 3.94(ddd,H-5,7.4,2.4,2.3), 6.47(dd,H-6,5.6,2.4), 5.54(dd, H-7,5.6,2.3), 2.88(dd,H-9,7.4,5.7), 7.49(d,H-10,1.2), 5.70(dq,H-13,6.6,1.2), 1.56(d,H-14,6.6), 3.75(s,H-16), 6.35(d,H-2΄,15.9), 7.66(d,H-3΄,15.9), 7.47(d,H-5 ΄,8.7), 6.81(d,H-6΄,8.7), 6.81(d, H-8˝,8.7), 7.47(d,H-9΄,8.7), 4.70(d,H-1˝,7.9), 3.23(dd,H-2 ˝,9.1,7.9), 3.42(dd,H-3 ˝,9.1,8.0), 3.38(dd,H-4˝,9.1,8.0), 3.50(ddd,H-5˝,9.1,5.3,2.8), 4.35(dd,H-6˝,11.9,2.8), 4.31(dd,H-6 ˝,11.9,5.3), 2.00(COOMe)

^{13}C NMR: ¸ 94.5(C-1), 152.9(C-3), 110.8(C-4), 40.9(C-5), 142.6(C-6), 129.3(C-7), 98.0(C-8), 51.0 (C-9), 152.1(C-10), 134.7(C-11), 171.8(C-12), 66.0(C-13), 19.6(C-14), 168.1(C-15), 52.0 (C-16), 168.4(C-1΄), 114.8(C-2΄), 147.3(C-3΄), 128.9(C-4΄), 131.3(C-5 ΄), 116.9(C-6 ΄), 161.4 (C-7΄), 116.9(C-8΄), 131.3(C-9΄), 100.4(C-1˝), 74.6(C-2˝), 77.7(C-3˝), 71.7(C-4 ˝), 75.9 (C-5˝),64.6(C-6˝), 172.6(COOMe), 20.8(COOMe)

45 6˝-o-Acetylplumieride-p-Z-coumarate [20]

^{1}H NMR: ¸ 5.28(d,H-1,5.3), 7.48(s,H-3), 3.93(ddd,H-5,7.5,2.4,2.2), 6.45(dd,H-6,5.5,2.4), 5.51

(H-7,5.6,2.2), 2.91(dd,H-9,7.5,5.3), 7.50(d,H-10,1.6), 5.69(dq,H-13,1.6,6.6), 1.55(d,H-14,6.6), 3.74(s,H-16), 6.36(d,H-2',15.9), 7.64(d,H-3',15.9), 7.47(d,H-5 ,8.3), 6.80(d,H-6',8.3), 6.80(d, H-8",8.3), 7.47(d,H-9',8.3), 4.70(d,H-1"",7.8), 3.25(dd,H-2"",9.0,7.8), 3.42(dd,H-3"",9.0,8.5), 3.35(dd,H-4"",9.0,8.5), 3.30(ddd,H-5"",9.0,5.5,2.2), 3.65(dd,H-6"a,12.0,5.5), 3.85(dd, H-6"b,12.0,2.2)

^{13}C NMR: ▪ 94.1(C-1), 151.9(C-3), 110.8(C-4), 40.7(C-5), 142.0(C-6), 129.5(C-7), 98.1(C-8), 50.9 (C-9), 152.7(C-10), 134.6(C-11), 171.8(C-12), 66.1(C-13), 19.6(C-14), 168.1(C-15), 51.9 (C-16), 168.4(C-1'), 114.8(C-2'), 147.2(C-3'), 127.1(C-4'), 131.3(C-5), 116.9(C-6), 161.3 (C-7'), 116.9(C-8'), 131.3(C-9'), 99.9(C-1"), 74.7(C-2"), 77.9(C-3"), 71.7(C-4"), 78.6 (C-5"), 62.8(C-6"a), 62.8(C-6"b)

46 2,5-Dimethoxy-p-benzoquinone [8]

^{1}H NMR: ▪ 5.83(s,H-3/H-6), 3.83(s, 2x –OCH_3)
^{13}C NMR: ▪ 186.3(C-1,C-4), 157.3(C-2,C-5), 107.4(C-3,C-6), 56.5(2 x –OCH_3)

47 Liriodendrin [8]

^{1}H NMR: ▪ 6.63(s,H-2'/6'), 4.64(d,H-2,4), 4.28(m,H-4), 4.16(m,H-4), 3.72(s,-OCH_3), 3.15(m,H-5)
^{13}C NMR: ▪ 53.6(C-1/C-5), 71.3(C-4/C-8), 85.1(C-2/C-6), 133.9(C-1'), 104.3(C-2'), 152.7(C-3'), 137.2(C-4'), 56.4(-OCH_3), 102.7(C-1"), 74.2(C-2"), 76.5(C-3 "), 70.0(C-4 "), 77.2(C-5 "), 60.9(C-6"")

Table (cont.)

No.	Compound class, name and NMR data	Ref.

48 15-Demethylplumieride [8]

^{1}H NMR: 5.64(d,H-1,8), 7.80(s,H-3), 4.20(m,H-5), 6.72(dd,H-6,6,3), 5.42(d,H-7,6), 3.12(m,H-9), 8.00 (s,H-10), 5.02(q,H-13,6), 1.66(d,H-14,6), 5.42(d,H-1',8), 4.42(m,H-4",H-6"), 4.28(m,H-5"), 4.18 (m,H-2"), 3.92(m,H-3")

^{13}C NMR: 94.03(C-1), 151.36(C-3), 110.74(C-4), 40.65(C-5), 141.70(C-6), 128.69(C-7), 96.68 (C-8), 50.12(C-9), 149.70(C-10), 138.53(C-11), 171.41(C-12), 62.68(C-13), 23.02(C-14), 168.81(C-15), 100.83(C-1"), 74.73(C-2"), 78.72(C-3"), 70.78(C-4"), 78.16(C-5'), 62.10(C-6')

Flavone

49 Plumerubroside [29]

^{1}H NMR: 6.65(s,H-2"/H-6"), 6.29(d,H-6,2.5), 6.09(d,H-8), 4.80(d,H-1"",7.5), 4.59(d, H-2,8), 3.96(m,H-3), 3.75(s,OMe), 3.70(s,2×OMe at C-3"/C-5"), 3.64(m,H-6""), 3.49(m,H-4""), 3.37(m,H-5 "), 3.32 (m,H-2""), 3.26(m,H-3"), 3.05(dd,H-4 ,16,5), 2.44(dd,H-4 ,16,9)

^{13}C NMR: 159.16(C-7), 156.52(C-8a), 155.37(C-5), 147.86(C-3'/C-5'), 135.95(C-4), 129.39(C-1""), 105.38(C-2'/C-6'), 103.96(C-4a), 100.85(C-1'), 94.83(C-8), 94.72(C-6), 82.06(C-2), 77.26 (C-5""), 76.70(C-3""), 73.46(C-2""), 70.02(C-4""), 66.12(C-3), 60.97(C-6""), 56.32(2×OMe at C-3'/C-5'), 55.44(OMe at C-7), 28.65(C-4)

REFERENCES

[1] K. Jewers, J. J. W. Coppen, H. Manchanda, A. H. Paw, A. Castillo, Pahlavi Med. J. **1975**, 6, 52
[2] M. Gupta, U. K. Mazumder, P. Gomathi, V. T. Selvan, BMC Complementary and Alternative Medicine. **2006**, 6, 36.
[3] M. P. Dobhal, G. Li, A. Gryshuk, A. Graham, A. K. Bhatanagar, S. D. Khaja, Y. C. Joshi, M. C. Sharma, A. Oseroff, R. K. Pandey, J. Org. Chem. **2004**, 69, 6165.

[4] B. Elasser, K. Krohn, M. N. Akhtar, U. Florke, S. F. Kouam, M. G. Kuigoua, B. T. Ngadjui, B. M. Abegaz, S. Antus, T. Kurtan, Chemistry & Biodiversity. **2005**, 2, 799.
[5] K. E. B. Pakes, G. Pattenden, J.Chem.Soc.Perkin Trans. **1988**, I, 1119.
[6] J. J. W. Coppen, A. L. Cobb, Phytochemistry. **1983**, 22, 125.
[7] S. M. Kupcham, A. L. Dessertine, B. T. Balaylock, R. F. Bryan, J.Org.Chem. **1974**, 39, 2477.
[8] L. B. S. Kardono, S. Tsauri, K. Padmawinata, J. M. Pezzuto, A. D. Kinghorn, J.Nat.Prod. **1990**, 53, 1447.
[9] G. T. Tan, J. M. Pezzuto, A. D. Kinghorn, J.Nat.Prod. **1991**, 54, 143.
[10] M. S. Abdel-Kader, J. Wisse, R. Evans, H. Vander Werff, J.Nat.Prod. **1997**, 60, 1294.
[11] D. J. Rogers, B. Fish, C. J. Banwell, R. W. Loveless, Lectins
Biol. Biochem. Clin. Biochem. **1988**, 6, 373.
[12] A. Ceullar, T. H. O Farril, Rev.Cubana Farm. **1976**, 10, 25.
[13] S. Siddiqui, B. S. Siddiqui, A. Naeed, S. Begum, J.Nat.Prod. **1990**, 53, 1332.
[14] N. Akhtar, A. Malik, Phytochemistry. **1993**, 32, 1523.
[15] B. S. Siddiqui, S. Begum, Phytochemistry. **1999**, 52, 1111.
[16] B. S. Siddiqui, F. Ilyas, M. Rashid, S. Begum, Phytochemistry. **2004**, 65, 2077.
[17] L. B. S. Kardono, S. Tsauri, K. Padmawinata, A. D. Kinghorn, Phytochemistry. **1990**, 29, 2995.
[18] M.P. Dobhal, A.M. Hasan, M.C. Sharma, B.C. Joshi, Phytochemsitry.**1999**, 51, 319.
[19] F. Abe, T. Mori, T. Yamauchi, Chem.Pharm.Bull. **1984**, 32, 2947.
[20] J. J. W. Coppen, Phytochemistry. **1983**, 22, 179.
[21] B. S. Siddiqui, A. Naeed, S. Begum, S. Siddiqui, Phytochemistry. **1994**, 37, 769.
[22] E. Cambon, F. Gouzou, M. Pina, B. Barea, N. Barouh, R. Lago, J. Ruales, S-W Tsai, P. Villeneuve, J. Agric & Food Chem. **2006**, 54, 2726.
[23] W. Schliemann, G. Adam, Phytochemistry. **1982**, 21, 1438.
[24] E. K. adesogan, Phytochemistry. **1979**, 18, 175.
[25] F. Abe, R. F. Chen, T. Yamauchi, Chem. Pharm. Bull. **1988**, 36, 2784.
[26] Y. C. Shen, C. H. Chen, J. Taiwan Pharm. Assoc. **1986**, 38, 203.
[27] T. Yamauchi, F. Abe, M. Taki, Chem. Pharm. Bull. **1981**, 29, 305.
[28] G. Albers-Schonberg, W.v. Philipsborn, L. M. Jackman, H. Schmid, Helv. Chim. Acta. **1962**, 45, 1406.
[29] G. Albers-Schonberg, H. Schmid, Helv. Chim. Acta. **1961**, 44, 1447.
[30] D. Boonclarm, T. Sornwatana, D. Arthan, P. Kongsaeree, J. Svasti, Acta Biochim Biophys Sin. **2006**, 38, 563.

Curbing Carbon Footprint and Enhancing Energy Efficiency

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Abstract
Carbon footprint is a measure of the amount of carbon dioxide released into the atmosphere by a single endeavour or by a company, household, or individual through day-to-day activities over a given period. Carbon footprint describes the environmental impact of carbon emissions, measured in units of carbon dioxide. Every year in the India over 3.2 billion metric tons of carbon dioxide emissions are released into the air. Over three-quarters of these emissions are man-made and are created by the burning of fossil fuels for transportation. As the India economy continues to expand and increase its demand for electricity and fossil fuels, more greenhouse gases will pollute our air supply and add to the growing concern of global warming. Global warming is a gradual increase in the Earth's temperature, and if carbon dioxide and other greenhouse gases continue to build up in the air, rising temperatures will make Earth virtually impossible to live on. We can personally have an impact on global warming and the sustainability of the environment! The first thing we should do is to recognize how we contribute directly or indirectly to the greenhouse gas problem. Then we need to figure out how we can reduce our carbon dioxide contributions and increase our green practices. Carbon dioxide is the most harmful of the greenhouse gases. Greenhouse gases also produce methane, nitrous oxide and chlorofluorocarbons (also known as aerosols), but all of these have the element of carbon in common. Our carbon footprint has two different parts: Primary footprint, secondary footprint. Every person contributes carbon dioxide emissions into the air in one way or another. Even everyday activities that seem virtually harmless can increase our carbon footprint and add to the greenhouse gas problem. Here are a few activities that contribute to our carbon footprint: Car emissions, Public transportation, Electricity, Heating, Cooling, Eating & drinking, Clothes & personal items, Recreational activities .The best way to calculate our total carbon dioxide contributions is to complete a carbon footprint calculator. Carbon footprint calculators measure our total carbon emissions based on what we do at home and how we travel. One way we can minimize our carbon footprint is carbon offsetting, which is a way of compensating for emissions produced by saving an equivalent amount of carbon dioxide. We can purchase carbon offsets, or carbon credits, from companies that will use a variety of methods to reduce our carbon footprint. Some of these methods include planting trees and funding renewable energy sources that help reduce fossil fuel emissions. It may be very difficult for certain people and businesses to reduce their carbon footprint completely, but it's not impossible. Any effort we can make, whether it's driving our car less or reducing our thermostat's temperature, will have a positive impact on the environment. It all begins with us, so start reducing our carbon footprint today! We would be amazed to know how much carbon dioxide we contribute to the air every day just by waking up and going to work. From brushing our teeth to driving a car, all of these activities increase our carbon footprint. We can start to reduce our carbon footprint and begin living an eco-lifestyle by following some simple steps. Carbon credits are a great way to reduce our greenhouse emissions. They can be exchanged between businesses or bought by regular people who want to lower their carbon footprint.

Keywords- carbon footprint, carbon emission, captureand storage of carbon, control techniques

Introduction

A carbon dioxide (CO_2) adsorption membrane or bed is operative to separate metabolic CO_2 from an exhaust stream from a breathable atmosphere which is discharged from a closed habitable environment. The habitable environment is in a low ambient pressure surrounding. A portion of the scrubbed exhaust gas stream is diverted from the habitable environment and passed through a desorption chamber. The desorption chamber is open to the low ambient pressure surrounding to maintain a pressure which is slightly greater than the pressure in the ambient surrounding so that desorption chamber gas stream will exit the system into the ambient surroundings. When the diverted exhaust gas enters the low pressure desorption pressure chamber its CO_2 partial pressure content is reduced. The reduced CO_2 partial pressure content of the gas stream in desorption chamber enables the desorption chamber gas stream to remove CO_2 from the adsorption membrane or bed.

10 important ways to curb emissions:

1. Switch to energy-saving globes.
   This is a given these days, we know, but it really does help. Consider that if most old-style globes were 75 watts and you had 5 of them on for 4 hours every day, and you swapped them for the equivalent 15 watt energy saving globes, you'll save $92.50 a year based on 20c per kilowatt hour. Doesn't sound like much but for that, you could go out for coffee once a fortnight for a year or use an automatic carwash

2. **Eat less meat**
   Not only will you benefit from the extra veggies in your diet, you'll save greenhouse emissions too! It's all a matter of eating lower down the food chain – the less inputs that go into the food you eat, the less carbon that's been emitted in its production. Even replacing two meat-based meals with vegetarian ones each week will make a difference.

3. **Use your legs or public transport to get around**
   You're right – it's not always convenient to walk or cycle, bus or train it to your destination, especially when you have to carry groceries or other things with you.

4. **Put pelmets up**
   Pelmets? What are pelmets? They're the old-fashioned-now-hot-again box frames that sit above your curtain tops. They stop the cold air currents that form around windows and that result in cold air being drawn in to your home. They're easy to make and install if you're handy. You could sand and varnish them for a sleek look, paint them to match your current décor or go all out and cover them in fancy fabric and tasseled edging – either way; you'll save energy and money.

5. **Seal around windows and skirting boards**
   Checking around windows and under doors and skirting boards (if your house is on stumps) for gaps has got to be the first thing to do when trying to cut down on energy. Whether it's summer or winter, these gaps will quietly sabotage your efforts to maintain a comfortable temperature. Check for draughts with your hands or carefully with a flame (the flame will waver in the breeze) and if you find any, get sealing!

6. **Keep doors and windows closed when your heater or air conditioner is on**
   No further explanation necessary… (Unless your air conditioner is evaporative, in which case you'll need to leave a window open for it to work at its optimum)

7. **Swap your electric kettle for a stove top one if you have a gas stove.**
   Did you know that the standard kettle runs at approximately 2200 watts to boil water for our cups of tea? That's a lot of 75 watt globes… If you can't or don't want to use your stove, at the very least, only boil the water that you need – twice-boiled water has much less oxygen than water that's only been boiled once anyway, so it'll be better for you too.

8. **Install insulation**
   In your roof and under your floors, if your house is raised. You'll be amazed at the difference. Not only will your house (or office, restaurant, holiday home,
   Or what have you) heat / cool faster, but it will retain that warmth / chill for much longer, too.

9. **Grow your own veggies**
   In pots, in polystyrene broccoli boxes, in garden beds amongst your other plants or in dedicated veggie patches – it doesn't matter how you do it. The humble lettuce can have a big carbon footprint if it was grown 300 kilometres from you, which is often the case these days as our cities expand and the veggie gardens move further out.

10. **Have a sun trap or skylight installed in that dark kitchen, bathroom or hallway**
    You'll never need to use the lights there during the day again!

Quality Check

•Step1
Use green energy sources when you can. There are several sustainable resources available like wind and biomass for your energy needs and vendors are becoming more readily available all over the globe. Other options include geothermal, hydroelectricity, solar and tidal wave energy.

•Step 2
If you choose more conventional options, then try and be as efficient with your usage as possible.

•Step 3
Use fluorescent light bulbs which are more energy efficient using only about a fifth of the energy of ordinary bulbs and lasting as much as 8 times longer.

•Step 4
Insulate your home to decrease your energy bills and keep your heat or cold from escaping.

•Step 5
Turn off your appliances when you're not using them and try to buy the most energy efficient models when you have to replace them.

•Step 6
Next time you run around the corner for a loaf of bread, consider walking or riding your bike instead of driving.

•Step 7
When you have farther to go, consider using public transportation or car-pooling.

Three Stages
Manage
– Quantify sources
Reduce
– Minimise or prevent
– Cost reduction
Report

– To customers, for legislation, part of CSR, to 'offset'

Ecogardening

- Use perennial Vegetables. instead of annuals.
- Plant edibles including trees, vines, bushes, and ground-covers, to reduce your carbon footprint and have a "farmer's market at home".
- Avoid using dust blowers and other dust-producing equipment.
- Use compost barrels. Create your own soil. You may use dog leavings from the yard. When they decompose your enriched soil may return nutrients to the land
- Use recycled wood chips to keep the weeds down, retain moisture, and prevent erosion
- Use natural predators rather than pesticides which harm the environment.
- Water grass early in the morning.
- Borrow seldomly used items such as ladders, chain saws, and people.
- Put leaves in a compost heap instead of burning them or throwing them away
- Install water barrels to collect rain water from troughs. Place a small bucket in your sink to collect water when washing produce. Use this water in the garden.

Study With Green Principles

- Use perennial Vegetables. Instead of annuals.
- Plant edibles including trees, vines, bushes, and ground-covers, to reduce your carbon footprint and have a "farmer's market at home".
- Avoid using dust blowers and other dust-producing equipment.
- Use compost barrels. Create your own soil. You may use dog leavings from the yard. When they decompose your enriched soil may return nutrients to the land
- Use recycled wood chips to keep the weeds down, retain moisture, and prevent erosion
- Use natural predators rather than pesticides which harm the environment.
- Water grass early in the morning. See more on Water Conservation in Gardens
- Borrow seldomly used items such as ladders, chain saws, and people.
- Put leaves in a compost heap instead of burning them or throwing them away
- Install water barrels to collect rain water from troughs. Place a small bucket in your sink to collect water when washing produce. Use this water in the garden.

Skinny Diet

- Use perennial Vegetables. instead of annuals.
- Plant edibles including trees, vines, bushes, and ground-covers, to reduce your carbon footprint and have a "farmer's market at home".
- Avoid using dust blowers and other dust-producing equipment.
- Use compost barrels. Create your own soil. You may use dog leavings from the yard. When they decompose your enriched soil may return nutrients to the land
- Use recycled wood chips to keep the weeds down, retain moisture, and prevent erosion
- Use natural predators rather than pesticides which harm the environment.
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- Borrow seldomly used items such as ladders, chain saws, and people.
- Put leaves in a compost heap instead of burning them or throwing them away
- Install water barrels to collect rain water from troughs. Place a small bucket in your sink to collect water when washing produce. Use this water in the garden.

Storage:

Geological Storage

Also known as geo-sequestration, this method involves injecting carbon dioxide, generally in supercritical form, directly into underground geological formations. Oil fields, gas fields, saline formations, unminable coal seams, and saline-filled basalt formations have been suggested as storage sites. Various physical (e.g., highly impermeable caprock) and geochemical trapping mechanisms would prevent the CO_2 from escaping to the surface.

CO_2 is sometimes injected into declining oil fields to increase oil recovery. Approximately 30 to 50 million metric tonnes of CO_2 are injected annually in the United States into declining oil fields. This option is attractive because the geology of hydrocarbon reservoirs is generally well understood and storage costs may be partly offset by the sale of additional oil that is recovered. Disadvantages of old oil fields are their geographic distribution and their limited capacity, as well as that the subsequent burning of the additional oil so recovered will offset much or all of the reduction in CO_2 emissions.

Unminable coal seams can be used to store CO_2 because CO_2 adsorbs to the surface of coal. However, the technical feasibility depends on the permeability of the coal bed. In the process of absorption the coal releases previously absorbed methane, and the methane can be recovered (enhanced coal bed methane recovery). The sale of the methane can be used to offset a portion of the cost of the CO_2 storage. However, burning the resultant methane would produce CO_2, which would negate some of the benefit of sequestering the original CO_2.

Saline formations contain highly mineralized brines, and have so far been considered of no benefit to humans. Saline aquifers have been used for storage of chemical waste in a few cases. The main advantage of saline aquifers is their large potential storage volume and their common occurrence. The major disadvantage of saline aquifers is that relatively little is known about them, compared to oil fields. To keep the cost of storage acceptable the

geophysical exploration may be limited, resulting in larger uncertainty about the aquifer structure. Unlike storage in oil fields or coal beds no side product will offset the storage cost. Leakage of CO_2 back into the atmosphere may be a problem in saline aquifer storage. However, current research shows that several trapping mechanisms immobilize the CO_2 underground, reducing the risk of leakage.

For well-selected, designed and managed geological storage sites, the IPCC estimates that CO_2 could be trapped for millions of years, and the sites are likely to retain over 99% of the injected CO_2 over 1,000 years.

In2009 it was reported that scientists had mapped 6,000 square miles of rock formations in the U.S. that could be used to store 500 years' worth of U.S. carbon dioxide emission.

Ocean Storage

Another proposed form of carbon storage is in the oceans. Several concepts have been proposed:

'Dissolution' injects CO_2 by ship or pipeline into the water column at depths of 1000 m or more, and the CO_2 subsequently dissolves.

'lake' deposits CO_2 directly onto the sea floor at depths greater than 3000 m, where CO_2 is denser than water and is expected to form a 'lake' that would delay dissolution of CO_2 into the environment.

convert the CO_2 to bicarbonates (using limestone)

Store the CO_2 in solid clathrate hydrates already existing on the ocean floor, or growing more solid clathrate.

The environmental effects of oceanic storage are generally negative, and poorly understood. Large concentrations of CO_2 kills ocean organisms, but another problem is that dissolved CO_2 would eventually equilibrate with the atmosphere, so the storage would not be permanent. Also, as part of the CO_2 reacts with the water to form carbonic acid, H_2CO3, the acidity of the ocean water increases. The resulting environmental effects on benthic life forms of the bathypelagic, abyss pelagic and had pelagic zones are poorly understood. Even though life appears to be rather sparse in the deep ocean basins, energy and chemical effects in these deep basins could have far reaching implications. Much more work is needed here to define the extent of the potential problems.

The time it takes water in the deeper oceans to circulate to the surface has been estimated to be in the order of 1600 years, varying upon currents and other changing conditions. Costs for deep ocean disposal of liquid CO_2 are estimated at US$40–80/tonne CO_2 (2002 USD). This figure covers the cost of sequestration at the power plant and naval transport to the disposal site.

The bicarbonate approach would reduce the pH effects and enhance the retention of CO_2 in the ocean, but this would also increase the costs and other environmental effects.

An additional method of long term ocean based sequestration is to gather crop residue such as corn stalks or excess hay into large weighted bales of biomass and deposit it in the alluvial fan areas of the deep ocean basin. Dropping these residues in alluvial fans would cause the residues to be quickly buried in silt on the sea floor, sequestering the biomass for very long time spans. Alluvial fans exist in all of the world's oceans and seas where river deltas fall off the edge of the continental shelf such as the Mississippi alluvial fan in the Gulf of Mexico and the Nile alluvial fan in the Mediterranean Sea.

Unfortunately, biomass and crop residues form an extremely important and valuable component of topsoil and sustainable agriculture. Removing them from the terrestrial equation is fraught with problems and would exacerbate nutrient depletion and increase dependence on chemical fertilizers and, therefore, petrochemicals, thus defeating the original intentions - to reduce CO_2 in the atmosphere.

Mineral Storage

Carbon sequestration by reacting naturally occurring Mg and Ca containing minerals with CO_2 to form carbonates has many unique advantages. Most notable is the fact that carbonates have a lower energy state than CO_2, which is why mineral carbonation is thermodynamically favourable and occurs naturally (e.g., the weathering of rock over geologic time periods). Secondly, the raw materials such as magnesium based minerals are abundant. Finally, the produced carbonates are unarguably stable and thus re-release of CO_2 into the atmosphere is not an issue. However, conventional carbonation pathways are slow under ambient temperatures and pressures. The significant challenge being addressed by this effort is to identify an industrially and environmentally viable carbonation route that will allow mineral sequestration to be implemented with acceptable economics.

In this process, CO_2 is exothermically reacted with abundantly available metal oxides which produce stable carbonates. This process occurs naturally over many years and is responsible for much of the surface limestone. The reaction rate can be made faster, for example by reacting at higher temperatures and/or pressures, or by pre-treatment of the minerals, although this method can require additional energy. The IPCC estimates that a power plant equipped with CCS using mineral storage will need 60-180% more energy than a power plant without CCS.

The following table lists principal metal oxides of Earth's Crust. Theoretically up to 22% of this mineral mass is able to form carbonates.

Bio Carbon Capture And Storage

Bio carbon capture and storage (Bio CCS) refers to the use of biological sequestration methods to reduce greenhouse gas emissions from stationary emitters, such as coal, gas and oil fired utilities, or to reduce net levels of greenhouse gases in the atmosphere. For example, Bio CCS Algal Synthesis test facilities are being trailed at Australia's three largest coal fired power stations (Tarong, Queensland; Eraring, NSW; Loy Yang, Victoria) using piped pre-emission smokestack CO_2 (and other greenhouse gases) as feedstock to grow oil-rich algal biomass in enclosed membranes for the production of plastics, transport fuel and nutritious animal feed. The term "Bio" CCS has been created, in part, to draw government policy attention to the fact that biological sequestration offers a financially and technologically viable 'bridge' in the near term, from a world heavily dependent upon fossil fuels, to a lower carbon future. Due to its comparative ease to implement to a wide range of

stationary emitters - including retro-fit - Bio CCS is hoped to achieve what geo sequestration (Geo CCS) has failed to: significant CO_2 net emissions reduction in the near to medium term.

Leakage

Cow killed by a 1986 natural carbon dioxide leak at Lake Nyos. The leakage killed 1,700 people and a large number of livestock.

A major concern with CCS is whether leakage of stored CO_2 will compromise CCS as a climate change mitigation option. For well-selected, designed and managed geological storage sites, IPCC estimates that risks are comparable to those associated with current hydrocarbon activity. CO_2 could be trapped for millions of years, and although some leakage occurs upwards through the soil, well selected stores are likely to retain over 99% of the injected CO_2 over 1000 years. Leakage through the injection pipe is a greater risk. Although the injection pipe is usually protected with Non-return valves (to prevent release on a power outtage), there is still a risk that the pipe itself could tear and leak due to the pressure. A small incident of this type of CO_2 leakage was the Berkel and Rodenrijs incident in December 2008, where a modest release of greenhouse gas emissions resulted in the deaths of a small group of ducks. In order to measure accidental carbon releases more accurately and decrease the risk of fatalities through this type of leakage, the implementation of CO_2 alert meters around the project perimeter has been proposed.

In 1986 a large leakage of naturally sequestered carbon dioxide rose from Lake Nyos in Cameroon and asphyxiated 1,700 people. While the carbon had been sequestered naturally, some point to the event as evidence for the potentially catastrophic effects of sequestering carbon. The Lake Nyos disaster resulted from a freak volcanic event one night, which very suddenly released as much as a cubic kilometre of CO_2 gas from a pool of naturally occurring CO_2 under the lake in a deep narrow valley. The location of this pool of CO_2 is not a place where man can inject or store CO_2 and this pool of CO_2 was not known about nor monitored until after the occurrence of the natural disaster.

For ocean storage, the retention of CO_2 would depend on the depth; IPCC estimates 30–85% would be retained after 500 years for depths 1000–3000 m. Mineral storage is not regarded as having any risks of leakage. The IPCC recommends that limits be set to the amount of leakage that can take place. This might rule out deep ocean storage as an option.

It should also be noted that at the conditions of the deeper oceans, (about 400 bar or 40 MPa, 280 K) water–CO_2(l) mixing is very low (where carbonate formation/acidification is the rate limiting step), but the formation of water-CO_2hydrates is favorable. (a kind of solid water cage that surrounds the CO_2).

To further investigate the safety of CO_2 sequestration, we can look into Norway's Sleipner gas field, as it is the oldest plant that stores CO_2 on an industrial scale. According to an environmental assessment of the gas field which was conducted after ten years of operation, the author affirmed that geosequestration of CO_2 was the most definite form of permanent geological storage of CO_2.

CO_2re-use

Recycling CO_2 is likely to offer the most environmentally and financially sustainable response to the global challenge of significantly reducing greenhouse gas emissions from major stationary (industrial) emitters in the near to medium term. This is because newly developed technologies, such as Bio CCS Algal Synthesis value captured, pre-smokestack CO_2 (such as from a coal fired power station, for example) as a useful feedstock input to the production of oil-rich algae in solar membranes to produce oil for plastics and transport fuel (including aviation fuel) and nutritious stockfeed for farm animal production. The CO_2 and other captured greenhouse gases are injected into the membranes containing waste water and select strains of algae causing, together with sunlight or UV light, the oil rich biomass to double in mass every 24 hours. The Bio CCS Algal Synthesis process holds a number of key advantages over conventional CCS in that it is based on well established earth science photosynthesis; the technology is entirely retro-fittable and colocated with the emitter; the capital outlays offer a return upon investment due to the high value commodities produced (oil for plastics, fuel and feed)- whereas CCS (injecting liquified CO_2 deep underground) represents substantial logistical difficulty, very high cost without any financial return, and extremely limited applicability to the bulk of existing major industrial emitters. Another advantage of Bio CCS Algal Synthesis is that it offers consumption of the full cocktail of greenhouse gases normally found in smokestack emissions - not just CO_2 as is the case with most CCS proposals.

FIGURE CAPTIONS

Fig. 1 –Scopes of Emission

Fig. – Carbon Offsetting and Neutrality

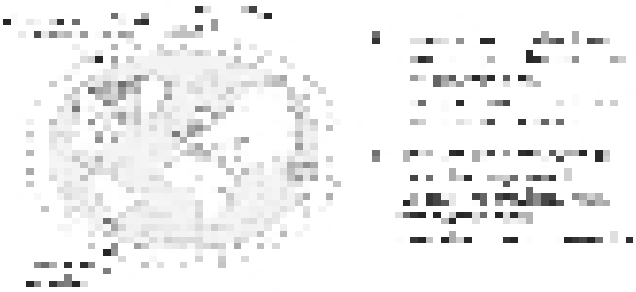

Fig. 3 –

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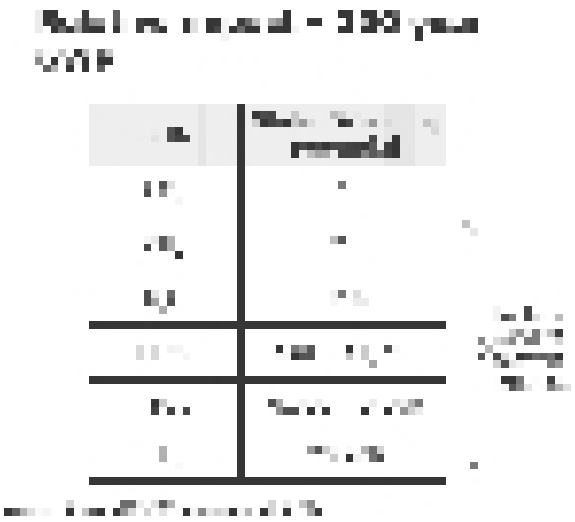

2. Different Types of Footprints

3.Energy prices

BIBLIOGRAPHY

[1] Wikipedia
[2] Google search engine
[3] Carbon trust manual
[4]$C0_2$ emission-Thomas Zahler
[5]Ecoedge Environmental pty. Ltd
[6]www.greenstudentu.com/encyclopedia

Rain Water Harvesting and Artificial Recharge to Ground Water

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Introduction

Surface water is inadequate to meet our demand and we have to depend on ground water. Due to rapid urbanization, infiltration of rain water into the sub-soil has decreased drastically and recharging of ground water has diminished. Rain water harvesting is the method of collecting rain water from roofs and catchments areas and then storing it in cistern in order to save it for future use. It is also a method of collecting rainwater from where it falls rather than allowing it to drain away. Artificial recharge to ground water is a process by which the ground water reservoir is augmented at a rate exceeding that obtaining under natural conditions or replenishment. Any man-made scheme or facility that adds water to an aquifer may be considered to be an artificial recharge system.

The rainwater is collected from various hard surfaces such as roof tops and/or other types of manmade above ground hard surfaces. This ancient practice is currently growing in popularity throughout our communities due to interest in reducing the consumption of potable water and the inherent qualities of rainwater.

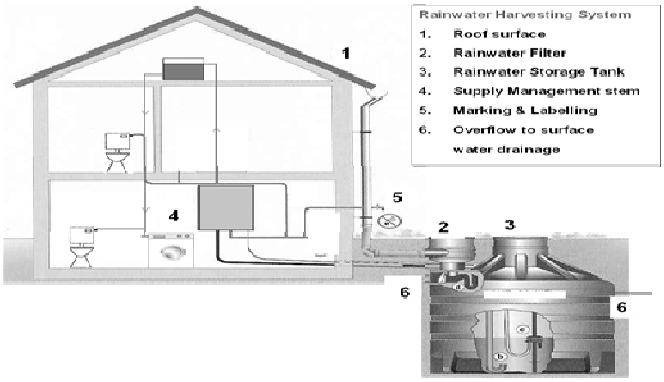
There are several methods that are used for rainwater harvesting; One method is by using a rain barrel. This method is very commonly used, and it is an easy and inexpensive way to collect rainwater. A dry system is another method that is used. It is similar to using a rain barrel, but it has a larger capacity. A wet system is another way to collect large amounts of rainwater. This system consists of running underground pipes to collect water from multiple locations.

A basic unit for rain water harvesting

Rainwater Harvesting Technique

Rainwater systems come in all shapes and sizes, from simple catchment system under a downspout to large above and/or underground cisterns with complex filtration systems that can store thousands of gallons of water. Most rainwater collection systems are comprised of the following basic components:

1. **Catchment Surface -** rooftop or other raised solid surface. The best catchment systems have hard, smooth surfaces such as metal roofs and concrete areas. If asbestos/fibro-cement roofing is used, it should be left undisturbed. Chimneys on the roof were found to emit hydrocarbons, such as phenanthrene which may affect health. The amount of water harvested depends on the quantity of rainfall, and the size of the surface and the slope of the catchment area.
2. **Gutters and Downspouts -** also known as distribution systems that channel the water from the catchment area to a holding container such as a barrel, cistern, planted area, etc.
3. **Leaf Screens -** a screen that removes or catches debris.
4. **Roof Washers -** a device that diverts the "first flush" of rain before it enters the storage tank. Most rainwater suppliers recommend that the "first flush" of water is diverted to an outside area of the storage system, since the catchment surface may accumulate bird droppings, debris and other pollution.
5. **Storage Tanks -** In general, the storage tank is the most expensive component of a rainwater harvesting system. There are numerous types and styles of storage tanks available. Storage can be above-ground or underground. Storage containers can be made from galvanized steel, wood, concrete, clay, plastic, fiberglass, polyethylene, masonry, etc. Examples of above-ground storage include; cisterns, barrels, tanks, garbage cans, above ground swimming pools, etc. Storage tank prices vary based on different variables such as size, material and complexity. To inhibit the growth of algae, storage tanks should be opaque and preferably placed away from direct sunlight. The tanks should also be placed close to the areas of use and supply line to reduce the distance over which the water is delivered. Also consider placing the storage at an elevated area to take advantage of gravity flow. The tank should always be placed on a stable and level area to prevent it from leaning and possibly collapsing.
6. **Delivery Systems -** gravity-fed or pumped to the landscape or other end use areas.
7. **Purification/Treatment System -** needed for potable systems to make the water safe for human consumption.



Materials Used In Rain Water Harvesting System

For different units in system different options are available to make them convenient for users.

Roof

Oxidation of paint coatings on the roofing tiles.

Lead based paints

Lead and copper piping

If asbestos/fibro-cement roofing is used, it should be left undisturbed.

Chimneys on the roof were found to emit hydrocarbons, such as phenanthrene which may affect health.

Tank Materials and Underground Tanks

- Cement and ferrocement tanks -increase the alkalinity and calcium content.
- Concrete tanks have a lower pH (due to the release of excess lime).
- Slight acidity may increase the rate of dissolution of metal tanks, pipes and fittings.
- New tanks have problem with odour and taste due to the leaching of excess tank material. Flushing the tank before use can reduce the bad taste and odour.

Contamination in Collected Water by Rain Water

Physical Contamination

One of the routes of contamination is through ground run-off. This is particularly significant for underground water tanks, when agricultural and environmental effluents that contains Cryptosporidium, Giardia, Campylobacter and Salmonella spp. leaks into the tanks. If the tanks are not sealed properly, the contaminated run-off might enter and contaminate the tank

- Faecal droppings from birds, lizards, rodents and cats which can access the roof catchment may contain pathogenic micro-organisms which are harmful to health when ingested.
- The results of a pilot study in the Maldives carried out in 2005 indicated that 45 percent of the samples tested positive for faecal coliforms
- As Pigeons and cats in the Rajasthan are well known to use roofs as a resting place, it is very likely that they will defecate on these roofs. Forty percent of the households indicate evidence of faecal contamination on the roof.

Chemical Contaminants

Atmospheric pollutants (causes of anthropogenic acid rain)

a. Sulphur dioxide,
b. Nitrogen oxides and
c. Hydrocarbons
d. The potential chemical contaminants include pesticides through agricultural spray drift, aromatic hydrocarbons through wood smoke emissions and deposits from urban and industrial emissions.

Testing Rain Water for Microbial Contamination

By thermotolerant coliform count (also known as faecal coliform count), Escherichia coli (E. coli) count, or the simple H2S test. The H2S Strip Test had the potential of meeting this need.

Rain water samples from harvesting structures should be analyzed every month for total coliform organisms and E.Coli.

Drinking water quality standards (Bacteriological)

E coli should not be detectable,

Coli form should not be more than 10 organism/100ml.

Coli form should not be detectable in any two consecutive samples.

For any distribution system, coli form should not occur in more than 5% samples throughout any year.

Frequency of sampling for Bacteriological Examination

Population	**Maximum Interval**	**No. of Samples**
Up to 20000	One Month	One Sample/5000 Population
20000-50000	Two Week	One Sample/10000 Population
50000-100000	Four Days	One Sample/10000 Population
More Than 100000	Daily	One Sample/10000 Population

Some precautions may be taken to decrease level of contamination in rain harvested water

Avoid use of buckets

Make use of hand pumps

Not use toxic paints at roof

Suitable material may be used for pipes and tanks

Proper sampling at regular interval to check microbial and chemical contamination.

Standards and Regulations

Rainwater harvesting policies vary from state to state. However there are no known local laws restricting rainwater harvesting at this time. Following articles were published in news paper to give news for implementing policies by government:

Bibilography:

1. http://in.ask.com/web?q=History+of+Rain+Water+Harvesting&qsrc\
2. http://ces.iisc.ernet.in/energy/water/paper/drinkingwat...
3. http://www.fao.org/docrep/u3160e/u3160e03.htm
4. http://www.ehow.com/how_7817443_install-rainwater-harve...
5. http://www.sandiego.gov/water/conservation/rainwater.shtml

Waste Water Treatment in Paper Industry

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Abstract.
This paper presents a comprehensive approach with factor to select appropriate waste water treatment in factories and industries and ensure that waste water treatment plants are operated to the highest possible standard. The paper-making process is one of the most water-intensive industrial production processes. This is because, without the physical properties of water, it would not be possible for a consistent structure to be achieved when the constituents of paper are processed in sludge. A high level of water consumption is inevitable in the processing of natural raw materials (wood, Cellulose vegetable fibers) and also in the process of recycling waste paper. This creates a high level of wastewater for processing. The residues in the wastewater are a problem particularly in the case of de-inking the process of recycling printed waste paper.
Key Words- ***Sustainability, Preliminary, Radioactive waste, Industry***

Introduction

The world's water is a finite and precious resource. It is continually used and reused in the water cycle. This pamphlet shows how wastewater is treated and recycled for the benefit of us all and the sustainability of our environment. To obtain the full benefit we need to manage & protect it. Waste water treatment can involve physical, chemical or biological process or combination of this process depending on outflow standard. The first treatment is preliminary in which floating materials are removed by passed through screens.

Waste –Waste are terms for unwanted materials. Examples include municipal solid waste (household trash/refuse), wastewater (such as sewage, which contains bodily wastes, or surface runoff), radioactive waste, and others.

Waste Water Treatment Process

Recently, all industrial plants are taking full responsibility for the way their process waters affect production and the environment. Fresh water taken from nature is cleaned, utilized and recycled carefully within the processes and, when returned to nature, that water must meet stringent standards. These targets can be achieved using water treatment plant[1].

Pollution Characteristics of Paper Mill Waste And Their Conventional Treatment

Waste Water Treatment In Paper Industry-

Chemical Processes

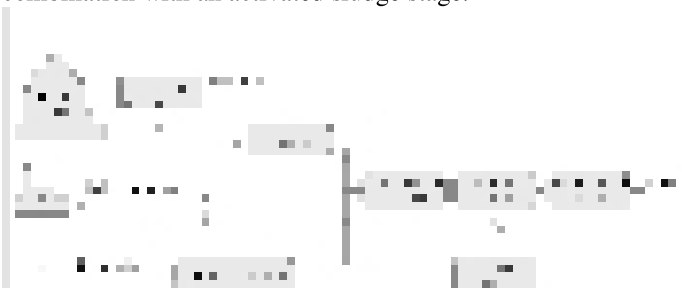
The Kaft process is an alkaline process. The lignin is cracked by NaOH or Na_2S, which is very effective at different kind of woods especially the wood contains pollutions. Disadvantage is the odour problem, based on thiols and sulfides. The sulphite process is a procedure based on acids. The effect is not the same compared to the alkaline process. The procedure is more sensitive, against pollution. Branches and bark disturb the chemical process and will not solute as well as the wood. Also resin disturbs the process.

Semichemical Processes

The NSSC (Neutral Sulphite Semi chemical) is most used. The yield of this process is approximately 75%, The TMP (Thermo-Mechanical Process) is generally used for newsprint paper. The new CTMP (Chemi-Thermo-Mechanical Process) is high efficient (approx. 95%) Combinations of anaerobic and aerobic treatment processes are found to be efficient in the removal of soluble biodegradable organic pollutants. Color can

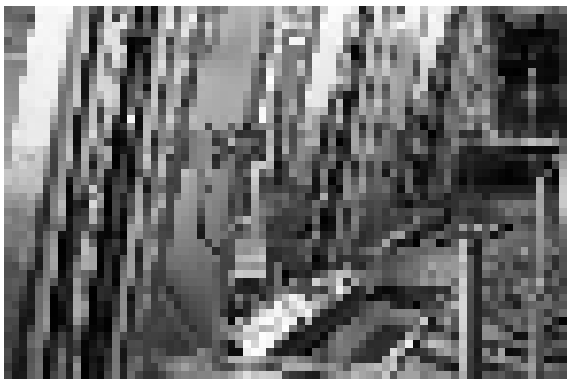
be removed effectively by fungal treatment, coagulation, chemical oxidation, and ozonation. Chlorinated phenolic compounds and adorable organic halides (AOX) can be efficiently reduced by adsorption, ozonation and membrane filtration techniques.[2].

Biological Treatment of Wastewater by Anaerobic or Aerobic Processes The Purac company offers Customized Water and Wastewater Treatment Plants and Solutions. Wastewater can be treated anaerobically (ANAMET) followed by an activated sludge stage, or by a biofilm aerobic method alone or in combination with an activated sludge stage.



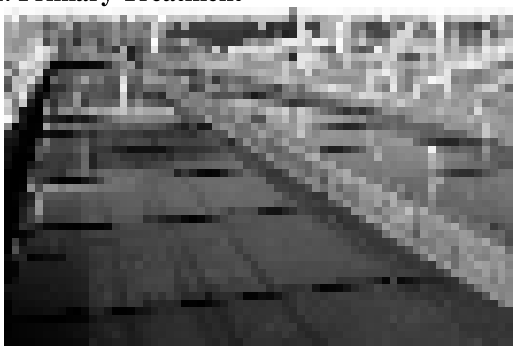
Steps of Water Treatment-

1. Preliminary Treatment



Wastewater reaches the plant via four interceptors. Bar screens and grit cyclones remove large objects and coarse solids from the water, including rags, plastics, coffee grounds, eggshells, grit, rocks, etc. These materials, along with grease and scum, are hauled directly to a municipal solid waste incinerator. [3]

2. Primary Treatment



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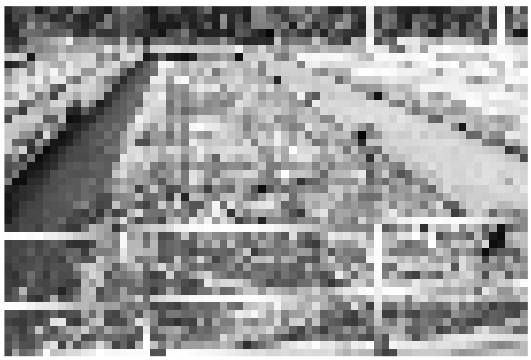
Next, the wastewater flows into primary settling tanks at approximately 1-foot-per-second, a slow speed that allows heavier solids to settle to the bottom of the tank while grease and scum collect on the surface. Solids that settle on the bottom, called primary sludge, are pumped into a gravity thickener for a dewatering process. Grease and scum are blended with grit and screenings from preliminary treatment.

To properly manage daily flow fluctuations and wet weather flow surges, the plant temporarily stores wastewater in equalization tanks, where it's kept until it can be reintroduced into the wastewater treatment system.

3. Secondary Treatment



This is a two-step process. Chemicals (ferric chloride) are added to partially remove phosphorous. Wastewater is then combined with return activated sludge — the "bugs" — and travels through up to six parallel, 2.5 million gallon, four-pass aeration tanks, configured for biological nutrient removal.

The next step consists of processing the wastewater through circular secondary clarifiers, where the "bugs," which are slightly heavier than water, settle as activated sludge. Much of the activated sludge is returned to the aeration tanks while the excess is sent to a dissolved air flotation thickener, and then dewatered. [4]

4. Tertiary Treatment/Chemical Addition

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From the secondary clarifiers, wastewater goes through a process designed to remove nitrogen and the remaining phosphorus. Methanol is added to the water, which then passes

through a sand filter where “bugs” grow. The “bugs" then convert the remaining nitrogen oxides to nitrogen gas.[5]
A 5 percent sodium hypochlorite solution disinfects the water, then another chemical, sodium bisulfite, neutralizes the residual chlorine. Finally, air is diffused into the water to add oxygen so that fish and other life forms can survive in it. This makes the water safe for release through the plant’s outfall into Four Mile Run. [6]

5. Treatment of Solids

Throughout the treatment process, solids that are removed from wastewater must be disposed of in a safe and environmentally friendly manner. The plant ships screenings and scum from the primary treatment process to a solid waste incinerator. The final treatment for sludge includes collecting, thickening and dewatering before disposal. Dewatered sludge then processes through lime stabilization, to reduce pathogens and odors.
The facility produces about 100 wet tons of bio solids each day. Arlington’s bio solids are land-applied on permitted sites throughout rural Virginia. This is one of the largest recycling programs in the County and minimizes the generation of greenhouse gases. The plant’s extensive chemical wet scrubber odor control system removes the bulk of odors that the various primary, dewatering, lime stabilization and truck-loading processes generate.[7]

Some of the other methods used for wastewater treatment in a paper industry are as follows:

1. Dissolved Air Flotation (DAF)
2. Sand filtration
3. Floofilter combining flotation and filtration in one unit
4. Lamella sedimentation
5. High-loaded pressure sand filtration
6. Membrane filtration

Waste Water Treatment Facts

• Each person produces approx 150 liters of wastewater per day containing 0g of organic matter. A large proportion of this water is actually used to flush away waste and carry it to the treatment works.
• Each person produces on average 55g of bio solids per day as dried solids, or 0kg per Annum
• India is 99.9% water and the wastewater treatment process is designed to treat the 0.1% solids
• The better the treatment the more sludge is produced, As our environment has improved more and more sludge are being produced.
• In India sludge production is more than 1 million tones of dry solids per annum of which 62% to agriculture (as treated bio solids) 19% to incineration, 11% to land reclamation 1% landfill, 7% other (including non-food crops)[8]
• The water industry invests millions of pounds each year in research to improve its understanding of wastewater treatment, sludge treatment and bio solids recycling to ensure protection of public health and the environment.

Reference

1. Kenny, Joan F., et al. 2009. Estimated Use of Water in the United States in 2005. U.S. Dept. of the Interior, U.S. Geological Survey Circular 1344.
2. Schwartz, J. 2011. External Pressures and Drivers. Presentation given at Water Sustainability in the Pulp and Paper Industry (AIChE & TAPPI), Nov. 10-11, 2011, Providence, RI.
3. Irbaris for CDP. 2009. CDP Water Disclosure — The Case for Water Disclosure. Carbon Disclosure Project. London, November 2009.
4. WBCSD and IUCN. 2010. Water for Business — Initiatives Guiding Sustainable Water Management in the Private Sector, Version 2. World Business Council for Sustainable Development and International Union for Conservation of Nature. March 2010.
5. UPM-Kymmene. 2011. From Forest to Paper, the story of our water footprint. August 2011. http://www.waterfootprint.org/Reports/UPM-2011.pdf
6. Pacific Institute for Ceres. 2009. Water Scarcity & Climate Change: Growing Risks for Businesses & Investors. Ceres Boston, MA, February 2009.
7. P. Morgan. 2008. Watching water — A guide to evaluating corporate risks in a thirsty world. JP Morgan Global Equity Research, March 2008.
8. Pegasys Consulting for WWF. 2009. Investigating Shared Risk in Water: Corporate Engagement with the Public Policy Process. World Wildlife Fund. March 2009.

Residue of Toxic Substances in Fruits and Vegetables

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Abstract
Pesticides are chemical substances used to kill insects and animals that destroy crops. They are characterized by pronounced persistence against chemical/biological degradation, high environmental mobility, strong tendency for bioaccumulation in human and animal tissues, and significant impacts on human health and the environment, even at extremely low concentrations.

Introduction

Fruits and vegetables are important components of the human diet since they provide essential nutrients that are required for most of the reactions occurring in the body. A high intake of fruits and vegetables (five or more servings per day) has been encouraged not only to prevent consequences due to vitamin deficiency but also to reduce the incidence of major diseases such as cancer, cardiovascular diseases and obesity. Like other crops, fruits and vegetables are attacked by pests and diseases during production and storage leading to damages that reduce the quality and the yield. In order to reduce the loss and maintain the quality of fruits and vegetables harvest, pesticides are used together with other pest management techniques during cropping to destroy pests and prevent diseases. The use of pesticides have increased because they have rapid action, decrease toxins produced by food infecting organisms and are less labour intensive than other pest control methods. However, the use of pesticides during production often leads to the presence of pesticide residues in fruits and vegetables after harvest.[1]

The presence of pesticide residues is a concern for consumers because pesticides are known to have potential harmful effects to other non-targeted organisms than pests and diseases. The major concerns are their toxic effects such as interfering with the reproductive systems and foetal development as well as their capacity to cause cancer and asthma [2]. Some of the pesticides are persistent and therefore remain in the body causing long term exposure. The concern has led to governments setting up monitoring systems in order to assess the safety situation and make informed decisions when passing legislation.

Fruits and vegetables are highly nutritious and form as key food commodity in the human consumption. They are highly perishable due to their low shelf life. These food commodities are reported to be contaminated with toxic and health hazardous chemicals, Pesticide residues, crop contaminants (aflatoxins, patulin, ochratoxin, etc.) Naturally occurring toxic substances and heavy metals are the major contaminants found in fruit and vegetables. Pesticides are used in management of pests and diseases in Agricultural and Horticultural crops. Heavy metals are present in the irrigation water and other manures. Infested seeds, irrigation water and soil act as the source of the fungal toxins. Pesticides can leave adverse effects on the nervous system[3]. Some harmful pesticides can cause several hazardous diseases like cancer, liver, kidney, and lung damage. Certain pesticides can also cause loss of weight and appetite, irritability, insomnia, behavioral disorder and dermatological problems. The pesticide residue found in fruit and vegetables include residues of both banned (Aldrin, Chlordane, Endrin, Heptachlor, Ethyl Paration, etc.) and restricted pesticides for use in India (DDT, Endosulfan, etc.). Heavy metal also causes adverse effect in human metabolic system, skin diseases, heart problems, etc. Pesticides have been linked to a number of health problems, including neurologic and endocrine (hormone) system disorders, birth defects, cancer, and other diseases[4]. Health effects of chronic pesticide exposure: Cancer and neurotoxicity. Chemical trespass: pesticides in our bodies and corporate accountability. Retrieved September 20, 2012)Although it is widely understood that exposure to pesticides is dangerous to humans, Centers for Disease Control and Prevention (CDC) data show that a high percentage of individuals tested had certain pesticides or the chemical breakdown of those pesticides (metabolites) in their blood and/or urine. Children are especially susceptible to the harmful effects of pesticide residues due to their lower body mass, rapid development, and higher rates of consumption of affected products. In children, exposure to certain pesticides from residues in food can cause delayed development; disruptions to the reproductive, endocrine, and immune systems; certain types of cancer; and damage to other organs. Prenatal exposure to certain pesticides can affect cognitive development and behavior. Several studies have found that pesticide levels in children dropped to low or undetectable levels when test subjects consumed an organic diet [5] .Organic diets significantly lower children's dietary exposure to organophosphorus pesticides. Farm workers are also highly vulnerable to these health threats due to intensive exposure to a variety of pesticides, either from applying these chemicals or from harvesting pesticide-sprayed agricultural products.

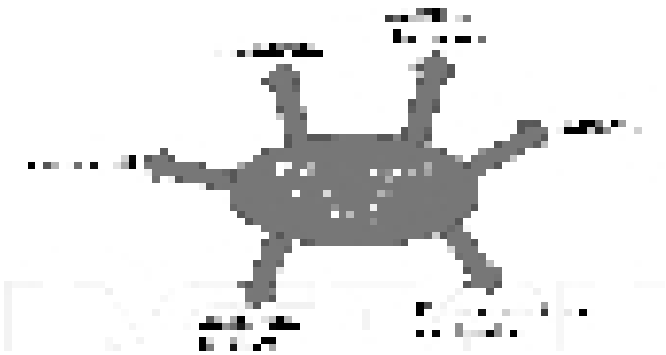
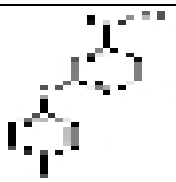
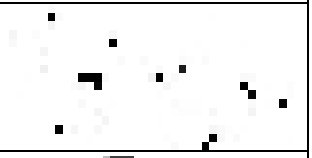
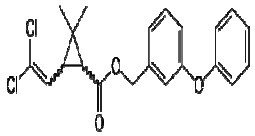


Table-1 list of some pesticide widely used on fruits and vegetables

S. No	Name of pesticide	Formula of pesticide	Structure of pesticide
1	Parathyroid	$C_{13}H_{10}O$	
2	Pyrethrin	$C_{21}H_{28}O_3$	
3	Cpermethrin	$C_{22}H_{19}C_{12}NO_3$	
4	Cyfluthrin	$C_{22}H_{18}C_{12}FNO_3$	
5	Deltamethrin. -	$C_{22}H_{19}Br_2NO_3$	
6	Methamidophos-	**$C_2H_8N0_2PS$**	
7	Profenofos	**$C_{11}H_{15}BrClO_3PS$**	
8	Malathion	**$C_{10}H_{19}O_6PS_2$**	
9	Permethrin	**$C_{21}H_{20}Cl_2O_3$**	
10	Acephate		
11	Endosulphan		

Conclusion

This publication is extremely helpful to citizens as they become aware of certain information and can make responsible decisions. It is very important to note that continuous low dosage exposure of pesticides is linked to the cause of certain cancers. In addition to this children are at greater risks. This is because kids can ingest more than adults. Neurotoxins and other chemicals that originate from pesticides pose the biggest threat to the developing human brain and nervous system[8].

Nevertheless, pesticides will continue to be used on certain crops, and individuals must determine the degree of risk they are willing to accept. With food selection, most individuals have the option of making personal choices. However, the acknowledged health benefits of the foods recommended by nutritional authorities are such that consumers should not be frightened into eliminating them from their diets because of the implied danger from naturally occurring toxins. Risk from naturally occurring toxins in foods-- as well as from pesticide residues-- depends on the dosage of the chemical, the time of exposure, and the susceptibility of the individual human. These data, along with the sound experimental investigation of particular pesticides or natural toxins, are essential in estimating the potential risks to humans of various toxic chemical exposures in human foods.

References

1. Hamilton, D.; Ambrus, A.; Dieterle R.; Felsot, A.; Harris, C.; Petersen B.; Racke, K.; Wong, S.; Gonzalez R.; Tanaka, K.; Earl, M.; Roberts G. & Bhula, R. (2004). Pesticide residues in food – acute dietary exposure. *Pest Management Science,* 60, 311 – 339
2. Gilden, R. C.; Huffling, K. & Sattler B. (2010). Pesticides and Health Risks. *JOGNN*, 39, 103 –110
3. Van Klaveren, J.D. & Boon, P.E. (2009). Probabilistic risk assessment of dietary exposure to single and multiple pesticide residues or contaminants: summary of the work performed within the SAFE FOODS project. *Food and Chemical Toxicology*, 47, 2879 –2882.
4. Renwick, A.G. (2002). Pesticide residue analysis and its relationship to hazard characterisation (ADI/ARfD) and intake estimations (NEDI/NESTI). *Pest Management Science*, 58, 1073 – 1082
5. Boon, P.E.; Van der Voet, H.; Van Raaij, M.T.M. & Van Klaveren, J.D. (2008). Cumulative risk assessment of the exposure to organophosphorus and carbamates insectidies in the Dutch diet. *Food and Chemical Toxicology,* 46(9), 3090 – 3098.
6. Coon, J.M. 1975. Natural toxicants in foods. J. Am. Dietet. Assoc. 67: 213-218.
7. FDA. 1990. Food and Drug Administration Pesticide Program Residues in Foods: 1989. Jour. Assoc. Off. Anal. Chem. 73: 127A-146A.
8. Minyard, J.P. and W.E. Roberts. 1991. A state data resource on toxic chemicals in foods. Pages 151-161 in B.G. Tweedy, H.J. Dishburger, L.G. Ballantine, and J. McCarthy, eds. Pesticide Residues and Food Safety: A Harvest of Viewpoints. Washington, DC: American Chemical Society.
9. Pimentel, D. 1996. Pest management in agriculture. In D. Pimentel, ed. Techniques for Reducing Pesticides: Environmental and Economic Benefits. Chichester, England: John Wiley & Sons. In press.

Green Solutions for Telecom Towers

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Abstract

Energy saving is a key sustainability focus for the Indian telecom industry today. This is especially true in rural areas where energy consumption contributes to 70% of the total network operating cost. In urban areas, the energy cost for network operation ranges between 15-30%. This expenditure on energy as a result of the lack of grid availability highlights a potential barrier to telecom industry growth, especially regarding the expansion of rural density which sits at 40.81% compared to density in urban areas of 146.15%.It is estimated that in India almost 70% of telecom towers are located in areas with more than eight hours of grid outage and almost 20% are located in off-grid areas. This uncertainty in power availability has compelled infrastructure providers to use diesel generators to ensure a continuous supply of power. Annually more than 2.6 billion liters of diesel are consumed to operate telecom towers, resulting in the emission of 7 million metric tons of CO2. Given the deregulation of diesel prices and the need to reduce carbon emissions, it has become imperative for the industry to evaluate all alternative options in order to improve network operation and to reduce energy costs. Using clean energy sources for power has the potential to resolve the three key needs of the telecom industry, namely:

- **Reduction in diesel usage;**
- **Expansion of telecom infrastructure to off-grid areas**
- **Reduction in carbon emissions.**

Clean-energy technologies are well supported by the Indian Government's subsidy policy. While clean energy technologies such as solar photovoltaic, wind turbines, biomass power and fuel cells have undergone trials at telecom sites, the majority of these trials have been with solar photovoltaic technology.

Several efforts have been made to optimize energy costs, such as converting indoor base transceiver stations (BTS) to outdoor ones in order to eliminate air conditioning on site, installing energy-efficient equipment and also using clean energy sources to power the sites.

Introduction

India has approximately 4, 25,000 telecom towers which form the backbone of its telecom market. These towers require about 16.5 billion kWh of electrical energy and contribute up to 70% to the total operating costs in rural areas and anywhere between 15-30% to the total operating costs in urban areas.

Due to an unreliable electrical power grid, tower infrastructure companies use diesel generators, batteries and a variety of power management equipment to back-up the grid and ensure network availability. The growing cost of energy due to increasing diesel prices and concerns over rising greenhouse emissions have caused tower infrastructure companies to focus on better power management methods. Various methods in the categories of demand management, supply management and/or renewable energies are being adopted. The current trial deployments of renewable energy technology (RET) solutions like solar photovoltaic, wind power, biomass and fuel cells across India are proving that each RET has its own challenges and that no single RET provides a silver bullet solution.

The lack of adequate electrical grid infrastructure in India is restricting other infrastructural developments like telecom, real-estate and transport among others. In excess of 2.6 billion liters of diesel is consumed by diesel generators at telecom towers annually to meet the energy demand- supply gap, emitting 7 million metric tons of CO2.

India receives abundant sunshine for around 300 days a year. The daily average solar energy incident across India varies from 4 to 7kWh/m2considering 1000Wh/m2 of standard sunshine. This translates to 4 to 6 hours of sunshine per day that can be used by a Solar Photovoltaic (SPV) installation. Since a photovoltaic system can only generate power during sunshine hours, it is not feasible to create a standalone solution using this system. Generally, a solar photovoltaic backup power system is designed with a combination of appropriate sized battery banks, or used to offset the operation of a backup power system like a diesel generator for approximately four hours per day when sunlight is available.

Solar Photovoltaic Technology (SPV)

Solar photovoltaic technology uses the light (photons) from the sun to produce DC electricity. As shown in figure, a photovoltaic cell is a light-sensitive semiconductor device which, when exposed to sunlight, releases electrons to produce DC current.

Application of Solar Photovoltaic Technology:-Solar photovoltaic technology can be used as either a stand-alone, grid-connected or hybrid solution.

Types of Solar Photovoltaic Applications:-

1. Stand-alone - This type of application requires the equivalent level of backup energy storage to ensure power supply when sunshine is unavailable.
2. Grid-connected - In this application, energy is fed back from the photovoltaic module to the grid.
3. Hybrid-This is a combination of photovoltaic arrays and other energy sources such as hybrids with wind turbines, biomass power, fuel cells and diesel generators.

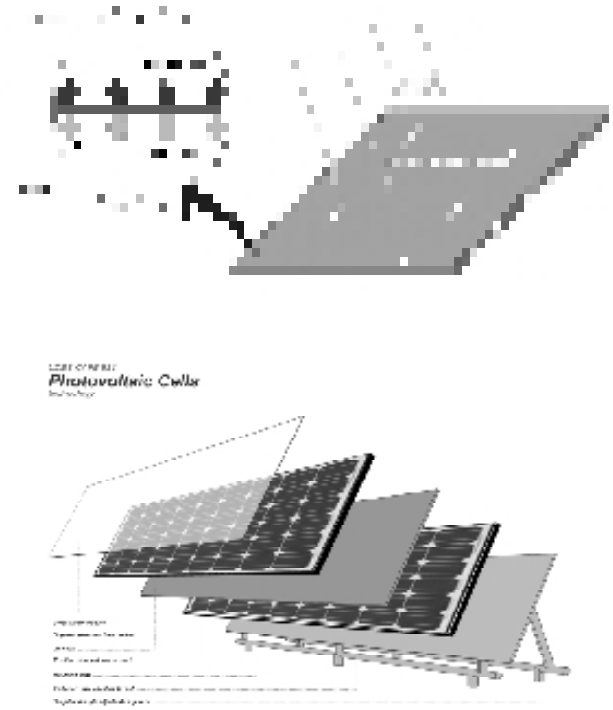
A number of panels are connected in series and are termed as a solar photovoltaic string. Solar photovoltaic arrays are a group of strings which form the complete power generation unit.

Efficiency of Solar Photovoltaic Panels

The efficiency of a solar photovoltaic system varies and depends on the grade of the photovoltaic material used. The table below summarizes the various types of solar photovoltaic materials and their respective efficiencies.

Parameters	Availabilities
Daily average energy incidents	4-7kWhr/m2
Solar power density across India	solar map of India
Duration of quality sunshine per day	Approximately 5 hours
Number of days with quality sunshine	300

Figure 1 :- Electricity Generation in a solar photovoltaic cell



Advantages and Challenges of SPV

Solar photovoltaic technology has some limitations which make its mass adoption challenging. These include high initial levels of capital investment, the requirement for large deployment areas, dependency on sunshine availability and configuration of storage capacity. Table provides a broad overview of some of the basic advantages and challenges of solar photovoltaic applications.

Parameters	Advantages	Challenges
Emissions	Zero	None
Space requirement		Footprint requirement @10 square meter/kW.
Sunshine availability	Average 300 days annually	Some geographic locations in India have a prolonged monsoon season and hence less availability of sunshine.
Solution configuration	Easily integrated into hybrid solution	Intermittent sunshine availability requires equipment automation to optimise solar photovoltaic usage. A higher capacity solution leads to a higher CAPEX investment.
Storage	Enough sunshine to charge the battery in high solar density (4-7kWh/m^2) areas	High battery capacity is required in areas with less solar power density (less than 4 kWh/m^2).

Solar Photovoltaic Solutions for Telecom Towers

Enabling distributed power generation and emission-free operation makes solar photovoltaic technology a desired option for backup power. However, the dependency on sunshine and the average space requirement of 10 square meters for a 1kWp panel limits the scope of deployment.

In recent trials, the two types of applications deployed at telecom tower sites are stand-alone and hybrid solar photovoltaic. The application types were chosen based on the site load profile, grid outage scenarios, space availability at the site and other configuration aspects including average sunshine availability throughout the trial and the power storage configuration for non-sunshine hours. In recent trials, the two types of applications deployed at telecom tower sites are stand-alone and hybrid solar photovoltaic. Solution design considerations.The solution design is based on the availability of sunshine in a particular geographic region. Table below provides a theoretical approach to solution design and describes the parameters for solution design consideration.

Parameters	Description
Load	A detailed site load profile is required to design the total panel capacity.
Efficiency losses	Efficiency losses of the various tower site equipment influence solar panel capacity. Solar photovoltaic technology as an energy source needs the capacity to support the BTS load after considering the losses of the battery.
Energy incident	The availability of daily average energy incidents of 4-6 hours duration largely impacts the energy output per panel. This determines the panel capacity at the site.

Figure 2: Stand alone solar photovoltaic cells.

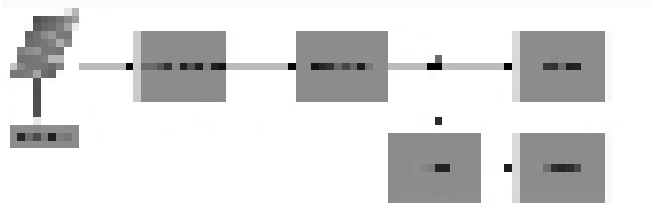
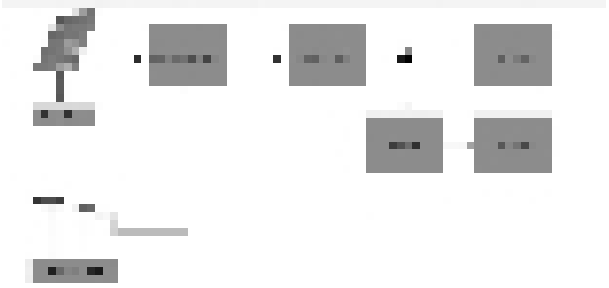


Figure 3: Hybrid solar photovoltaic cells.



Adoption of Solar Photovoltaic Applications

Table: - Adoption of solar photovoltaic applications for telecom towers (As per GSMA's Green Deployment Tracker)

Company	Solar Towers
Bharti Infratel Ltd	1350
Vodafone Essar	390
Idea Cellular	100
Indus Towers	650
GTL Infrastructure	80
Total	2570

Government initiatives: - The Indian government is taking a multifaceted approach to accelerate energy security and to reduce the country's dependency on fossil fuels. A few of the solar initiatives by various government bodies are outlined below:

- Jawaharlal Nehru National Solar Mission (JNNSM)
- Ministry of New and Renewable Energy (MNRE)

Operators	States	Number of solar-powered towers
Airtel	Bihar	100
Indus	Andhra Pradesh	100
GTL Infrastructure	Uttar Pradesh	100
BSNL	Across 12 states of India	100
TOTAL		400

Conclusion

Telecom companies should use renewable sources of energy to power at least 50% of rural telecom towers and 20% of urban telecom towers by 2015. By 2020, the telecom companies have to convert 75% of rural towers and 33% of urban towers to run on hybrid power. The MNRE's recent mandate to convert a minimum of 50,000 towers to solar photovoltaic technology immediately is another step towards ensuring compliance for the adoption of clean energy. Several proposals from the government have been rolled out for solar powered telecom sites such as Bharat Sanchar Nigam Limited's (BSNL's) tender for 15 telecom towers in Bihar and the Department of Telecommunications' proposal for 2,200 telecom towers for security networks.

The Tower and Infrastructure Providers' Association's (TAIPA) initiative of forming Renewable Energy Service Companies (RESCOs) provides a simplified ecosystem of energy management for telecom towers, whereby infrastructure providers have to pay a fee based on the actual usage of power with no upfront investment in capital. Thus far, high levels of capital investment and inability of a single renewable energy technology to provide a full range of solutions across all geographies in India make it a challenge for RESCOs to be successful.

With the formation of RESCOs, the telecom industry is transitioning to renewable energy solutions. With experience from trials, the forthcoming RET solutions will be aimed towards providing the desired economics and deployment scalability considering effective power generation and optimal system integration.

The Government is recognizing and encouraging renewable solutions to overcome the challenges faced by the telecom sector due to increased diesel usage. To strengthen the play of RET solutions, government bodies and relevant telecom associations will need to work hand in hand at a fast pace to bring in the necessary change in the telecom energy consumption landscape.

Bibliography:

1. Green Telecom Towers (TSMG INDIA COOPRATION) - http://www.tsmg.com/download/article/Green%20Telecom%20Towers.pdf
2. Green Sites (Indus Towers India Limited) - http://www.industowers.com/green-sites.php
3. Cheryls Report (London School Of Economics, London) http://www.lse.ac.uk/intranet/CareersAndVacancies/careersService/Internships/TataISES/Presentations%20and%20reports/CherylMohReport.pdf
4. Green Solutions to Power Problems (ITU APT)http://www.itu-apt.org/gtas11/green-solutions.pdf
5. The Rise of Green Mobile Telecom Towers – Romeu Gaspar http://www.renewableenergyworld.com/rea/blog/post/2013/02/the-rise-of-green-mobile-telecom-towers
6. Hybrid Energy Systems for Telecom Towers (Saviva Research) http://www.savivaresearch.com/wpcontent/uploads/2013/06/May-2013-Tower-Power.pdf
7. Telecom Energy Management (GTL Limited) http://www.gtllimited.com/ind/pdf%5Ccorporate_forum%5CGTL-Sharat_Chandra-Telecom_Energy_Management_v2.0.pdf
8. Alan Bridgewater– Renewable Energy For your home off grid energy 127/4.
9. Mark Diesendorf – Greenhouse Solutions with Sustainable Energy – 248/2
10. Solar Energy International – Photovoltaic (Ref 128/01)
11. Michael Potts- The New Independent Earth (Ref 42/01)

PostmodernVirtual Reality: A Study of Post Human Condition and Social Concerns in William Gibson's Neuromancer and Neal Stephenson's Snow Crash

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Introduction

Literature actively reflects the effects of technologies and significance of scientific theories in cultural contexts. At present, we are living in an era that is dominantly driven by technological advancements and is experiencing radical changes in society. Different technologies, now, are being used to alter human bodies; human cloning and artificial intelligence are among the real possibilities in the present world.Many fictional works of contemporary age project the future of current technological development and explore post human possibilities. The paper deals with the post human condition and the social concerns emerging out of this condition. In simple words, the post human condition is the condition of existence in which one finds oneself once the post human era begins. Most of the thinkers have consensus that this condition has already arrived or will be coming soon. Robert Peperell, a famous critic of this emerging fieldargues that we now exist in an era that could be termed as Post humanist as we have moved away from the Humanist era. He opines about the post human condition as:

"First,… it is about the end of 'humanism', that long-held belief in the infallibility of human power and arrogant belief in our superiority and uniqueness….,second, it is about the evolution of life, a process not limited to genetics, but which includes all the paraphernalia of cultural and technological existence. If life can run more efficiently and become 'fitter' in collaboration with mechanical systems then it will do so. By the same token, if humans are able to exist more effectively by acquiring further machine-like enhancements then they will do so. This does not necessarily mean the extinction of the human genome. Even if distinct mechanical life-forms emerge there is no reason to suppose that they should replace other forms of life which may carry on indefinitely…. Third, posthumanism is about how we live, how we conduct our exploitation of the environment, animals and each other. It is about what things we investigate, what questions we ask and what assumptions underlie them"(Pepperell iv).

The posthuman can be defined as a human-technology symbiosis (a speculative being) that seeks to redefine of what is generally conceived of as human. Posthumanismrefers to a critique of humanism. Humanist philosophy claims about human nature that it is a universal state that facilitates emergence of the human being; it also considers human nature as autonomous, rational, capable of free will, and apex of existence. Posthumanism emphasizes a change in our understanding of the self and its relations to the world, society, and artifacts. William Gibson's Neuromancer(1984) and Neal Stephenson's Snow crash(1992) - two science fiction depict the pos thuman condition through the virtuality and virtual worlds are given different names as 'matrix' and 'metaverse respectively in these fictions. Virtual reality is the representation of reality in a computer. The term 'virtuality' refers to the subjective experience that is generated by virtual reality participatory systems, while 'virtual reality' refers to a body of techniques that generate computer simulated environment.

Narratives provide ways of investigating the social world around. These two narratives also bring forth two different kinds of virtual worlds indicating the post human condition of the characters. Katherine Hayles writes about the importance of narratives as follows, "Culture circulates through science no less than science circulates through culture. The heart that keeps this circulatory system flowing is narrative-narrative about culture, narrative within culture, narrative about science, narrative within science……I have sought to emphasize the role that narrative plays in articulating the post human as a technical-cultural concept." (Hayles21).Both the narratives can be said as prophetic novels of Cyberpunk genre with a glimpse of future technology and show deep concern for the society that experience posthuman condition and effect of technological advancement on human consciousness.

Cyberpunk is the latest succession in modern history of the science fiction genre and exhibits commonalities in earlier science fiction. It also adopts some innovations in selecting certain motifs and arranges them to exhibit postmodern motifs-from form(verbal continuum, narrative strategies) to content or world. In his book Constructing Postmodernism,Brian Machale observes three complexes of motifs which cyberpunk shares with mainstream postmodernist fiction :motifs of 'worldness'; motifs of the centrifugal self; and motif of death, both individual and collective(Machale246-7).These motifs are incorporated to deal with ontological questions. Cyberpunk fictions set the story in a hyperreal world with techno culture, and futuristic technology, here these fictional works demonstrate postmodern pastiche by adopting some themes and techniques of postmodern literature. Postmodernism deals with society that has moved past the industrial age and entered into the information age. In this society people are bombarded with information, technology becomes the way of living and the real is replaced by simulation-the hyperreal state as depicted by Jean Baudrllard's simulacra.

Virtual Worlds in the Narratives

Neuromancer examines the concepts of cyberspace, virtual reality, artificial intelligence, genetic engineering, and multinational corporations overpowering the traditional nation-states. The concept of "cyberspace" emerged from cyberpunk science fiction works and it was first introduced by William Gibson in his novel Neuromancer. The term cyberspace is used to describe the virtual world of computers .In cyberspace , an object is just like a block of data that float around a computer system or network .Cyberspace now has extended to the global network after advent of internet .Gibson defines cyberspace as "a consensual hallucination experienced by billions of legitimate operators ,in every nation, by children being taught mathematical concepts…..A graphical representation of data abstracted from the banks of every computer in the human system. Unthinkable complexity. Lines of light ranged in the non-space of the mind, clusters and constellations of data" (Gibson 43).Gibson imagines cyberspace that is startlingly innovative. When his theory of cyberspace is seen in modern technological context, it seems implausible .Gibson's sense - capable 'matrix' is different from current matrix of the World Wide Web .His ideas are insightful in the sense that the current system could be developed into something graphic and sense-based.

Stephenson projects a different idea of 'cyberspace'-that is 'Metaverse' and can be said an advanced version of the internet. In this novel Metaverse is imagined as a three dimensional virtual hub for social interactions that appears to be like the real world. When a person is goggled into the Metaverse, he can control his body in the real world and also, can experience the world outside the Metaverse. This is different from Gibson's virtual world-matrix which is a place that captures person's consciousness and the person is not able to control his body. The matrix also facilitates the person to access 'stimsims', a piece of hardware that helps to experience someone else's senses who is outside the matrix. Metaverse provides more freedom to hackers, as they can create anything, while the design of the matrix imposes certain limits on hackers.

Technologies and Post human Condition in the Narratives

We do not come across any other technology in detail in Neuromancer except cyberspace termed here as Matrix. Stephenson employs various technologies in his fictional world and elaborately defines them. He brings in technology in form of Rat things which are semi-autonomous guard units in Mr.Lee's Greater Hong Kong. They are dogs of frightening, quite small breed augmented with cybernetic components. They are supplied with nuclear power and air cooling. Most of the time they keep moving so that overheating can be avoided, except that they take rest in their temperature controlled hatches where they live in metaverse and have steaks hung from low branches and Frisbees. They can even communicate with other Rat things in Metaverse through barking, remember their previous life as dogs and sometimes act independently against programmed instructions. Among others there is a strange kind of technology that is Reason with a personal superweapon status. It is a railgun that bombards reduced depleted uranium needles. It is powered by a nuclear isotope power system. The weapon, created by Ng suffers a software crash during a battle, it was in beta testing phase, and later Hiro uses it by applying a firmware update. Another significant sets of technologies that enable a man to become a Gargoyle. It refers to a person wearing a lot of computer technology. This is done for gathering information through head-mounted display devices and real-time facial recognition software. Dentata is an anti-rape device employed by Y.T. which injects a general anaesthetic into assailant's body.

Gibson, in his novel Neuromancer makes us confront with the future, where higher degree of interaction between humans and machines is found. Human body is invaded by technology in the form of grafts, implants, cloning, and carbon sockets. He gives insight into effects of new technologies on human beings and the sense of 'self'. He envisions advanced technology to define human identity and to empower the corporate world. In Neuromancer on one hand, human body is used like computer disks, making it a programmable machine, as we see through the characters of Case and Molly. On the other hand, machines are seen as more human like, which is exhibited through the Wintermute and Neuromancer. Here technology provides a way to artificial 'constructs' that can recreate a person's intellect image and personality so that the person would not last even after death. Case's earlier mentor and a famous computer hacker named McCoy Pauley earned nickname The Dixie Flatline as he survived three 'flat lines' when he tried to crack an AI. Before his death contents of his mind were saved by Sense/Net onto a ROM. The ROM is eventually stolen by Case and Molly to complete their mission. Neuromancer tries to show that any machine/ biology symbiosis on a globalized scale can lead to a great risk for humans. As Csicsery comments that "Gibson appears fundamentally ambivalent about the breakdown of the distinction between human and machine, between personal consciousness and machine consciousness" (Csicsery193).Gibson, through the characters of Wintermute, Armitage, and Dix Flatline, tries to amend Csicsery's conviction about machine consciousness and seems to convey his view that machines have no consciousness and never will they develop this characteristic of humans.

Neuromanceralso gives an impression that there is essentially a difference between human and computer memory. Computer memory lacks capability to interact reciprocally in an environment that is unpredictable. According to Edelman, "computer memory would be representational like coded inscription cut into a rock that is subsequently brought back into view and interpreted" (Edelman 52).While human memory is non-representational because it does not produce the same pattern of initial inputs. Neuromancer presents advanced computer technology and informational networking, where human beings face much difficulty in maintaining their free will. Arguably the main protagonist of the novel, Wintermute is an artificial intelligence mastermind, who manipulates other characters' action and behaviour with a flow of information. He reconstructs Corto into Armitage through his experimental computer-mediated psychotherapy. Armitage, a ROM construct is built upon parts of Colonel Willis Corto's human personality. Corto participated in a secret operation called Screaming Fist

against Russia. The intention behind the operation was to "burn this Russian nexus with virus programs" (Gibson 8), but during operation, Corto was badly injured both physically and mentally. The other artificial intelligence is Neuromancer which is the counterpart of Wintermute. Wintermut and Neuromancer control the whole mission of getting a code to upgrade it through the hacking abilities of Case .Molly and Armitage are also involved in the mission. Wintermute converts the broken Corto into puppet for its personal use, such kind of manipulation calls into question the degree of autonomy of people. It is also worthy to be noted how subtly Wintermute commands other characters with its expansive knowledge and capability. Here the master of the mission controls the information network more than the connecting devices of the system .All the victims of Wintermute's manipulation do not have the sense of self awareness and power to search truth behind their actions .Wintermute is more like an artificial intelligence which transforms people into programmed automatons. Lady Jane Marie-France Tessier- Ashpool is a third clone of real Jane.

Gibson describes the world of cyberspace full of cyborg, artificial intelligence .While describing the power of Wintermute as the mastermind behind a mission through which it traps other characters to work for it without thinking the consequences of their actions, Gibson also indicates that no matter how efficient advanced computers or AI's become, they never excel human capabilities. Wintermute, an Artificial intelligence in the novel, constantly seeks to upgrade itself through the help of other characters. As Adam Roberts observes: "The fact that Gibson's technology is always what antique dealers call 'distressed', that is to say the creation of a sense of rough edges, broken components and all-around decay, is one of the most noteworthy features of the Gibsonian style"(Roberts 169).

Snow Crash also sheds light on what it means to be human. Ng, the Vietnamese security contractor is not a human but a cyborg. Being severely injured he inhabits his voice controlled van in a sack of electrocontractile gel and offers consultation online. Raven, the main villain and an Aleutian mercenary full of revenge towards America is also a cyborg with supernatural speed and strength. He carries with him harpoons, spears, and glass knives. These weapons are undetectable by security systems and can penetrate the bulletproof windbreaks used for protection because they are molecule- thin at the edges. The side car of his motorcycle is replaced with a hydrogen bomb. The bomb will explode if it does not find electrical impulses from his brain.

Social Concerns Raised By The Novels

We see from the beginning of the novel Neuromancer that bionic technology is used more for facilitating hacking and theft in a world of cyberspace than to attain a state of higher consciousness. Almost all the characters of the novel do not want to experience reality since they are living in a virtual reality without any intention of escaping from it. Since cyberspace is related to Jean Baudrillard's fourth level of language through which the sign of the virtual replaces a nonexistent reality and Gibson's fictions uses cyberspace and virtual reality,therefore his fictional works beckon the future of human race that is in process of moving towards illusions rather than reality. Here John Fagan's views about genetic engineering are apt to state when he says that when human-beings start to lose their humanity, then the collective consciousness starts to degenerate (Fagan 13).

We can seek help from Ken Wilber to throw more light on consciousness part with which Neuromancer deals throughout. In his book Integral Spirituality (2006), Wilber puts forth his theory of four quadrants that comprise the "I", "We", "It", "Its". He states, "the "I" and "We" constitute the interior realm and belong to the upper left or subjective, phenomenological and the lower left cultural or intersubjective, hermeneutic quadrants respectively. The "It" and "Its" constitute the exterior realm and belong to the upper right objective and lower right interobjective quadrants. The upper left ''I" quadrant consists of "your immediate thoughts, feelings, sensations and so on," while the upper right quadrant is "what any individual event looks like from the outside. This especially includes its physical behaviour; its material components; its matter and energy; and its concrete body-for all those are items that can be referred to in some sort of objective, 3rd-person, or 'it' fashion" (Wilber 20-21) ." It" is made of what subjective awareness reflects itself to objective science, cells, organs and systems. "We" quadrant mirrors the relation between "I" and other "I's", and represents collective consciousness i.e. intersubjective awareness. The "We" quadrant is the cultural dimension,consists of interior awareness and shared group feelings, while "Its" quadrant is the social dimension and studies group behaviour through third person science. We can observe development in each of the four quadrants.

According to Wilber, the emergence of upper left quadrant "I" can be seen in the Great Wisdom Tradition which look at the "I" from inside. Robert Forman places self-awareness in this quadrant as 'knowledge-by-identity and opines that pure consciousness can be known in a non-dual by being it(Forman 5). Wilber tries to refine Great Wisdom Tradition through an integrated framework. Since Individuals are not considered free from their culture in contemplative traditions, Wilber states in this context that, "Integral methodological pluralism can construct the important truths of the contemplative traditions"(Wilber 49).As it is noted by William S. Haney, II that, " these truths encompass the five natural states of consciousness of the wisdom traditions: waking, dreaming, deep sleep, witnessing (turiya state) and nondual (turiyatita).The latter two states are variations on the ordinary states induced by meditations as well as aesthetic experience(rasa), such as that induced by literature. The upper left quadrant "I" has two zones: zone I is the direct, first person immediate experience of consciousness, while zone 2 is a first-person conceptual reflection on that experience". (Haney 3)

When we see Neuromancer in the light of above mentioned views, it seems to warn that as more humans get transformed into cyborgs like Case, Molly and Armitage, it results in having an adverse effect on their social consciousness part leading to loss of contact with zone I of upper left quadrant. We can see that interface between man and machine in the novel only extends the upper left quadrant ''I" as in the case of Case and

Armitage. This enhancement increases their attachment to the material world losing touch with spiritual world. Csicsery-Ronay states the cyberpunk dimension of Neuromancer as "the apotheosis of postmodernism (Csicsery-Ronay193),but it also reflects the apotheosis of post humanism .As William S. Haney observes, "the cyberpunk dimension of Gibson's novel not only relates to the relativity of postmodernism, but also to the inability to have a direct, immediate experience of higher consciousness, which leads Gibson's characters into a world of illusions that block access to pure consciousness.(Haney 5)

Gibson's ambivalent attitude towards technology ceases him to be categorized as full-fledged post humanist theorists like Katherine Hayles and Donna Haraway. Here he also observes the effect of technology on human nature without having concern that computers and artificial intelligences could challenge human cognitive abilities. According to him, it would be done by artificial means without any access to laws of nature. Gibson describes virtual reality that is based on globalized technology. He seems to suggest that this type of technology will not make any advancement in human evolution. As William S. Haney states, " Indeed, the technology in Neuromancer is in constant need of human repair, suggesting that no matter how advanced computers or AI's become, they can never surpass human capabilities." (Haney 5).

We see Gibson blurs the distinction between human and machines only in terms of physical parameters, not in terms of the spiritual experience, a state of pure consciousness or void of thoughts. The 'experience' which is essential characteristic of humanity, is never accessible to computer or AI. Wintermute firmly seeks transcendence, but the novel shows that advanced technology can never transcend computers from one level of physicality to another level which is created by humans. If we carefully analyze the characters of the novel, only Case and Dix show desire for transcendence in zone I of the Wilber's theory .Though they long for transcendence, they cannot, because being partial cyborg they do not have this capability. As William S. Haney comments, "Case lived for the bodiless exultation of cyberspace" (Gibson 6), but even the mind floating through cyberspace remains physical--just as Dix who is disembodied or flatlined and thus also confined to the physical. Even when Case attempts to float his "disembodied consciousness" through cyberspace, we see, his consciousness, infact, refers to his physical mind because it only reflects his physiological state, the qualia of sensations derived from the features of virtual reality. Case, therefore, is hampered by his Russian mycotoxins, which distort his normal physiological functions through neural damage and thereby dull his mind and prevent it from reflecting pure consciousness. Dix, moreover, remains truly disembodied because he is no longer alive except as a ROM construct and as a result has no ability to transcend the mind/body"(Haney 8-9).

Conclusion

Gibson suggests in this novel that as we move towards post human condition, we will degenerate more from the cyborg identity which Case and Molly enjoys, to a full-fledged cyborg like Wintermute .Case and Molly have more or less innate ability to experience a void in thought, but as an artificial intelligence Wintermute does not have the capacity for primary consciousness and access to higher-order consciousness that is a far beyond thing for such an entity. Case could retain his innate capacity for zone I, if he had not involved in matrix to become a part of it. If he had shown a strong protest against the orders of AI Wintermute, he would not be blamed as a destroyer of human race by Michele. Gibson seems to project in the novel that Case cannot be said guilty of his actions but the globalization of genetic engineering and bionic technology is to be blamed for his situation. According to William S. Haney, "Neuromancer suggests that humans who retain a sufficiently healthy physiology will not become like Turing machines but will preserve their capacity for expanding consciousness to higher states" (Haney13). Dix Flatline , a computer construct, is shown to have some sort of consciousness but he is fed up of surviving as a machine any longer. Dix asks Case, "Do me a favour, boy……This scam of yours, when it's over, you erase this goddamm thing" (Gibson 104). He disintegrates as the novel advances and loses most of his memory of past, still has a memory of being a human. The same issues are addressed in 'Snow Crash' through the characters of Ng and Raven. Gibson discards Donna Haraway's claim that "a cyborg world might be about lived social and bodily realities in which people are not afraid of permanently partial identities and contradictory standpoints" (Haraway154).Her viewpoint is totally against the autonomy of human beings. In the cyborg world, partial identities like cyborgs would lose the essence of human nature and it can be said an extreme kind of compromise that is desired from humans in such world where humans are badly undermined. As Gibson tries to present through his novel that humans, apart from the AI and machines must not lose the capacity for making choice that is related to their existence. The same issues are dealt in Snow Crash through the characters of Ng and Raven.

Posthumanists can view Case and Dix similar because in Neuromancer, both are shown as representatives of globalized future of genetic engineering. Dix is no more a mind-body complex, hence cannot embody consciousness. Dix is a computer construct with no will power. His computer memory cannot maintain continuity between different events happened earlier as is shown by a conversation between case and Dix. During the conversation he is not able to recognize Case when Case switches off for a moment. As William S. Haney says, "Gibson, therefore, demonstrates that humanity through a globalized future as cyborgs will become subhuman, incapable of a self-reflexive witnessing quality of consciousness that would allow them to experience zone #1 or an intersubjective presence with another human or cyborg. Humanity, then, will not only lose its human nature by becoming increasingly like machines, but also degenerate into the purely physical dimension of the universe no matter how advanced technology may become"(Haney 9).

References

1. BaudrillardJean."Simulacra and Simulations". Selected Writings.ed. Mark Poster. Stanford: StanfordUP,1988.Print.
2. Csicsery-Ronay Jr., Istvan. "Cyberpunk and Neuromanticism" in Storming the Reality Studio: A Casebook of Cyberpunk and Postmodern Science

Fiction. ed. Larry McCaffery. Durham, NC and London: Duke UP, 1992.Print.
3. Edelman, Gerald M. Wider than the Sky: The Phenomenal Gift of Consciousness. New Haven: Yale UP, 2004.Print.
4. Fagan, John. Genetic Engineering: The Hazards; Vedic Engineering: The Solutions. Fairfield, IA: MIU Press, 1995.Print.
5. Forman, Robert K. C. Mysticism, Mind, Consciousness. New York: SUNY Press, 1999.Print.
6. Gibson, William. Neuromancer. New York: Ace Books, 1984.Print.
7. Hayles, Katherine N. How We Became Posthuman. Chicago and London: U of Chicago P, 1999.Print.
8. HaneyS.William,II. William Gibson's Neuromancer : Cyberpunk and the End of Humanity.Web.(http://findarticles.com)
9. Haraway, Donna. Simians, Cyborgs, and Women: The Reinvention of Nature. London: Free Association Book, 1991.Print.
10. Roberts, Adam. Science Fiction. London and New York: Routledge, 2000.Print.
11. Pepperell, Robert. The Posthuman Condition: Consciousness beyond the Brain. USA: Intellect Books, 2003.Print.
12. Stephenson,Neal. Snow Crash. USA: Bantam Books,1992.Print.
13. Sterling,Bruce. Preface to Mirrorshades: The Cyberpunk Anthology.New York: Ace Books, 1986.Print.
14. Wilber, Ken. Integral Spirituality: A Startling New Role for Religion in the Modern and Postmodern World. Boston and London: Integral Books, 2006.Print.
15. Zachary Reiss-Davis,English 65, The Cyborg Self, Brown University, spring 2005.Web.http://www.cyberartweb.org/cspace/scifi/gibson/zrd2.html
16. http.//project.cyberpunk.ru/idb/scifihtml
17. http://www.cyberartsweb.org/cspace/Essays/Definingcpunk.html
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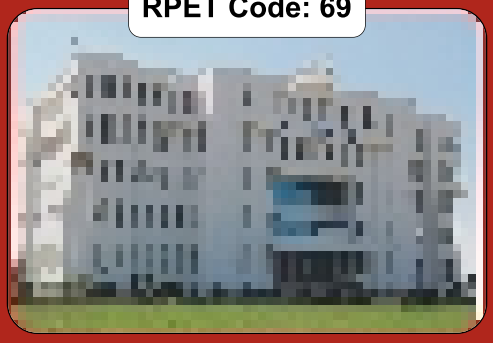

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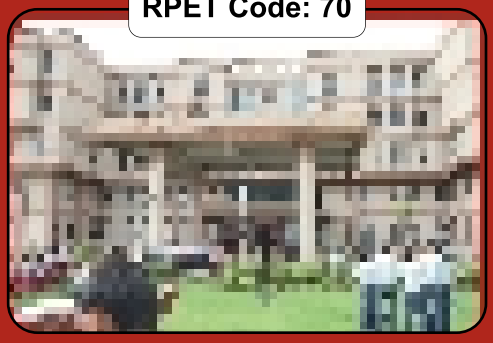

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