ISSN : 2349-8749 Volume 2; Number 1 : 2015

Khoj

An Interdisciplinary Journal of Research

VIVEKANANDA GLOBAL UNIVERSITY, JAIPUR

www.vgu.ac.in, vivekanandajournal@gmail.com

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.

If you think that you are bound, yor remain bound; you make your own bondage. If you know that you are free, you are free this moment. This is knowledge, knowledge of freedom. Freedom is the goal of all nature.

Swami Vivekananda

Khoj

An Interdisciplinary Journal of Research

ISSN : 2349-8749 **Volume 2; Number 1 : 2015**

VIVEKANANDA GLOBAL UNIVERSITY, JAIPUR

www.vgu.ac.in, vivekanandajournal@gmail.com

।। उतिष्ठत् जाग्रत प्राप्य वरान्निबोधत ।।

AIMS & SCOPE

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.

Frequency

Khoj - An Interdisciplinary Journal of Research will be published bi-annually

Number 1 : January - June
Number 2 : July - December

ISSN : 2349-8749

DISCLAIMER

Khoj
An Interdisciplinary Journal of Research

Khoj
An Interdisciplinary Journal of Research

CONTENTS

Challenges in assigning Infrared (IR) Bands to Sandalwood Oil – a Review

BARUN SHANKAR GUPTA

Department of Civil Engineering
Vivekananda Institute of Technology, Jaipur

E-mail : bsbarun@gmail.com

Abstract : For centuries, East Indian sandalwood is being used in human civilization for the strong, persistent, warm odour. East Indian sandalwood (*Santalum album* L.) is a tall evergreen tree that grows wild in India to Malaysia and is also cultivated. East Indian sandalwood is popularly known as Mysore sandalwood. East Indian sandalwood is different from West Indian sandalwood (*Amyris balsamifera*) and Australian sandalwood (*Santalum austrocaledonicum, S. spicatum* and *S. lanceolatum*). Sandalwood oil is used in perfumery because of the excellent smell and fixative properties, i.e., excellent blending with ionones, methylionone and vetiver. Primary constituents of East Indian sandalwood oil are the sesquiterpene alcohols, namely, -santalol and ß-santalol. Almost 90 % of the total alcohols are santalol, around 2-4 % of santalol are present as esters. East Indian sandalwood oil has a specific gravity slightly less than water (0.965-0.980 at 25 ^{o}C) and has a refractive index of 1.5-1.51 at 20 ^{o}C. East Indian sandalwood oil is sparingly soluble in water and insoluble in glycerine. Nearly 46 compounds have been chemically isolated from the East Indian sandalwood oil. The above diversity in chemical characteristics makes it difficult to accurately explain the FTIR spectra of sandalwood oil. The objective of this study is to perform literature review to assign infrared absorbance peaks to possible chemical moieties. Prominent infrared (IR) peaks were observed at 3350 cm^{-1}, 3053 cm^{-1}, 2968 cm^{-1}, 2875 cm^{-1}, 1567 cm^{-1}, 1459 cm^{-1},1374 cm^{-1}, 1003 cm^{-1}, 876 cm^{-1} and 853 cm^{-1} that contain signatures of wood and water along with other chemical groups.

Keywords: FTIR, Sandalwood, Essential oil, Santalol.

Khoj
An Interdisciplinary
Journal of Research
ISSN : 2349-8749
Vol. 2, No. 1
2015
pp. 1-9

Introduction

The East Indian sandalwood (*Santalum album* L.) tree is a mid-sized tree that is well distributed in South-East Asia. The *S. album* occurs naturally in India, Sri Lanka and the Malay Archipelago (Indonesia and surrounding islands). In India, it is found in the drier regions in the south of the country, especially the states of Karnataka and Tamil Nadu, up to 1400 m from mean sea level. Formation of

heartwood, from which the oil is obtained, is said to be best between 600 m and 900 m. Moderate rainfall (850-1200 mm) spread over several months and much sunshine are conducive to good growth. Sandal has become naturalized in parts of Rajasthan, Maharashtra, Madhya Pradesh and Uttar Pradesh and has been introduced into a number of other Indian states. The wood of trees outside their natural range, however, is very variable with respect to oil content and sometimes has little or no aroma. In Indonesia, *S. album* occurs on the neighbouring islands of Timor, Sumba, Flores, Alor and Roti. Other *Santalum* species occurring in Australia (AS 2112:2003) and islands of the Pacific have been, or are, harvested for their fragrant wood, although none (with the possible exceptions of very small quantities of *S. austrocaledonicum* and *S. yasi*) are currently used as sources of internationally traded oil. These include *S. spicatum* and *S.lanceolatum* (Australia), *S. ellipticum* (Hawaii), *S. yasi* (Fiji and Tonga), *S. macgregorii* (Papua New Guinea), *S. austrocaledonicum* (Vanuatu and New Caledonia) and *S. insulare* (French Polynesia)[1].

Sandalwood oil is skin, ocular, mucus membrane irritant and excessive dose may cause depression, nausea, vomiting and diarrhoea[2]. The oil of sandalwood is commonly obtained by steam distillation of chips and billets cut from the heartwood and root after removal of the bark, sapwood [1-2]. The highest yield of oil is obtained from roots (~10%), and lowest yield is obtained in wood chips (~1.5–2%)[3]. The oil content of the heartwood varies from tree to tree and is higher for older trees. In India, yields of about 0.9 percent have been reported from the heartwood of 10-year old trees, while mature trees of 30-50 years age have yielded 4 percent oil. The oil content also varies according to the colour of the heartwood. Light-coloured wood yields 3-6 percent oil, while dark brown wood yields about 2.5 percent oil[1].

The destructive nature of sandalwood oil production, which entails the uprooting of mature trees, has little or no quantitative information available on which to judge the extent to which the pressure on natural resources might have occurred. Sandal trees freely produce seed and natural regeneration occurs both via seedlings and through root suckers which are produced when the tree has been felled and the stump extracted from the ground. The absence of heartwood in young trees provides little reason for felling trees less than 20-25 years old so they are allowed to grow to at least this age. The extent of heartwood formation is at its maximum at around 30-50 years. The greatest threat to Indian sandalwood may be the loss through spike disease rather than oil production. Trees of all ages and sizes are liable to be attacked and, if infected, succumb to the disease within about three years. In Indonesia, continuous harvesting combined with very little regeneration (due to fires, shifting cultivation and uncontrolled cattle grazing) has led to a serious decline in the *S. album* population[1].

The international standard, ISO 3518:2002, for sandalwood oil (*Santalum album* L.) specifies certain characteristics of the oil to facilitate assessment of its quality which stipulates a minimum free alcohols (santalol) content of 90 percent (m/m). Ranges within which various physico-chemical properties must fall are also given. As perfumery oil, the aroma characteristics are all-important and these are judged by the buyer to be acceptable or not for individual consignments [1].

India and Indonesia are the two major producers and exporters of sandalwood oil but reliable production data are not available. Domestic consumption, which is certainly high in India and probably greater than the combined total for the rest of the world, is therefore also difficult to estimate. World production/consumption is probably of the order of several hundreds of tonnes annually[1]. Indian exports have averaged about 40 tonnes / annum on exploitation of wild trees (Table 1). Indonesia is the only other supplier of East Indian-type sandalwood oil with annual exports averaging 15 tonnes. Australian production of oil from *Santalum spicatum* ceased in 1971.

Table 1: Exports of sandalwood oil from India, and destinations (Indian national statistics) [1].

	1987/88	1988/89	1989/90	1990/91	1991/92	1992/93
Total (Tonnes)	39	26	34	37	65	42
Of which to:						
France	11	8	14	10	8	9
USA	10	5	5	6	14	8
Soviet Union	7	2	4	7	2	-
Japan	3	2	2	2	4	2
UK	2	1	2	3	3	3
Switzerland	3	2	2	2	1	2
W. Germany	1	2	1	1	3	1
United Arab Emirates	1	~	2	4	5	3
Singapore	~	~	~	~	21	~

Sandalwood oil is one of the most highly priced items in the essential oil (ISO: TC 54) trade, reflecting the nature of the raw material source and the tightness of supplies. In the late 1980s it was almost US$200/kg. Throughout 1992 the price of oil of Indian origin offered by London dealers was about US$140-150/kg; Indonesian oil was about US$5 lower. In mid-1993 the price of Indian oil rose again to US$180/kg and this was still the price in early 1994[1].

Chemical constituents and properties

East Indian sandalwood oil has a specific gravity slightly less than water 0.965-0.980 at 25 ^{o}C; and has a refractive index of 1.5-1.51 at 20 ^{o}C[2]. East Indian sandalwood oil is sparingly soluble in water and insoluble in glycerine[2]. Nearly 46 compounds, have been chemically isolated from the East Indian sandalwood oil, namely, santalone, 4-methylcuclohexa-1,3-dien-1-yl methyl ketone, 5,6-dimethyl-5-norbornen-exo-2-ol, E-5-(2,3-dimethyl-3-nortricyclyl)pent-3-ene-2-one, 1-furfurylpyrrole, 10 phenols, 17 terpenes, sesquiterpene derivatives, endo-2, endo-3 dimethylnorboran-exo-2-ol and alpha-santenol precursor[2]. The oil of sandalwood

(*Santalum album* L.) has a complex mixture of over 12 mono- and 90 sesquiterpenoids[5,6]. The acidic fractions of sandalwood oil are ß-santalic acid, teresantalic acid, nortricycloekasantalic acid, tricycloekasantalic acid, bicycloekasantalic acid, dihydro- ß- santalic acid (NLM 2014). The pH of sandalwood oil can vary between 0.5-8.0[2].

Sandalwood oil blends with ionones, methylionone and vetiver. The -santalol has the molecular formula of $C_{15}H_{24}O$. The molecular weight of -santalol is 220.3505. The only stereoisomer is (E)- -santalol. The ß-santalol has the molecular formula of $C_{15}H_{24}O$. The molecular weight of ß -santalol is 220.3505. The stereoisomers are (E)- ß –santalol and Epi- ß- santalol. Non volatile compounds 9(*E*)-11-Hydroxy-santalol, (2*S*,7*R*) - 2, 12, 13 – Trihydroxy -10 -campherene, Eugenol 4-*O*-rhamnosyl (1,2) glucoside, 7,8-*erythro*-4,9,9-trihydroxy-3,3-dimethoxy-8.*O*.4-neolignan, (2*S*,4*S*)-hydroxyproline were identified in solvent extracts[7].

Both -santalol and ß-santalol (Figure 1) can be separated by the column chromatography method[2].

Figure 1: -santalol and ß-santalol. : *NIST Chemistry WebBook*, The National Institute of Standards and Technology, U.S.A.

Gas chromatography (GC) and Mass-spectroscopy (MS) are the preferred methods of analysis to determine the -and ▮ -santalol and other sesquiterpene concentrations in essential oils. However, Fourier transform infrared (FTIR) spectroscopy is being increasingly used to assess quality criteria of the sandalwood oil.

FTIR spectroscopy of sandalwood oil extracted by the subcritical CO2 has shown peaks at 3350 cm^{-1}, 3053 cm^{-1}, 2968 cm^{-1}, 2875 cm^{-1}, 1683 cm^{-1}, 1656 cm^{-1}, 1567 cm^{-1}, 1459 cm^{-1}, 1374 cm^{-1}, 1320 cm^{-1}, 1289 cm^{-1}, 1250 cm^{-1}, 1158 cm^{-1}, 1104 cm^{-1}, 1084 cm^{-1}, 1003 cm^{-1}, 949 cm^{-1}, 876 cm^{-1}, 853 cm^{-1} [7]. The objective of this study is to identify the IR absorbance peaks and assign them to chemical moieties of sandalwood oil.

Discussion

The infra-red absorption band in the Fourier transform infrared (FTIR) spectra or vibrational spectra, is represented by its wavenumber ($\bar{\upsilon}$) either in cm^{-1} or in micrometer (m)
$\bar{\upsilon}$= 1 / (in cm)
or, $\bar{\upsilon}$= 10000 / (in m)

Figure 2, Figure 3 and Figure 4 show FTIR spectra of sandalwood oil and santalol.

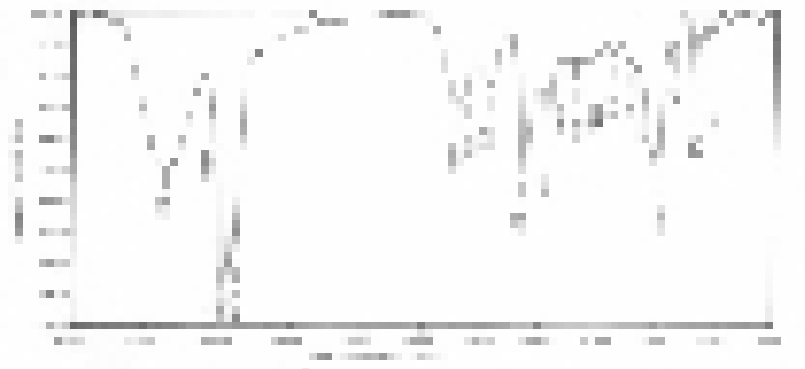


Figure 2: FTIR spectra of sandalwood oil [7].

Figure 3: FTIR spectra of -santalol, NIST Standard Reference Database 69: *NIST Chemistry WebBook*, The National Institute of Standards and Technology, U.S.A.

These spectra contain information of both -santalol and ß-santalol. Moreover, the spectra might have contained information of other volatile contents from wood as impurities. It is known that the wood FTIR spectra show a broad peak at 3350 cm^{-1} region and a cellulose-OH peak at 898 cm^{-1}. Furthermore, N-H stretching frequency of protein amide shows a prominent absorption at 3400 cm^{-1}.
From GC-MS studies, it was observed that the most significant differences between Z- and E-isomers are in the absorption range of 1370-1380 cm^{-1} and 1455-1465 cm^{-}

[18]. At other wavenumbers, the characteristic absorption ranges 1010-1020 cm^{-1} and 3650-3660 cm^{-1} were from primary sesquiterpene alcohols, 1510-1520 cm^{-1} from aromatic sesquiterpenes and 1640-1660 cm^{-1} were from exo-methylenic groups[8].
Figure 3 shows the FTIR spectra for –santalol. Several peaks were assigned for possible chemical bonds in Table 2.

Table 2: Assignment of IR peaks of –santalol.

Broad peak centring 3400 cm^{-1}	Hydrogen bonded OH group, adsorbed moisture
Sharp peak at ~ 3060 cm^{-1}	-
Broad peak centring 2900 cm^{-1}	C-H stretching of CHO
Sharp peak at ~ 1700 cm^{-1}	C=O str of sesquiterpene
Sharp peak at ~ 1460 cm^{-1}	-
Sharp peak at ~ 1380 cm^{-1}	-
Sharp peak at ~ 1320 cm^{-1}	-
Sharp peak at ~ 1290 cm^{-1}	-
Sharp peak at ~ 1260 cm^{-1}	C-O stretch in esters
Sharp peak at ~ 1100 cm^{-1}	2^{o} ROH
Broad peak at ~ 1000 cm^{-1}	-
Sharp peak at ~ 970 cm^{-1}	C-H out of plane bending
Sharp peak at ~ 860 cm^{-1}	-
Sharp peak at ~ 820 cm^{-1}	C-H out of plane bending
Sharp peak at ~ 680 cm^{-1}	C-H out of plane bending

Aldehydes show aldehydic C-H stretching frequency absorption in the 2850-2720 cm^{-1} region as medium intensity bands (two nos.) – due to Fermi resonance between the fundamental aldehydic C-H stretching frequency and first overtone of the aldehydic C-H bending vibration which appears around 1400 cm^{-1}. Only one C-H str band is observed for aldehydes whose C-H bending band is shifted appreciably from 1400 cm^{-1}.
Figure 4 shows the FTIR spectra of ß-santalol. There is a distinct difference in the spectral pattern at around 3300 cm^{-1} between –santalol and ß–santalol.

Figure 4: FTIR spectra of ß-santalol, NIST Standard Reference Database 69: *NIST Chemistry WebBook*, The National Institute of Standards and Technology, U.S.A.

The FTIR spectra of –santalol have a broader IR band than the ß–santalol in 3300 cm^{-1} spectral region. The other differences in absorption are shown in Table 2 and Table 3.

Table 3: Assignment of IR peaks of ß-santalol

Broad peak centring 3320 cm^{-1}	OH vibration, adsorbed water
Sharp peak at ~ 3060 cm^{-1}	-
Double peak centring 2900 cm^{-1}	C-H stretching of CHO groups
Sharp peak at ~ 1730 cm^{-1}	C=O str due to ring stretching in bicyclic system
Sharp peak at ~ 1650 cm^{-1}	C=C str
Sharp peak at ~ 1450 cm^{-1}	-
Sharp peak at ~ 1380 cm^{-1}	-
Sharp peak at ~ 1300 cm^{-1}	-
Sharp peak at ~ 1260 cm^{-1}	C-O str in esters
Sharp peak at ~ 1150 cm^{-1}	3^{o} ROH
Broad peak at ~ 1050 cm^{-1}	1^{o} ROH
Sharp peak at ~ 880 cm^{-1}	-
Sharp peak at ~ 830 cm^{-1}	Tri-substituted alkene
Sharp peak at ~ 650 cm^{-1}	-

Comparison of IR spectra in the near infra-red (NIR) spectral region with the results from Gas chromatography (GC) is a probable way to estimate the accuracy of the FTIR spectra (Figure 5). It is possible to use NIRS to predict -santalol content in sandalwood chip samples[9]. An R^2 (coefficient of determination) of 0.9258 was obtained, meaning that 92.58% of the variance in the reference samples (GC-MS results) can be explained. An RPD (**R**atio of (standard error of) **P**rediction (Validation) to (standard) **D**eviation) of 3.67 indicated that the model prediction would be suitable for process control purposes[9]. The fairly large error (root mean standard error of cross validation RMSECV) of 3.74 % may have resulted from the combined effects of (i) the NIR spectrum was not obtained on the exact sandalwood sample that was tested by the GC-MS reference method and (ii) there was a 12 to 19 month time lapse between the GC-MS and NIR sampling.

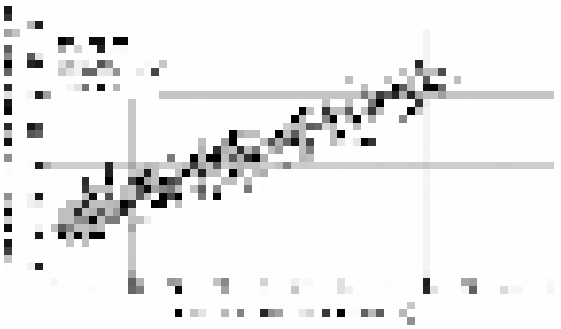


Figure 5: Predicted vs. actual -santalol content for sandalwood chips [9].

This time lapse may have resulted in a decrease in santalol content due to the volatility of the oil in the samples[9].

Conclusion

Sandalwood quality has a wide range of deviation depending upon the geographical regions of growth and the process of production. The market rate for the East Indian sandalwood oil (*Santalum album* L.) is higher than the sandalwood oil produced from other species owing to the presence of fragrant chemical components. FTIR spectra of sandalwood oil can be used for quality assessment of the oil. The wide range of chemical components present in the sandalwood oil makes it difficult to assign a specific fingerprint region. Several bands, namely, 3300 cm^{-1}, 1700 cm^{-1}, 1370-1380 cm^{-1} and 1455-1465 cm^{-1} were found to interesting to differentiate between the types of santalol and E, Z isomers. Infrared (IR) spectra correlates (R^2 = 0.93) well with the findings from Gas chromatography (GC). However, extensive researches are necessary to assign the IR bands at all wavenumbers in the mid-IR region. The volatility of sandalwood oil components is a major concern. A time difference between the oil production and FTIR sampling may result in a loss of volatile components giving errors in IR interpretation.

References

1. F.A.O. 1995. Flavours and fragrances of plant origin, 1 ed. Food and Agriculture Organisation of the United Nations, Rome, Corporate Document Repository.
2. NLM 2014. East Indian sandalwood oil. Hazardous Substances Data Bank (HSDB), National Library of Medicine's TOXNET system, HSN 1926, (RN 8006-87-9) available from: http://toxnet.nlm.nih.gov
3. Daramwar, P.P., Srivastava, P.L., Priyadarshini, B., Thulasiram, H.V. 2012. Preparative separation of a- and b-santelenes and (Z)- a- and (Z)-b-santalols using silver nitrate-impregnated silica gel medium pressure liquid chromatography and analysis of sandalwood oil. Analyst, 137, 4564-4570
4. Burdock, G.A. Carabin, L.G. 2008. Food. Chem. Toxicol., 46, 421-432
5. Baldovini, N., Delasalle, C., Joulain, D. 2011. Flavour Fragrance Journal, 26, 7-26
6. Kim, T.H., Ito, H., Hatano, T., Hasegawa, T., Akiba, A., Machiguchi, T., Yoshida, T. 2005. Journal of Natural Products, 68, 1805-1808
7. Nautiyal, O.M. 2011. Analytical and Fourier transform infra red spectroscopy evaluation of sandalwood oil extracted with various process techniques. Journal of Natural Products, 4, 150-157

8. Nikiforov, A., Jirovetz, L., Buchbauer, G., Raverdino, V. 2008. GC-FTIR and GC-MS in odour analysis of essential oils. Mikrochimica Acta, II, 193-198
9. Wedding, B. B., White, R. D., Grauf, S., Tilse, B., Gadek, P. A. Near infrared spectroscopy as a rapid method for sandalwood oil determination. Sandalwood Research Newsletter September[23], 5-7. 2008. James Cook University, PO Box 6811,Cairns, 4870 Australia.

Power Sector Reforms in India and an Implementation of Power Sector Restructuring Programme in Rajasthan

S. K. KHATRY[1] AND R. K. JAIN[2]

[1]Rajasthan Rajya Vidyut Prasaran Nigam Limted, Jaipur
[2]Department of Management Studies, Vardhman Mahaveer Open University, Kota, Rajasthan

E-mail:-skkhatry@gmail.com

Abstract : This paper focuses on the Power Sector reforms in India and an implementation of Power Sector Restructuring Programme in Rajasthan. The past two decade has been a tumultuous one for the Indian electricity sector. The winds of change that have swept electricity sectors worldwide have also buffeted Indian shores, bringing the promise of an entirely new framework and approach for electricity, but also considerable uncertainty and few short-term result. In India as well as in Rajasthan, the challenge has been to implement the sweeping changes introduced by the new Act through policies and regulations.

Key words : Electricity Act-2003, CEA, Regulatory Commissions (CERC, SERCs), Transmission Utilities (CTUs, STUs), Generation Utilities (CGUs, SGUs), DISCOMS, States Electricity Utilities (SEBs), Independent Power Producers (IPPs), Transmission and Distribution (T&D) etc.

Khoj
An Interdisciplinary Journal of Research
ISSN : 2349-8749
Vol. 2, No. 1
2015
pp. 10-16

Introduction

The Indian constitution has included power in concurrent list, which means both the centre and state share the responsibility for this sector. Article 246 of the constitution vests the parliament as well as the state legislature with the power to frame laws. The Electricity Supplies Act 1948 was amended in 1991 to permit private sector participation in generation. Many Independent Power Producers (IPPs) came with their proposals but very few could get the financial closure and commissioning of power plants in 10 years. The most important factor was that most of the state electricity boards were fast moving towards bankruptcy. The reforms carried out in 1991 in the area of power generation made us realize that reform has to begin from distribution end for sustainable development of power. The process of distribution reform started with the enactment of regulatory Act. In

1998 to minimize the political interference in power sector and rationalize the tariff. In pursuance to reforms, states started unbundling the vertically integrated structure of state electricity boards (SEBs) into three separate corporate identities of Generation, Transmission and Distribution as a precursor to the participation of private sector in distribution.[1,2]

Learning from the experience, the main metric for choosing companies was not based on valuation, but on performance improvement goals. In order to promote competition in the electric power sector, the Electricity Act 2003 (E. Act) mandates open access to the transmission and distribution network for any supplier of electricity. Successful implementation of structural reform requires both the hardware of technological advances in the power system and the software of workable contractual relationships. Utilities need to make efforts to identify such links / areas of high losses; there is still significant uncertainty and differences over the real level of total as well as Transmission losses. Even more than ten years after the establishment of the SERCs and the reforms process, there is still ambiguity over the real level of T&D losses.

The past two decades has been a tumultuous one for the Indian electricity sector. The winds of change that have swept electricity sectors worldwide have also buffeted Indian shores, bringing the promise of an entirely new framework and approach for electricity, but also considerable uncertainty and few short-term result.

The short history is quickly told. The introduction of private players in electricity generation, in 1991, marked the first departure from state-owned and controlled electricity. In the second half of the 1990s, numerous states began a more fundamental reform that involved dismantling SEBs, "unbundling" them, and in two cases so far, privatizing portions of the former SEB. Critically, during this period state and central electricity regulatory agencies were set up in order to pass control over decision-making to regulators intended to be independent from political, commercial and consumer interests. Following three years of debate, the national Electricity Act, 2003 was passed, enshrining these various changes in a law, and providing a skeletal framework for further reforms that provided for, but only partially mandated, a shift toward an electricity sector increasingly organized around the private sector and competition. Since 2003, the challenge has been to implement the sweeping changes introduced by the act through policies and regulations.

The Concept of Reforms

Reform is a word of recent origin, a phenomenon of the 1980's. There have been instances of changing borders between the state and market but the range, urgency, thrust and ideological fervor of the change from public to private has merited the title of Privatization.

The package of reforms, variously termed privatization, deregulation and liberalization, that has been applied to electricity industries worldwide in the past 10-15 years contains at least five elements most of which are interdependent. The main elements are:

- **Privatization**

- **Wholesale competition**
- **Retail competition**
- **Unbundling and**
- **Independent regulation**

2.0 Background of the Study

In recent years, many studies have found than many countries adopted a development model in which 'command economy' or state playing a prominent role as owner, policy maker and regulator to produce, deliver goods and services was an important characteristics (Spulber 1997[3], World Development Report, 1997). State-owned enterprises or subsidized private firms have failed to deliver sustainable productivity growth (Broadman and Vining 1989[4]; Boubakri and Cosset 1998; Earle and Estrain 1998; Ehrlich and others 1994; Frydman and others 1999a; Magginson Nash and Van Randenborgh 1994; Pohl and others 1997)[2,4-9]. With the state assuming the catalytic role of development in most of the developing countries, bureaucracy - the instrument of state action - exercised enormous power and came to be associated with inefficiency and corruption (Ghuman 2001 : Klitgaard 2000; Jain 2000; Hussain 1990; Maheshwary 2000, Sangita 1995)[10-15]. Service delivery by State has not been satisfactory in many cases (Punyaratabandhu-Bhakdi et. al. 1986; Paul 1995)[16]. As a result, the recent times have been witnessing a debate on 'government failure' and 'crisis in power sector.' These theoretical recommendations are being applied in action worldwide through the initiation of reforms in the form of privatization, downsizing the government structure, contracting out, public-private partnerships, deregulation, de-bureaucratization, independent regulation and so on. With this changing idea of public private intervention in economic activity many reforms have been initiated redefining the role of the state and market with an objective of achieving expected outcomes.

Power sector involves complex activities like generation, transmission, distribution and final delivery of service to end users i.e. consumers. Initially, private sector was the main player in the power sector when the electricity came to be used in India during the pre-independence period. Thereafter, from independence to the year of 1991, state entered the arena and now there is a U-turn with the initiation of pro-privatization reforms since, 1991. Power sector, an important segment of the infrastructure has been subjected to comprehensive reform programme in recent years. Researcher find two types of processes functioning in two different points of time - pre reform and post reform, During pre reform period, Governance process in which state was the dominant actor and then comes another process after reforms in which market dominates. What policies are to be framed and what institutions are to be created to execute the set policies is still the subject matter of contestation. Whether this question can be addressed through the state marked synergy or state being given an important role or market being allowed an upper hand in the sector or adopting any other strategy is undecided. Which institution can best address the question of equitable distribution of goods and services in the society and the question of efficiency of the utility has become a subject matter of concern for policy makers and researchers.

Problems in the Power Sector

The power sector activities like generation, transmission and distribution of electricity in India are being carried out by the public sector organizations namely State Electricity Boards (barring a few metropolitan areas and in some states where the distribution business has been initiate to privatise) and these organizations are financially non-viable. During 1980s the SEBs started facing problems of poor technical, commercial and managerial efficiency (Report on India's Power Sector 2003)[17]. Problems relating to SEBs were their poor financial health, huge Transmission & Distribution (T&D) losses, political interference, inadequate billing, poor collection, huge theft, lack of proper management, lack of commercial orientation on the part of the SEB employees (Reports on India's Power Sector 2003)[17]. The consumers of electricity also faced a lot of problems in terms of high frequency of power cuts, low & fluctuating voltage and lack of responsiveness of service providers, inadequate grievance redressal mechanism, and speed money (Paul 1995; Balakrishnan et al 1998)[1, 18]. The SEBs failed to pay the bills for the electricity they purchased from the power generators. According to Expert Group 2003, the dues of SEB accumulated to Rs. 41.473 crore of credit consisting of Rs. 25.727 crore of principal and Rs. 15,746 crore of interest (Reports on India's Power Sector 2003)[17]. There was a huge gap between availability and demand of electricity. The total energy shortage during 2001-02 was 39,816 million units amounting to 7.8 per cent and peak shortage was 10,157 MW translating to 13 per cent of peak demand (Reports on India's Power Sector 2003)[17].

So far as the rural electrification is concerned a lot has to be done. Forty two per cent in Utter Pradesh, 53 per cent in Bihar, 78 per cent in Jharkhand, 50 per cent in Meghalaya and 23 per cent in Assam has to be electrified. The household electrification is dismal. Only 43.5 per cent of households in India have got electricity connections. Thus, substantial percentage which is 56.5 of the household in India has no accesses to electricity (www.indiastat.com)

Rajasthan Power Sector

In accordance with the provisions of Electricity Supply Act 1948, the Rajasthan State Electricity Board (RSEB) was formed in 1957, which became the only institution for carrying out three major activities such as generation, transmission and distribution of electricity in the state. The state government of Rajasthan served the financial requirements of RSEB for all these activities. However, in early 1990s the state government was in a poor financial condition (Annual Reports 1990-99). The revenue deficit of government of Rajasthan (GoR) stood at 11.3 billion rupees (losses) in the year 1999-2000 as against a surplus of 927.2 million rupees in the year 1984-85. The state domestic product was second lowest and 48.56 per cent of the population was living below the poverty line during early 1990s. Therefore, the government of Rajasthan could not make budgetary allocations for the state's power sector as per the requirement. This affected the power sector activities in the state.

The installed generation capacity of the state was 1632 MW in the year 1991-92 which was inadequate for catering to the need of the demand in the state. The state's

peak deficit was 23.9 per cent and an energy deficit of 7 per cent (Planning Commission 2001). At the national level the deficit was 18.8 per cent and 7.8 per cent in respect of peak and energy respectively (Ramanathan and Hasen 2005)[19]. The gap between the average cost of supply and average tariff was increasing in the state. It increased from 8 paise in 1989/90 to 1991-92 to 18 paise. The RSEB was overstaffed which is evident from the fact that in Rajasthan the number of employees per million units of energy sold was 6.2 as compared to the national average of 4.5 (Annual Reports, RSEB).

In order to address these problems in the sector, as in different countries of the world, a series of reform have been initiated in the power sector in India. These include competition through private sector participation, unbundling of the SEBs, corporation and independent regulation through regulatory commission.

The Reform Process

The Power Sector Development Policy of the Government of Rajasthan states, one of the pioneers among the states in India, the government has embarked on a radical programme of reform to address the fundamental issues underlying poor performance. GoR decided to restructure the state power sector and substantially privatize the power sector in Rajasthan to make supply more efficient and to be able to meet the investment needs of the sector. The government's ultimate objective is to provide an appropriate policy environment for growth of power sector and withdraw from it as an operator of facilities, having instead privately managed utilities operating where feasible in a competitive environment under an appropriate regulated power market. Power sector industry and market structure being established under the reform programme have been defined so as to facilitate the realization of this ultimate objective. Significant private sector participation is has to be achieved during the implementation of bank loan (World Bank, 1999) which we are seeking to support out power sector reform programme" (Government of Rajasthan).

Rajasthan introduce reforms in its power sector since 2000. The important components of reforms in power sector includes the unbundling of RSEB by structural separation and corporatization of generation, transmission and distribution, establishment of Rajasthan Electricity Regulatory Commission (RERC) for power sector regulation and the protection of the interest of the consumers and the privatization of distribution business of electricity by three companies like **Jaipur Vidyut Vitaran Nigam Limited (JVVNL) Ajmer Vidyut Vitaran Nigam Limited (AVVNL) and Jodhpur Vidyut Vitaran Nigam (JdVVNL)** through the passage of the Rajasthan Electricity Reform Act, 1998 coming into force on 1st June, 1999 (Report of the Committee on Power Sector of Rajasthan 2001)[20]. The other components of reform in the sector which provides an opportunity for the participation of the consumers in the decision making as well as in the service delivery process include the constitution of the State Advisory Committees (SAC), District Level Electricity Committees.

Conclusions and Results

In brief, the aim of Power Sector Reforms/Restructuring Programme in Rajasthan was to bring economy and efficiency in the power sector, to bring accountability on the part of the service providers, to attract private sector investment, to establish an independent transparent regulatory regime. Besides these objectives, providing reliable, adequate and qualitative service to the consumers as well as protecting their interest through an effective grievance reddressal mechanism has been important objective of the reforms of the power sector.

On 19th July 2000, Government of Rajasthan has successfully implemented important component of 'Rajasthan Power Sector Restructuring Programme' with the financial assistance by World Bank (i.e. unbundling of Rajasthan State Electricity Board in five Power Sector Companies). The unbundling of RSEB by structural separation and corporatization of generation, transmission and distribution, establishment of Rajasthan Electricity Regulatory Commission (RERC) for power sector regulation and the protection of the interest of the consumers and the privatization of distribution business of electricity by three companies like **Jaipur Vidyut Vitaran Nigam Limited (JVVNL) Ajmer Vidyut Vitaran Nigam Limited (AVVNL) and Jodhpur Vidyut Vitaran Nigam (JdVVNL)** through the passage of the Rajasthan Electricity Reform Act, 1998 coming into force on 1st June, 1999 (Report of the Committee on Power Sector of Rajasthan 2001). The other components of reform in the sector which provides an opportunity for the participation of the consumers in the decision making as well as in the service delivery process include the constitution of the State Advisory Committees (SAC), District Level Electricity Committees.

References

1. Balakrishnan Suresh and Sitasekhar (1998), Public Services and the Urban Poor in Mumbai, A Report Card, Public Affairs Centre, Bangalore, pp. 29-31.
2. Boubakri. Narjess, and Jean-Claude Cosset (1998), "The Financial and Operating Performance of Newly Privatized Firms." *Journal of Finance* 53: pp. 1081 -1110.
3. Spulber, Nicholas (1997), Redefining the State: Privatisation and Welfare Reform in Industrial and Transitional Economies, Cambridge University Press, UK.
4. Broadman, Anthony E., and Aidan R.Vining (l989),"Ownership and Performance in Competitive Environment: A Comparison of the Performance of Private, Mixed, and State-Owned Enterprises." *Journal of Law and Economics* 32: pp. 1-33.
5. Earle, John S., and Saul Estrain (1998), Privatisation, Competition, and Budget Constraints: Disciplining Enterprises in Russia, *Working Paper* 128. Stockholm Institute of Transition Economics, Stockholm.
6. Ehrlich, Isaac George Gallais-Hamonno. Zhiqiang Liu, and Randall Lutter (1994), "Productivity Growth and Firm Ownership: An Empirical Investigation." *Journal of Political Economy* 102: pp. 1006-1038.
7. Frydman, Roman, Cheryl Gray, Marek Hessel, and Andrej Rapaczynski (1999a), The Limits of Discipline: Ownership and Hard Budget Constraints in the Transition Economics, Transition Economics Series 5. Vienn: Institute for Advanced Studies.
8. Megginson, William L., Robert C. Nash, and Matthias Van Randenborgh (1994), 'The Financial and Operating Performance of Newly Privatized Firms: An International Empirical Performance Analysis." *Journal of Finance* 4992): pp.403-52.
9. Pohl, Gerhard, Robert E. Anderson, Stijn Claessens, and Simeon Djankov (1997), "Privatization and Restructuring in Central and Eastern Europe: Evidence and Policy Options." *Technical paper 368.* World Bank, Washington, D.C.

10.Ghuman, B. S (2001), "New Public Management: Theory and Practice", *Indian Journal of Public Administration,* Vol. XLVII, (4) pp. 769-779.
11.Klitgaard, Robert (2000), Corrupt Cities: A Practical Guide to Cure and Prevention, ICS Press, California.
12.Jain, R.B. (2000), "Bureaucracies in the Third World: A Comparative Analysis" in R.D. Sharma, (ed.), Administrative Systems in Developing Societies, Mittal Publications, New Delhi.
13.Hussairn, Atlas Syed (1990), Corruption, its nature, causes and functions, Gower Publishing Company, New Delhi.
14.Maheshwari, S. R. (2000), "Major Issues and Challenges of Public Administration in the Third World - An Overview" in R.D. Sharma, (ed) Administrative Systems of Developing Societies, Mittal Publications, New Delhi.
15.Sangita, S.N. (1995), "Institutional Arrangements for Controlling Corruption in Public Life: Karnataka Experience", *Indian Journal of Public Administration ,* 41 (I), January-March
16.Punyaratabandhu, Bhakdi Suchitra, Purachi Piumsomban.Voradej Chandrasoran,Soonthem Kerdkaew, Piasan Suriyamongkol and Kusumal Devahastin (1986), Delivery of Public Services in Asian Countries: cases in Development Administration, Thamassat University Press, Bangkok, Thailand.
17.Reports on India's Power Sector (2003), Academic Foundation, New Delhi.
18.Paul, Samuel (1995), A Report Card on Public Services in Three Indian Cities: A View from below, Public Affair Centre, Bangalore, pp.2-5.
19.Ramanathan, K. and Shahid Hasan (2005), Privatisation of electricity distribution the Orissa Experience, TERI Press, New Delhi.
20.Report of the Committee on Power Sector in Rajasthan (2001), Government of Rajasthan, Jaipur

Websites

http://www.indiastat.com
http://cea.nic.in/
http://www.cercind.org/
http://www.rvpn.co.in/
http://www.avvnl.com/
http://www.jaipurdiscom.in/
http://www.jdvvnl.com/
http://www.rajenergy.com/
http://www.rajsldc.co.in/
http://powermin.gov.in/
http://www.worldbank.org/

Acts

Electricity Supplies Act-1948, Government of India
Electricity Act-2003, Government of India

Corporate Governance – Indian Perspective

Dr. PRAVEEN CHOUDHRY

Department of Management Studies
Vivekananda Global University, Jaipur

E- mail: registrar@vgu.ac.in

Executive Summary
The worldwide awareness of the concept of corporate governance grew faster as a topic of systematic study after the publication of Sir Adrian Cadbury Report. The shift from maximization of shareholder's value to maximizing the stakeholder's value including environment as stake holder, inter alia, has influenced the practices in different countries resulting differences in **corporate governance mechanisms among countries**. The governance mechanism of each country is shaped by its political, economic and social history as also by its legal framework. Despite the differences in shareholder philosophies across countries, good governance mechanisms felt to be encouraged among all corporate and non-corporate entities. While multilateral organisations like the World Bank and the Asian Development Bank have evinced keen interest in the subject of corporate governance an effective lead has been given by the OECD in evolving a set of cogent principles of corporate governance which are internationally recognised to serve as good benchmarks.

*"**Corporate governance** is the set of processes, customs, policies, laws, and institutions affecting the way a corporation (or company) is directed, administered or controlled. Corporate governance also includes the relationships among the many stakeholders involved and the goals for which the corporation is governed. The principal stakeholders are the shareholders, management, and the board of directors. Other stakeholders include employees, customers, creditors, suppliers, regulators, and the community at large."*
The simplest and most common definition of corporate governance is that provided by the Cadbury Report (U.K.), which is frequently quoted or paraphrased: "Corporate governance is the system by which businesses are directed and controlled."

Corporate governance is a multi-faceted subject. An important theme of corporate governance is to ensure the accountability of certain individuals in an organization through mechanisms that try to reduce or eliminate the principal-agent problem. A related but separate thread of discussions focuses on the impact of a corporate governance system in economic efficiency, with a strong emphasis on shareholders'

Khoj
An Interdisciplinary
Journal of Research
ISSN : 2349-8749
Vol. 2, No. 1
2015
pp. 17-24

welfare. There are yet other aspects to the corporate governance subject, such as the stakeholder view and the corporate governance models around the world.

There has been renewed interest in the corporate governance practices of modern corporations since 2001, particularly due to the high-profile collapses of a number of large U.S. firms such as Enron Corporation and MCI Inc. (formerly WorldCom). In 2002, the U.S. federal government passed the Sarbanes-Oxley Act, intending to restore public confidence in corporate governance.
There have also been some welcome initiatives by the stock exchanges in the UK and the US in prescribing good governance practices to their listed companies. These initiatives have been especially in the area of audit committee of the board and appointment of truly independent directors to tone up the quality of board deliberations and performance. Advisory board has also developed a model for India to follow in order to further the development of the practices.

Globally, the process of convergence in corporate governance is gathering momentum due to growing international integration of financial and product markets. Foreign investors and creditors are more comfortable in dealing with economic entities that adopt transparent and globally acceptable accounting and governance standards. Companies that embrace high disclosure and governance standards invariably command better premium in the market and are thus able to raise capital at lower costs. The predominant form of corporate governance in India is much closer to the East Asian 'insider' model where the promoters dominate governance in every possible way. Indian corporates, which reflect the pure 'outsider' model with widely dispersed shareholdings and professional management control, are relatively small in number. A distinguishing feature of the Indian Diaspora is the implicit acceptance that corporate entities belong to the 'founding families' though they are not necessarily considered to be their private properties. Even today, the concept of industrial house popularised some time ago by the Dutt Committee and the MRTP Act continues to be the commonly accepted reference points in most of the discussions on ownership patterns of industrial/business units.

Introduction

Corporate governance is one of the most talked about topic in business as also in society today. It is the general set of customs, regulation habits and laws that determine to what end a firm should be run. Corporate governance represents the value framework, the ethial framework and the moral framework under which business decisions are taken. In simple words, when investments take place, within or across national borders, the investors want to be sure that not only is their capital handled effectively and adds to the creation of wealth but the business decisions are also taken in a manner which is not illegal or involving moral hazards.
Issues of Corporate governance have been hotly debated in the United States and Europe over the last about 2 decades. In India, these issues have come to the force only early 90s. In the Indian context, the need for Corporate governance has been highlighted because of the corporate scams occurring frequently since the

emergence of the concept of liberalisation in 1991 e.g. Harshad Mehta scam, Ketan Parikh seam, UTI Scam, CR Bhansali scam, vanishing companies etc. The stock market scandals post liberalization in 1991, most of which were linked to insider trading; stock market frauds; preference shares allotment to promoters and highly discounted price; and several vanishing companies emphasized the urgent need of a serious discussion on corporate governance in India.

Since the first report of Sir Adrian Cadbury on the governance of corporation there is visible development in the concept, approach, direction and application of the relevant theories and perspectives. Do corporations have a responsibility to individuals or groups beyond their stock holders? Corporate social responsibility is the concept that corporation should go beyond the minimum service to its stock holders and include the interest of its other stakeholders, the community and the environment. The concept of social responsibility is culturally dependent and is significantly rooted in the culture in which the corporation exists.

The extent of the responsibility of corporations to its stake holders has been debated since the 1970s in different ways depending upon the social conditions and sensitivities at the time. In general, for a given corporation there is no agreement as to who the stake holders are and the extent to which the corporation has a sense of duty to these stake holders. The concept of stake holders generally includes the share holders, the triad of employees, community and customer and can also include suppliers, regulators and other special interest groups.

The extent to which corporations accept social responsibility depends largely on the culture in which the corporation exits. In a western culture, identified by individualistic perspective and free market economy, perspective on corporate social responsibility exits on a philosophically based bi-polar continuum between a weak and strong sense of social responsibility beyond the corporate share holders.

In the corporate dyad of weak – strong sense of social responsibility, the classical perspective represents the extreme perspective on the weak side where the sole responsibility of the corporation is the interest of the stock holders.

Milton Friedman (1970) introduced the concept of corporate responsibility which is known as the Classical View of corporate responsibility. He posed that in a free market, private property system, the purpose of the corporation is to make money for the stock holders and the corporate executive works as an agent of the stock holders. Since any additional cost expended in programs benefiting others outside the corporation, would come from a reduction in stock- holders profit, increased prices to the customers or reduced wages to the employees, those expenditures are not fair to the corporate stock holders. Thus ‘social’ objectives should be instituted by the government and paid for in part through taxes on the profits of the corporations. The responsibility of the corporation is therefore to make profits in order to be a good corporate citizen, and through the taxes on its profits, to fuel the social vehicle which provide services to the community. According to this perspective, the managers’ personal responsibility is realized outside of the corporate structure, for within the structure the manager is an agent of the stock holders and is responsible only for maximizing their profits.

This perspective, according the Friedman, is further legitimized by the assumption that politicians are elected to their positions in order to serve their constituents, where corporate boards are appointed & have the responsibility for acting as agents to those individuals who appointed them - the share holders. How could the corporate executives be expected to fairly address social issues if they are not ultimately responsible to the general public, but act as agents for the share holders.

Neo – Classical View

The NEO classical view of corporate responsibility is generally a restatement of the Classical perspective with a further development of two important concepts as suggested by Norman Bowie in 1991. The concept of a moral minimum is developed, wherein the corporation shall not cause avoidable harm, honor the individual stakeholder's rights and adhere to ordinary canons of justice. Additionally, the corporation has the duties of a citizen - to abide by the laws of land and rules of common morality. Thus, the corporation has an implied "Social Contract" with society to live according to these laws and moral duties.

The weak social perspective is based upon the concept that "……corporations do not have an obligation to solve social problems". Indeed it is arguable that corporations could solve social problems even if it sensed the need to do so. However, based upon sensed duties of gratitude, citizenship and the responsible use of power, corporations should have:

1. A duty to contribute to the solution of social problems beyond simply contributing taxes to cover their obligations,
2. a responsibility as a citizen of the community, and
3. a responsibility for the stewardship of the power and resources that it has been granted.

Bowie (1991) asks whether profit should be a goal for the corporation or simply the by-product of an effective corporation as it meets its other goals. The underlying question is whether the corporations like individuals, have a desire or need to be virtuous. McIntire (1981) poses that virtue overcomes corrupting power internal to and external to the corporation. If the corporation has a virtuous focus, the perspective of fairness and representation of all groups are encouraged and defended. C.S. stone (1975) describes this and as "virtuous deliberation" and a mark of a mature corporation. Other embodiments of a virtuous corporation would be restrained action until all of the ramifications of the action have been fully explored, action with consciousness of the ramifications of the action and being able to justify all of the action that the corporation takes in a social context.

As stated earlier, corporate social responsibility is related to ethical corporate governance. Having a reputation of trustworthiness in polices and practices, sincere commitment and sense of justice and truthfulness are indicators of corporate social responsibility or "corporate character". These attitudes are embodied in organization's goals, strategies and activities.

Some Researches

Kenneth A. Kim, John R. Nofsinger "Corporate Governance"

Kenneth and John in their study on Corporate Governance talk of the emergent evolution of the traditional forms of Corporate governance as a consequence of low investor confidence, spread of mistrust in the market, calls for regulatory reforms and Corporate governance improvements consequent to the shocking corporate scandals of the 1990s in the world corporate history. They suggest that there are various mechanisms through which corporations can be effectively monitored in the present day scenario and discuss these mechanisms holistically such as that of the empowered and strategic role of the executive incentives, accountants and auditors, the Board of Directors, investment banks and securities analysts, creditors and credit rating agencies, share holders and share holder activism, new governance rules and corporate citizenship .

P. V. Sarma, S. Rajani

In their book titled "Corporate Governance: Contemporary Issues and Challenges" state the fact that although over the last few years a series of regulatory and legal reforms have transformed the Indian Corporate governance framework and improved the levels of accountability & responsibility of insiders, fairness in the treatment of minority share holders, Board practices and transparency; but still there remains a lot to be done in the direction by way of contemplating upon the various challenges and unleashing the opportunities in the field that are ahead.

Baxi CV:

In his research he has identified pertinent issues of corporate governance such as: accountability issues; performance evaluation mechanisms, the structure of the Board of the corporations etc., and examined them critically with respect to Board objectives and strategies, Board compositions, training & development requirements of the Directors etc.

Scott C Newquest, Max B. Rusell

In their publication titled "Corporate Governance Putting Investors First" they have provided a critique of the American system of corporate governance which they suggest is facing one of the greatest challenges in history. They have discussed the evolution and practice of the concept of corporate governance in the American markets and the already initiated steps in the direction of effective corporate governance such as: the recent regulations, legislations, equipping of the financial markets and the public sector. They have suggested that for the betterment of corporate America, a judicious mix of good managers and owners need to work together to work together to restore the integrity of the system. They have also stressed upon the need to improve the practices of corporate citizenship, separation of ownership from management, return to a long term focus, provision of tax incentives, bringing back dividends etc.

Richard Smerdon

He, in his study on corporate governance, has provided critique of the practices related to corporate governance followed in the UK corporate environment. He has discussed the background of the major corporate scandals in the UK markets and the evolution of the contemporary UK corporate governance model. He has also discussed the regulatory régime, structure of the Board like Non Executive Director, Chairman, Company Secretary etc., the sermons of the Board meetings, financial reporting and internal control, auditor and audit function, communication with share holders', corporate social responsibility etc.

Indian Heritage & Corporate Governance

Good governance has been the hallmark of Indian society, polity and economy since times immemorial. India had a very rich culture of good governance much of which has been forgotten by Indians now. The very fact that Lord Rama ordered for Agni Pariksha of Setaji due to public's demand bears testimony to the system of governance in traditional Indian Society.

The Rigveda, the oldest book on record in the world, first coined the term as 'Harmony'. The common corporate goal was "Prosperity to all." According to the narration given in *Rigveda* "Corporates should work like a honeybee, which takes the nectar of a flower without the flower losing its shape and fragrance and provided honey for the well being of the society".

In the traditional Indian society, the King was always considered to be the representative of the people. The wealth of the state was not the personal wealth of the king. The principle of trusteeship is the backbone of corporate management.

Some of the "Jeevan Mulyas" of traditional Indian Society speak volumes of the system of governance in India and a few of which are listed below:

"Atma Neyantrit Samaj" - or the society which was regulated by self and no external pressures were needed.

"Bahujan Hitaya" – was the concept of public good in all your deeds.

Creation of wealth through competence and productivity.

Dharm Yudh- fights for righteousness.

Trusteeship – The owner of wealth does not have any attachment with the wealth as he knows he was only a trustee.

"Paropkaar" - The concept of ploughing back a part of what one earns.

Kautilya's Approach To Corporate Governance

More evidence of good corporate governance is also available from the treatise of Kautilya (also known as Chanakya) titled 'Arth Shastra' which was written in 1st century AD. In this treatise the following concepts reflect on corporate governance:

1. Production - to obtain what is not (available)
2. Protection - to protect what is there - conservation of existing resources.
3. Growth - to add to what is protected. It never meant to destroy the existing for growth.
4. Distribution - to distribute what is added. Not to be kept by the producer.

List Of Corporate Governance Initiatives In India

Rahul Bajaj Committee by CII in 1996
N. Vittal Committee (Code for Public Sector Enterprises) 1997
Kumar Mangalam Birla Committee (SEB1) 2000
Advisory group of RBI
Naresh Chandra Committee.
Narayan Murty Committee.
Amendments in Companies Act 1956.
Clauses 49 of listing agreement of SEBI
National Foundation for Corporate Governance
J. J. Irani Committee.
Corporate Governance Ratings.

Conclusion

There are more than 200 written corporate governance codes across the world, despite that the issue of governance of the corporations are of prime importance to researchers from all economics - developing to developed alike. There is also a need to explore the truth behind the effectiveness of the application part of the corporate governance issues. Governance models should be so designed as to ensure good governance.

All researches in the field of corporate governance have been focused on area specific e.g. legal, regulatory, compliance, audit committee, independent directors etc. indicating a gap in the comprehensiveness of approach. Hence studies should be conducted and models should be prepared to ensure effectiveness of corporate governance practices.

Bibliography

- BOWIE, Norman E (1991): New Directions in corporate social responsibility. Business horizon 34, July/Aug 1991
- Milton Friedman (1970): The Social responsibility of business is to increase its profit. New York Times magazine Sept 13,1970
- MacIntire A (1985) After Virtue. London England Duckworth Press.
- Sethi, S Prakash (2003), globalization and the good corporation: a need for proactive co-existence. Journal of Business Ethics 43, 21-31.
- Kushwaha S. K. (2008) Mapping the efficiency: Global practices in corporate governance: 6th AIMS International Conference proceeding Dec 2008.
- Pandey T. N. "Ethics in corporate governance" Chartered Secretary, January 2004.
- Kale Y. M. "Corporate Governance- International and Indian Practices" The Chartered Accountant May 2005
- Rahul Bajaj, Corporate Governance, The Chartered Accountant, Journal of Institute of Chartered Accountant of India, Vol.58, July 2009, p.44
- ICSI National Award for Excellence in Corporate Governance, New Delhi, 2003

Choudhry P

- The Institute of Company Secretaries of India, New Delhi, 'Corporate Governance' (Modules of Best Practices), 2004 December
- Emerging Role of CEO's- Corporate Governance & Accounting Standards, discussion paper of FICCI.

Goli Vada- Pav: A Case Study of an Ethnic Fast Food Chain its Production And Branding Strategies

Dr. SWATI MISHRA[1], Dr. ABHISHEK MISHRA[2], Dr. NITASHA KHATRI[3]

[1]International School Of Business Management, Suresh Gyan Vihar University, Jaipur.
[2]Director Creations, Suresh Gyan Vihar University, Jaipur
[3]Department of Commerce, St. Xavier's College, Jaipur

E-mail: swati.pandey9@gmail.com

Abstract : This case study discusses the Goli Vada Pav Chain set up in 2004 which sells hygienic & affordable Indian Ethnic fast food to the lower income customers in India. The co-founder of Goli Vada Pav Mr. Venkatesh Iyer could see potential market of more than 500 million which included mostly teenage & young adults who were ready to pay nearly Rs. 10/- (almost equal to 20 US cents) once & sometimes twice a day. Vada Pav is a typical Mumbai Street Food which is made of fried patty with spicy potato fillings stuffed in a bun (like a burger). It is quite famous in Mumbai for the local long distance commuters who have no time to spend on cooking or rather eating meals. And it is equally famous in other big & small cities of Maharashtra like Nashik, Pune, Aurangabad, Manmaad, Ahmednagar etc.. Its liking and consumption spreads to the cities of the neighboring states touching Maharashtra and ofcourse to the cities of Gujarat like Ahmedabad & Surat. Goli has been quite successful in occupying the potentially lucrative position in the Indian Fast food Market by connecting the traditional street food to the Global Chains. And has reached an applaud able turnover of Rs. 15 Cr. and is now planning to make a multifold jump to Rs. 180 Cr. with almost 500 outlets all over India.

Khoj
An Interdisciplinary Journal of Research
ISSN : 2349-8749
Vol. 2, No. 1
2015
pp. 25-32

Introduction

Goli Wada Pav's concept popped up into the mind of Mr. Venkatesh Iyer when he assessed the brands that we use on the daily basis starting from Colgate, Gillette, Lux, Nivea, etc.. The daily consumed products only have foreign brands and so is the case with the food chains & rather prefer them instead of any Indian brands. And thus this Indian brand of Ethnic Snack came into existence.

Brand Idea

No one carrying the real idea about the brand would disagree to the fact that Goli Vada Pav is a proven innovation in the ethnic fast food industry founded by Mr. S. Venkatesh Iyer and Mr. Shivdas Menon who thought of creating a brand which could provide the same old economic Vada – Pav prepared more hygienically in a more humble and better suited ambience[1]. The brand idea was to provide standardized, hygienic, clean and economic Indian Snack to the mobile masses with a vision to create an Indian Brand in the Fast food market of Indian being crowded by most of the foreign brands and to raise fast food entrepreneurship all over the country. So with the franchises of Goli it is a very promising career opportunity for the start up businesses and young entrepreneurs[2].

Now, as far as the name of this brand is concerned, when Venkatesh Iyer, who was then a finance professional explained to his friends that he would quit the job to start his own Vada-Pav business, no one took him seriously. His friends mad fun of his idea saying that he was giving them "Goli" which means 'ditching' in local language. And, that's how his business venture got its Brand Name.

The major reason behind choosing Vada-Pav business in Mumbai was the fact that it is a hugely popular staple-snack. With a population

Launch of the Brand

It is a fact that today most of the eating joints and fast food corners have been taken up by the multinationals fast food restaurants whether in shopping malls or in local markets. Foreign brands like Mc Donald's, Subway, Pizza Hut, Dominos, KFC's etc. are mushrooming in Indian Snack Market. But the point to be noted is that no matter what an Indian eats his likings can never divert from the Indian Flavors and spices and tangs… which is also known as the "Desi Tadka" in the local Indian language. The market research on the tastes of an Indian foody have always proven the same facts as mentioned above and hence all the multinationals are serving their products in Indian flavors like Mc Aloo Tikki served by Mc Donalds, Paneer Pizza with Indian Spices served at Pizza Huts or the extra spicy chicken served in KFC outlets. But no matter how hard they have tried they couldn't The company's first outlet was opened in Kalyan near Mumbai in 2004 by Venkatesh who launched it with Shiv Menon. Initially they were selling handmade patties with bun (vada pav) which of course had a very short shelf life being a perishable item due to quick bacterial growth in Indian with co-existing problems of pilferage made it even worse[3].So standardization in the context of taste and food safety laws was a big issue of concern. The second major problem was the steep rise in raw material and chef based costs which were damaging the profit margins. The pressure increased even further on the founder of the business in 2006 when the bank gave his company a ten

days notice to reduce the losses resulting from the aforementioned problems or else repay the bank loan.

Brand Survival and resurrection Strategy

The first option that could have been available to any brand manager of a fast food chain was to resurrect the brand which was reaching its decline so soon. And the resurrection could have been possible by applying the method study for its production & operations and quality control. For this instead of creating a production setup and moving into debts the owner chose to respond to the situation by outsourcing the production as well as supply chain.

He first accessed the CEO of Vista Processed Foods (who was also his friend) to address his problems of inconsistent product quality and short shelf life. Eventually Vista Processed Foods is a subsidiary of OSI, a US company which also supplied frozen vegetables and chicken patties to McDonald's outlets in India. Vista assured Venkatesh of solving his problem and then another friend of Venkatesh introduced him to an engineering college in Mumbai to help her improve their product quality consistency by installing automated fryer machines at their outlets.

Soon Goli Vada Pav managed to raise finance from Indian financers promising them that the business would shoot up fast with the recent production and operational reforms in the manufacturing and supply chain systems of the firm.

The next challenge was to increase the number of joints/outlets which carried Goli's Products as it was the only thing which could help them increase their sales. Mumbai being quite an expensive place to get real estate rented for kiosks or joints Goli first experimented by operating through milk kiosks first. So, they started with almost 350 state owned milk kiosks but they had to close down with this idea as soon as the local political parties started to co-opt them in campaigns. Later on when Mr. Venkatesh tried to get refunded by the investor somewhere during late 2008, the global economy was hit by a major financial crisis which made around five potential investors of Goli to withdraw. This led to the sudden and sad collapse Goli Vada Pav which had already invested a making the Milk kiosks agree to sell their Vada Pavs.

OSI which is a backend company of Mc Donald worldwide and partner for supply chain for almost more than 40 years world-wide. OSI which was established in 1928 in food business world with the name OTTO and Sons.

OSI is one one of the largest private food processing corporation in the world. It has a worldwide reach in thirty three countries. OSI Inc. is a highly regarded name throughout the food world and food service industry due to its effective and efficient product innovations, dedications to customer service, manufacturing efficiency and commitment to food safety.

Venkatesh with his co-founder Shivadas Menon gave their presentation to OSI Inc. which made OSI get back to them in a couple of months and

agreed to get into partnership with their company. OSI could identify the potential of the business Goli Vada-Pav was into at that time. Venkatesh and Menon agreed to go into partnership with OSI Inc. and then the Vada-Pav making process was restructured and redesigned by Vista Processes Foods Pvt. Ltd.'s and a fully automated HACCP (Hazards Analysis and Critical Control Point)[4] a certified hands free plant of Vista was developed. Some other advantages which the company achieved was increased shelf life of Vada from one day to ninety days when stored at minus eighteen degrees Celsius this helped Goli into elimination of wastages at storage level, standardization of the product to a large extent and also helped it in developing a standardized hygienic quality controlled product[3].

It also helped Goli track each and every packet sent to different stores and infact the system is so well prepared with the most effective use of information system that not only it could trace back its product to the batch in which it was prepared but also up to the farm from where the raw material was sourced. Hence, every lot dispatch has a batch number , its manufacturing date and its expiry date clearly mentioned on its packet. Golis (vada) are sent to the stores all over the country in reefer vans. Pav is procured from local bakeries as it isn't economical to the manufacturer and transport the pav from a centralized place to different parts of the country and that is something which couldn't be preserved for a long time. Company also made some store level innovations under which they used temperature controlled heaters and deep chillers which also reduced heavy dependency on labor. With the innovative practices Frying was also made simpler. And then of-course they had created a major difference between the road side vendor and the hygienically proven product served to the customers courteously by nicely uniformed store employees.

Manufacturing operations and production processes

They had designed automated processes for every step like : slicing, peeling, dicing, packaging, sealing and delivering the Vada-Pav. There is an in depth quality check and control at every step of the process. The Vadas are frozen at minus eighteen degree Celsius and packed and sent to the outlets.

The Vadas are frozen at -18 degree Celsius and packed and sent to the outlets. As Vada is made in Vista plant, it involves first washing of the sourced potato to remove the foreign particles and then peeling potatoes; once potatoes are peeled they are diced into cubes, and then blanched at 100 deg Celsius and sorted and then smashed to form wet potato mash. This potato mash is mixed with 'Thecha' (a kind of chutney specially used as ingredient in Vada). Once potato mash and 'Thecha' are thoroughly mixed, patties are made according to the specified shapes and sizes. Patties are then dipped in "besan" (Gram Flour) batter which is prepared by mixing with water and soda as per recipe provided by Goli kitchen. The patties are parfried for 30 seconds and then blast frozen at -18 deg Celsius for 1 hour. Then each finished patty or better known as Vada is sorted and counted to pack in quantities of

22 each in a plastic bag. Then bags are weighed and passed through metal detector to ensure if patties have not engulfed any metallic particles during Vada making process and is good to consume by the consumers. Once ensured, these bags are packed in cartons with each carton containing 12 packets each. Again filled carton is weighed to specify same on the packed carton. After this is done, carton is sealed and stored at -18 deg Celsius in cold room. The machines which produce Vada for the company have a capacity to produce 100,000 Vadas in a single batch of production. And each packet has batch Number, manufacturing date and expiry date mentioned on it[3].

Raw Material Sourcing and Distribution System

The raw material's most important part the potatoes as a main ingredient of Goli's Vadas are supplied from the farms directly to Vista's HACCP (Hazard Analysis and Critical Control Point) which is a certified hands free plant where the potatoes are processed to form Vadas. The company then assigns the transportation schedules for transporting the frozen Vadas (packed hygienically in cartons) through reefer vans to the Goli kitchen which is again a cold room where they are stored till they are sent to the Goli Stores. The company owns all the reefer vans used for the transportation purposes. Pav being a different kind of baked bread can't be stored for a long time and thus can't be manufactured centrally as it loses its moisture content if kept in cold storage. Secondly, Pav is the lesser expensive part of the product so it is locally sourced from the bakers of the city itself.

Goli Franchisees

Goli Vada Pav after being successful in managing its production processes and in increasing the shelf life of the product they went into the mode of expansion to reach a target of 300 stores within 3 months but this was not an easy task to setup any new store in Mumbai due to the highly risen prices of real estate their. Finally, they came up with a new idea of tying-up with the rented roadside "Aarey" kiosks which are used to sell milk. With the help of this tie-up Goli company was successful in creating 150 Vada-Pav kiosks within two months. These kiosks were able to attract heavy footfalls as they were located in the most crowded areas of the town like Peddar Road, Gateway of India and Nariman point etc..

They were able to resurrect the existing stores of Goli Vada – Pav chain and open new ones with the help of the finance arranged from ICICI and ADB bank. As the company expanded in Mumbai it had to face some political issues as well as some financial issues. Due to these hazards the company had a new strategy of moving to the tier 2 cities in Maharasthra like Ahmednagar, Nashik, Nanded, Dhulia, Latur, Beed, Jalna, PArbhani, Nagpur, Aurangabad and they were able to launch 75 stores within 18 months short span of time. The intelligent part was that company didn't need to invest too much into the infrastructure or the manpower as all this was arranged by the store franchisee itself and the only responsibility that lied on the

company was to supply the product to the kiosk. This proved to be a key turning point for Goli as they were able to make the presence of their brand felt in the cities in the Southern part of India for example some cosmopolitan cities like Chennai, Bengaluru and Hyderabad and others like Koramangala, Jayanagar etc.[5].

The basic idea behind working on this Franchisee scheme is to work on the Transfer Price Model wherein the company provides raw ,material or semi – finished product to the franchiser at a nominal rate.

So if any one who wishes to operate a franchisee of Goli Vada-Pav, must own a constructed space of 100 – 300 sq. ft. in a prime commercial location like near railway station, bus depot, market, schools, colleges and coaching classes or any other crowded locality with a high footfall. So a potential franchisee requires around INR 7 lacs setup to open Goli's Franchisee.

In turn Goli not only looks after the purchasing, manufacturing, logistics, training the manpower and marketing of the unit and of-course the security of being a part of a successfully growing business venture . The other benefits that a franchisee avails are the privileges like economies of scale through bulk purchasing and mass marketing done by the company.

Marketing Strategies of Goli

Initially as a start up business venture it obviously didn't have any budgets spared for advertising and branding of its product. So initially the strategy was to use the popularity of the name "Vada-Pav" itself hence in the starting their sign boards on the shops bore the brand name Goli written in a smaller font whereas "Vada Pav" was written in a larger font comparatively. So when footfalls arrived at these shops / kiosks for having vada-pav they automatically started recognizing the brand name Goli.

The logo of the company was designed in a very unique fashion. The color scheme used is red which is symbolic of the hot vada-pavs served at the store and the brand name written in white represents the hygiene and cleanliness with which their product is produced, transported and served and the third color in the color scheme is green which depicts the spiciness of Goli's product. The mascot of the brand is a man with a Gandhi topi (cap). This type of cap is which is quite popular in Maharashtrian men. This mascot is selected to give the brand a local symbol as the company felt that this would help their targeted customer to relate to their brand.

The interiors of the kiosks / Goli stores are also designed with the same color combination as that of the brand logo.

Brand Resurrection

To create the brand "Goli", company's prime stress was upon its association with youth and nearby age groups from 10-35 years of age. In order to create the brand "Goli", company has always stressed upon its association with youth targeting customer which like to eat this quick snack for a small appetite. The company started engaging customers with the help of social

media by ensuring its presence over social networking websites like facebook [6], twitter etc.. They engaged their customers by creating various categories / communities and like creating a wall named Goli Gyan, Garam Goli, Goli Gossip, Aaj Ka Goli providing them a platform to discuss and thus identify the brand "Goli". The co-founder of the company Mr. Venkatesh also started blogging on www.vada-pavmurmurings. wordpress.com which had some hilarious stories cooked up to amuse the people and engage them with the brand Goli Vada-pav.

They also came up with some catchy slogans like "Vada-pav+ cutting chai+aamchi Mumbai = awesomeness". Company also started with putting slogans like "Goli Goli Goli... Vadapav Goli" during the train schedule announcements at Mumbai local railway stations.

To reach to the targeted masses the company made some good moves to reach to the masses during the biggest 10 day festival of Maharashtra "Ganesh Chaturthi". During this 10 days festival Goli company came up with a great promotional stunt under which they created a huge base of Vada-pav over which Ganesh Idol was placed on that base and then it was taken in a huge procession which they named "Goli Ganpati".

Another promotional stunt that they used was to compose some music C.D.s with Goli as the central theme and this music was played at every Goli outlet so that the customers could associate with the brand. These music C.D.s were distributed for playing at the Ganesh Pandals of different mandals of various localities. Goli also organized a dance competition event with mega prizes to the winners where the participants danced on the Goli compositions. This helped them create a good brand recognition amongst the targeted masses. These music C.D.s were also distributed to the local Auto rickshaw drivers for free to play in their auto while driving to spread their brand awareness.

Product Innovations

Goli has brilliant product innovations and its product range includes seven different kinds of innovative and tasty vada-pav. Goli Vada Pav produces 75,000-100,000 vada-pavs per day and comprises a basic menu of Mumbai snacks, namely Vadapavs, Tikkis, Bhajjis, Samosas etc. All Time favourties of Goli Vada Pav customers include:

1. Goli Aloo Tikki Pav, a blend of mash potatoes and spices cutlet placed between Indian buns, served with tomato chutney.
2. Goli Samosa Pav, a Maida dough ball with potato, peas and spices filling.
3. Goli Sabudhana Vada, a cutlet of potatoes, spices, vegetable oil and sago served with curds.
4. Goli Cheese Vada Pav, a cheddar cheese and potato culet with spices placed between burger buns served with sweet and dry chutney.
5. Goli Vada Pav, the special yet simple vadapav with potato cutlet and spices served with a dry and sweet chutney and a green chilly.

The chain store is also famous for various other snacks and fast food items, all prepared within a time limit of 6 minutes.

Conclusion

Goli Vada – Pav in Mumbai has the advantage of being distinct from others for being the only kind of machine made Vada – Pav that is standardized with a long shelf life. Now, Goli brand sells around 1000-1250 vadas everyday from every store. And along with this it has been able to recruit around 350 people at different locations all over the country. The success of this chain could be judged from the fact that a store located in Dhulia sold nearly 3500 Vada-Pav in a single day which was a turnover of INR 50,000.

Though initially they faced a lot of ups and downs an had spent quite a lot of their energy on quality control, research on the production processes like water content of potatoes, tying -up with high-tech firms for automation of their production processes, today, Goli has a stable backened, production and supply chain management system. Thus, now Goli's focus is on marketing and expanding their reach[7].

Future Aspects

Today, Goli Vada-pav company has turned into a brand with around INR 10-12 crore, with outlets all over the country and the astonishing fact remains that it is selling more than 1.5 crores of Vada-Pav everyday[8]. Soon they plan to add another 50 outlets in the upcoming time[9]. Their revenue target for the next five years is Rs. 180 crores, with the presence expanding to around 500 outlets. They even plan to open their chains overseas.

References :-

1. http://lifebeyondnumbers.com/goli-vada-pav-how-two-friends-built-indias-largest-ethnic-food-chain/; Retrieved on 23rd March, 2015.
2. http://golivadapav.com/index.html; Retrieved on 23rd March, 2015.
3. "Business Opportunity in Ethnic Fast Food Industry – Goli Vadapav No.1"; Compiled By - Manoj Gupta.
4. http://www.fda.gov/Food/GuidanceRegulation/HACCP/ ; Retrieved on 24th March, 2015.
5. http://www.thehindu.com/business/companies/goli-vada-pav-comes-to-chennai/article2482418.ece; ; Retrieved on 24th March, 2015.
6. https://www.facebook.com/pages/GOLI-VADA-PAV-Coimbatore/178656238853947; ; Retrieved on 24th March, 2015.
7. http://www.business-standard.com/article/companies/goli-vada-pav-on-expansion-mode-in-north-and-east-india-114080701448_1.html ; Retrieved on 24th March, 2015.
8. http://www.dnaindia.com/money/report-goli-vada-pav-eyes-500-outlets-10-fold-turnover-jump-in-5-years-1430359; Retrieved on 24th March, 2015.
9. http://articles.economictimes.indiatimes.com/2011-08-29/news/29941505_1_ventureast-chain-brand-building; Retrieved on 24th March, 2015.

Prospects of the Applying of UPFC in Modern Distribution Network

RUCHI SHARMA

Department of Electronics & Communication Engineering
Vivekananda Global University, Jaipur

E-mail: sharma.ruchi@vgu.ac.in

Abstract : The fault in the distribution network will cause voltage sags, three-phase imbalance and frequency fluctuations, seriously, forced to exit the system, increasing the instability of power and voltage in the distribution system. To solve many problems caused by the access of large-scale distributed wind power, to improve the penetration of wind power, to promote the development of wind power, to ease the environmental and economic issues that aroused by traditionally centralized power generation and to increase the quality and reliability of power supply. UPFC (Unified power flow controller, UPFC) is the most powerful FACTS controllers, it is well known to change the system parameters quickly and regulate the system voltage magnitude and phase angle so that it can control the system voltage and power flow. Taking the unified power flow controller as an example, this paper states the applying foreground of flexibility AC transmission system technology in distribution system. It proposes the idea that integrating the energy storage system into the DC bus of the unified power flow controller, The voltage regulation feature of UPFC to compensate for voltage asymmetry and fluctuations of distribution system voltage; the use of power flow regulation of UPFC can ensure DC working normally, even if the system is in failure to enhance the power system transmission capacity, when there exists the active shortage in the system, it need to provide active support to the static regulation of the system voltage and power flow for UPFC.

Key words : Increasing the instability • Large-scale distributed • Traditionally centralized • Applying foreground of flexibility

Khoj
An Interdisciplinary
Journal of Research
ISSN : 2349-8749
Vol. 2, No. 1
2015
pp. 33-40

Introduction

In recent years, more and more distributed wind power generation system is in place access to distribution networks around the world. Wind power access, so that the power transmission system changes gradually from the traditional one-way flow to the two-way flow, causing the short-circuit current of the system increasing and the power transmission blocked; the uncertainty of the output of wind power makes the power distribution system fluctuate; fast and frequent changes of wind power in the

size and trends make the node voltage of distribution system voltage keep fluctuating, even deviating its limits[1-5]. In addition, the fault in the distribution network will cause voltage sags, three-phase imbalance and frequency fluctuations, seriously, the wind turbines will be forced to exit the system, increasing the instability of power and voltage in the distribution system[6-9].

The development of large-scale distributed wind power generation, the increase of power quality and reliability requirements, demand a sufficiently flexible and smart modern distribution system with enough transmissioncapacity. However, due to economic constraints, theconstruction of a large and complex distribution network isbehind the booming construction of distributed powergeneration system, which is represented by the wind power[10-16].

Flexible AC Transmission Systems (FACTS) technologyhas been well known as its successful application in the powertransmission network. Applying the FACTS technology into the distribution network forms the distribution FACTS technology FACDS (flexible ac distribution systems), which is expected to build a flexible and controllable modern distribution network on the basis of the traditional network, to solve many problems caused by the access of

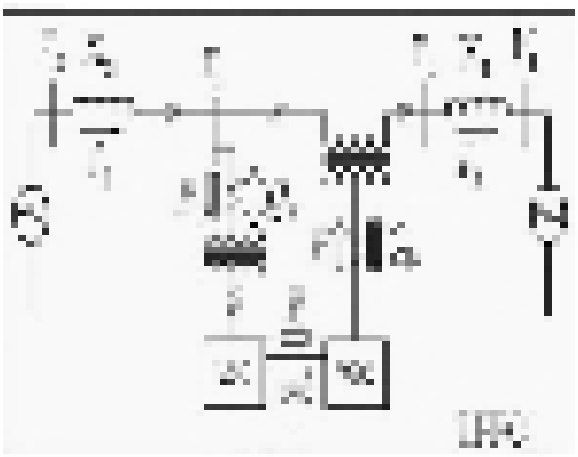


Fig. 2.0: Circuit Diagram of UPFC

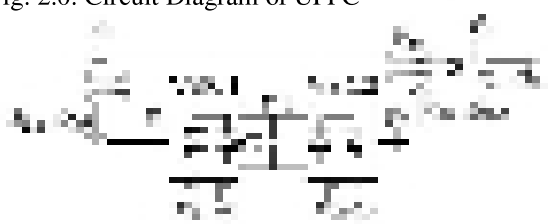


Fig. 2.2: Simplified schematic of UPFC

Fig. 2.3: Schematic of energy storage based UPFC accessing distribution system with wind power

large-scale distributed wind power[17], to improve the penetration of wind power, to promote the development of wind power, to ease the environmental and economic issues that aroused by traditionally centralized power generation and to increase the quality and reliability of power supply.
UPFC (Unified power flow controller, UPFC) is the most powerful FACTS controllers, it is well known to change the system parameters quickly and regulate the system voltage magnitude and phase angle so that it can control the system voltage and power flow. This paper will take it as a representative to explain the new mission given by the modern distribution network[18].

Description of Circuit Diagram
The UPFC combines together the features of two FACTS devices: the Static Synchronous Compensator (STATCOM) and the Static Synchronous Series Compensator (SSSC). The DC terminals of the two underlying VSCsare now coupled and this creates a path for active power exchange between the converters[19]. Hence, the active power supplied to the line by the series converter, can now be supplied by the shunt converterTherefore, a fundamentally different range of control options is available compared to STATCOM or SSSC. The UPFC can be used to control the flow of active and reactive power through the line and to control the amount of reactive power supplied to the line at the point of installation.

Working Principle of UPFC in the Modern Distribution Network
The working principle of conventional UPFC, it consists of two back-to-back converters VSC1 (voltage source converter), VSC2 are coupled through the DC capacitor C, VSC1 is paralleled into system bus through the coupling transformer T1, VSC2 is connected in series into system through coupling transformer T2. The AC side voltage of converter VSC1 is V1, converter VSC2 is V2. By changing the converter firing angle $\delta 1$, $\delta 2$ and the modulation ratio m1[20], m2, VSC1, VSC2

injected reactive power Qsh, Qse into the system respectively to regulate the transmitter and receiver side bus voltage of the system; VSC2 injected Vse to the system, its changes in amplitude and phase can reach the purpose of adjusting the system flow. The stability of DC capacitor voltage is a working prerequisite of UPFC system.

The UPFC in distribution network with wind power in order to regulate the voltage of distribution network and to reduce the loss of distribution lines.

The voltage regulation feature of UPFC to compensate for voltage asymmetry and fluctuations of distribution system voltage[21]; the use of power flow regulation of UPFC can ensure DG working normally, even if the system is in failure.

The Control Method of Switching System: Wind power can be rectified through the VSC1 of UPFC and then charging to the energy storage device ESS through the DC-DC chopper circuit directly, without additional rectifier circuit. ESS acts not only as the wind power energy storage devices, but also as the support for the UPFC power unit. However, the existing storage device is mostly the form of DC power, when the ESS-based support UPFC system is at different wind speeds, the power needs to flow between wind power, ESS and system, it acts as the wind power energy storage devices and at the same time needs to inhibit the active power fluctuations, transient stability, voltage fluctuations and frequency fluctuations in the system through power control, to compensate for the asymmetry of the system voltage, to improve the low-voltage through ability of the wind power when the system is in the failure, to enhance the power system transmission capacity, when there exists the active shortage in the system, it need to provide active support to the static regulation of the system voltage and power flow for UPFC.

For this, the DC chopper undertakes the tasks of realizing ESS through the active power exchange with the UPFC and the wind power system for four quadrants.

So much energy flow and multi-objectives controlled complex systems; we must consider the three parts coordination control of voltage source converter in both series and parallel sides of the UPFC and DC chopper, in order to achieve the comprehensive control principle of new UPFC based on the energy storage.

Power system itself is a multi-variable, strong nonlinear dynamic time-varying system, the UPFC system based on energy storage technology was added in order to further strengthen the non-linear and coupled, the whole controlled system is then changed into a multi-objective, multi-level and extremely complex and hybrid system with the combination of discrete and continuous.

Most of the control to the existing FACTS devices are to control the continuous variables and discrete variables separately, which will affect the control performance; there are also some design methods to take the system continuous variables and the switching logic of switches as a whole, such as subsystems and the corresponding switching strategies with both discrete and continuous state path, it has been applied successfully in the process of robot and vehicle speed adjustment control and achieved good control effect. Since the switching system can describe characteristics of the controlled object accurately and control the system stably and

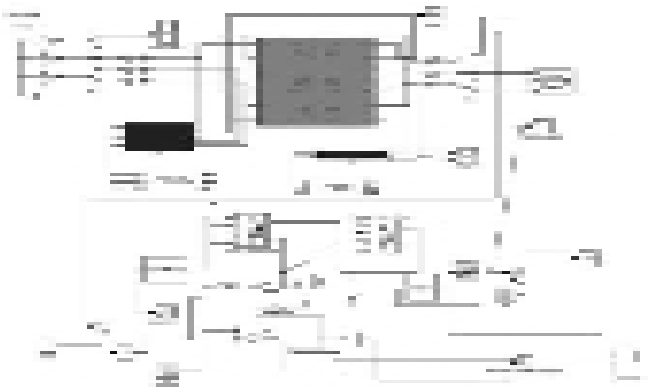


Fig. 4: Simulation Diagram

respond to control rapidly, in the recent years, some experts and scholars have tried to introduce the concepts and theories into the study of power systems and power electronics systems.

Simulation Diagram

Upfc simulation is based on the MATLAB Simulation model. As it is shown in the above simulation diagram it is clearly seen that the distribution of power in the power system is complicate and due to this complication many disturbance arises in the network, which affects the power distribution.

As the input is given in the power system and it distributed using three phase transformer, it can be seen in the scope that there are lots of noises and improper balance is present which cause frequency fluctuations, voltage problems.

So in order to rectify the problem upfc circuit is introduced, in this circuit there are two converters, one driver circuit, one dc link capacitor. The two converters in which one is rectifier which converts the ac to dc and aftere that, that converted dc power is fed to the dc link capacitor and the output of the dc link capacitor is fed to the second converter which is INVERTER converts the dc power to ac and then the rectified power is given as feedback power to be distributed.

Input Waveform

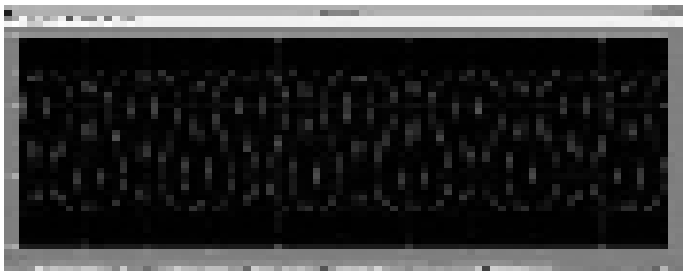


Fig. 4: 1Input Waveform

Distributed Power: This is the 3 phase input power which is given in the transmission lines for the distribution. Due to some losses occurs in the transmission lines the output in the distribution network is distorted or we can say it is disturbed or there is some voltage sags or 3ph imbalancement occurs which cause improper flow or improper distribution of power in the distribution network. This is the distributed power which is distributed in the current distribution network. There is lots of noise present in the system in form of voltage sags, frequency fluctuation etc.

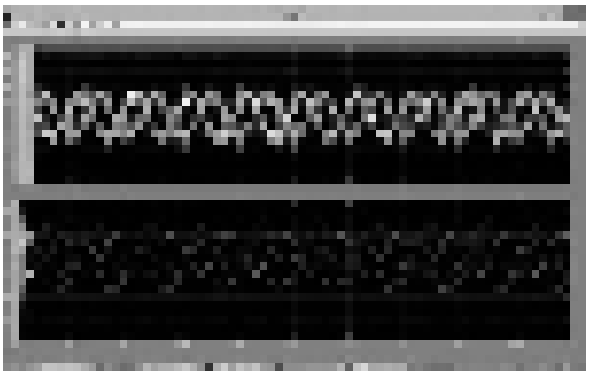


Fig. 4.2: Distributed Power

Output:

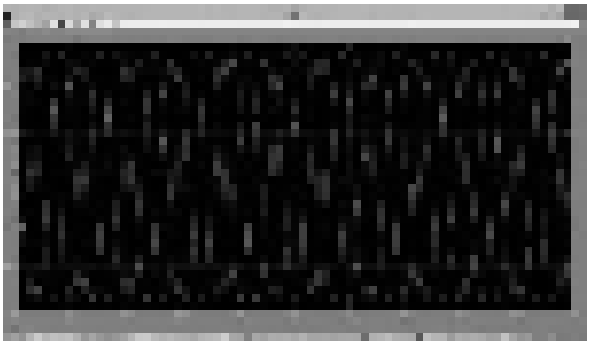


Fig. 4.3: Output Waveform

By the use of UPFC Fact controller it is clearly seen that all the problems in the distribution network is now rectified and there is continuous flow of power is available for distribution in which there is no frequency fluctuations, no voltage sag, no more noise is there. It is easily seen that there is pure energy is distributed over the transmission and distribution network.

Conclusion

This paper takes UPFC as an example; explain the effect of FACTS technology on the improvement of power quality in the modern distribution network with renewable energy represented by wind power. In this paper, the proposed topology model in which the ESS compatible with wind power will be access to the traditional UPFC DC bus is expected to be able to damp the oscillation of wind power and improve the capacity wind power through, under the premise of guaranteeing the power quality of distribution network.

References

1. Taro Kondo, Jumpei Baba and Akihiko Yokoyama, 2008. Voltage Control of Distribution Network with a Large Penetration of Photovoltaic Generation Using FACTS Devices. Electrical Engineering in Japan, 165(3): 16-28.
2. Kechroud, A., J.M.A. Myrzik and W. Kling, 2007. Taking the Experience from Flexible AC Transmission Systems to Flexible AC Distribution Systems. Universities Power Engineering Conference, 2007. UPEC 2007. 42nd International, pp: 687-692.
3. Tomonobu Senjyu, Yuri Yonaha and Atsushi Yona, 2009. Stable Operation for Distributed Generators on Distribution System Using UPFC. Transmission & Distribution Conference & Exposition Asia and Pacific, pp: 1-4.
4. Mahmoud A. Sayed and Takaharu Takeshita, 2009. All Nodes Voltage Regulation and Line Loss Minimization in Loop Distribution Systems Using UPFC. Energy Conversion Congress and Exposition, 2009. ECCE 2009. IEEE, pp: 2719-2726.
5. Jayashri, R. and R.P. Kumudini Devi, 2009. Effect of Tuned Unified Power Flow Controller to Mitigate the Rotor Speed Instability of Fixed-speed Wind Turbines. Renewable Energy, 34(3): 591-596.
6. Dizdarevic, N., M. Majstrovic and G. Andersson, 2003. FACTS-based Reactive Power Compensation of Wind Energy Conversion System. Power Tech Conference Proceedings, 2003 IEEE Bologna, 8(2).
7. Tarafdar Hagh, M., A. Lafzi and A. Roshan Milani, 2008. Dynamic and Stability Improvement of a Wind Farm Connected to Grid Using UPFC. Industrial Technology, 2008. ICIT 2008. IEEE International Conference on, pp: 1-5.
8. Zhang, L., C. Shen, A. Arsoy and S. Atcitty, 2001. A Comparison of the Dynamic Performance of FACTS with Energy Storage to A Unified Power Flow Controller. IEEE., pp: 611-616.
9. Molina, M.G. and P.E. Mercado, 2004. Comparative Evaluation of Performance of a STATCOM and SSSC both Integrated with SMES for Controlling the Power System Frequency. 2004 IEEE/PES Transmission & Distribution Conference c1 Exposition: Latin America, 535-541.
10. Wang, Q. and S.S. Choi, 2008. the Design of Battery Energy Storage System in a Unified Power-Flow Control Scheme. IEEE transactions on power Delivery, 23(2): 1015-1024.
11. Aihong Tang, Pingping Yin, Xianglian Xu, Shaorong Wang, Shijie Cheng, 2008. Performance of UPFC Integrated with SMES for Power Systems Controlling. ICEMS.
12. Domingo Biel, Rafael Ramos, Francesc Guinjoan, Juan Negroni, Carlos Meza, 2005. Sliding-mode Control Design of Parallel-Connected Switching Converters for Modular Transformerless DC-AC Step-up Conversion. ISCAS, pp: 3067-3070.
13. Masanori Sato, Atushi Kanda and Kazuo Ishii, 2007. A Switching Controller System for a Wheeled Mobile Robot. Journal of Bionic Engineering, 4(4).
14. Siu-Hong Wong, D.K.W. Cheng, Yim-Shu Lee and M.H.L. Chow, 2005. Design of Intelligent Switch System for In-vehicle Control Application. Power Electronics Specialists Conference, PESC, 1865-1868.
15. Eseobar, G., A.J. Vander Schaft and R. Ortega,1999. A Hamiltonian viewpoint in the modeling of switching power converters. Automatica, 35(3): 445-452.
16. Wang, Y., D. Cheng, C. Li and Y. Ge, 2003. Dissipative Hamiltonian Realization and Energy-Based L2-Disturbance Attenuation Control of Multimachine Power Systems. IEEE Trans. On Autom. Contr., 48(8): 1428-1433.

17. Jayalakshmi, V. and N.O. Gunasekar, 2013. Implementation of discrete PWM control scheme on Dynamic Voltage Restorer for the mitigation of voltage sag /swell, 2013 International Conference on Energy Efficient Technologies for Sustainability, ICEETS, pp: 1036-1040.
18. Uma Mageswaran, S. and N.O. Guna Sekhar, 2013. Reactive power contribution of multiple STATCOM using particle swarm optimization, International Journal of Engineering and Technology, 5(1): 122-126.
19. Arumugam, S. and S. Ramareddy, 2012. Simulation comparison of class D/ Class E inverter fed induction heating", Journal of Electrical Engineering, 12(2): 71-76.
20. Nagarajan, C. and M. Madheswaran, 2012. Experimental study and steady state stability analysis of CLL-T series parallel resonant converter with fuzzy controller using state space analysis, Iranian Journal of Electrical and Electronic Engineering, 8(3): 259-267.
21. Ramkumar Prabhu, M., V. Reji and A. Sivabalan, 2012. Improved radiation and bandwidth of triangular and star patch antenna, Research Journal of Applied Sciences, Engineering and Technology, 4(12): 1740-1748.

Design and Implementation of Elevator Using PLC

Dr. SHALINI RAJAWAT

Department of Computer Science, Vivekananda Global University, Jaipur

E-mail: shalinirajawat19@gmail.com

Abstract : During the last decades theelectronic technology has faced drastic changes mainly to reduce the human work in the field of Industrial Automation. This paper explains about an elevators operationwhich uses a DC motor to drive the elevatorcabin. The elevator mentioned here is fully automated using PLC. Its control is based on the input that we get from the operator as well as from the sensors. According to that signal PLC will make the motor and door motorto work correspondingly. Automation is the use of control systems and information technologies to reduce the need for human work in the production of goods and services. In the scope of industrialization, automation is a step beyond mechanization. Whereas mechanization provided human operators with machinery to assist them with the muscular requirements of work, automation greatly decreases the need for human sensory and mental requirements as well. Automation plays an increasingly important role in the world economy and in daily experience. PLC is a solid state device or mini industrial computer that performs discrete or sequential logics in a factory environment. It was originally developed to replace mechanical relay, timers, and counters. PLCS are successfully used to execute complicated control operations. Its purpose to monitor crucial parameters & adjust process operation accordingly

Keywords : PLC based elevator, Elevator Design, Constant speed Elevator, Ladder logic for Elevator using PLC, DC motor.

Khoj
An Interdisciplinary
Journal of Research
ISSN : 2349-8749
Vol. 2, No. 1
2015
pp. 41-48

Introduction

With the rapid development of city construction, the emergence of high-rise buildings and the expansion of buildings area, the use of elevator has become more Important, and the quality of elevator's service is required higher and higher. Therefore, the large-scaled building sare provided with a plurality of elevators so as to meet the transportation needs.

Due to the cause of rapid population growth at the cities and multi-stored buildings, the need of elevators is being increased. With the rising life standards and attention to human and with the technologic developments, elevator systems are getting better, more fast, stronger and better quality elevators are produced. Previously, most systems were focused on the mounting of elevators, especially after the 1980s

the need for elevator maintenance and fault staff have been started to increase. For instance, automatic doors have being used instead of splash doors, microprocessor electronic cards have being used instead of cards with relay, double-speed or speed-controlled elevators have being used instead of one- speed elevators. Such developments provide to improve the quality in elevator systems, develop and diverse the used setting and maintenance or repair tools and instruments and therefore facilitation of the work compared to previous years and increase the reliability of elevator. Some of the drawbacks of the traditional system are

1. The control system have high failure rate that were mainly due to numerous contacts, complexity of wiring circuit. In addition, electrical contacts were easy to burn out, which could result in poor contact.

2. Electrical controller and hardware wiring based on common method were difficult to achieve a more complex control function Some of the developments that have made to overcome the disadvantages of previously used elevators are

- The traditionally used relays and IC boards have been replaced by PLC for easy and cheap controlling of motors used in the elevator.

- Also by the use of PLC we can integrate monitoring software's like Intouch, Wincc etc.

- In order to control the motion of the elevator cabin smoothly DC motors are used because of its advantage of easy controlling and fast acceleration and deceleration.

In order to simulate the real elevator motion and control, do research on the control strategy of single elevator the paper builds an elevator with PLC control system of U.S. Rockwell A-B company and four sets 3-story elevator system model in the lab, writes an elevator peripheral interface program.

Background

A device for verticaltransportation of passengers or freight to different floors or levels, as in a building or a mine. The term elevator generally denotes a unit with automatic safety devices; the very earliest units were called hoists. Elevators consist of a platform or car traveling in vertical guides in a shaft or hoist way, with related hoisting and lowering mechanisms and a source of power. The development of the modern elevator profoundly affected both architecture and the mode of development of cities by making many storied buildings practical. A forerunner of the modern traction elevator was in use in Great Britain in 1835. The history of power elevators in the U.S. began in 1850, when a crude freight hoist operating between two adjacent floors was installed in a New York City building. In 1853, at the New York Crystal Palace. In 1859 an elevator raised and lowered by a vertical screw was installed in the Fifth Avenue Hotel in York City. In the 1870s the rope-geared hydraulic elevator was introduced. The plunger was replaced in this type by a

relatively short piston moving in a cylinder that was mounted, either vertically or horizontally, within the building; the effective length of the stroke of the piston was multiplied by a system of ropes and sheaves. Because of its smoother operation and greater efficiency, the hydraulic elevator generally replaced the type with a rope wound on a revolving drum. The electric motor was introduced in elevator construction in 1880 by the German inventor Werner von Siemens. Within the next 12 years, electric elevators with worm gearing connecting the motor and drum came into general use except in tall buildings. The equipment, which became available in 1948, made possible the solution of such scheduling problems as morning and evening peak loads and traffic balance and the elimination of operators. The use of automatic programming equipment eventually eliminated the need for starters at the ground level of large commercial buildings, and thus the operation of elevators became completely automatic. Automatic elevators are now generally employed in all types of buildings.

Elevator Software Implemantation

The elevator group control system software platform includes:

PLC Design

The controller used here is a Programmable Logic Controller (PLC) as this shows sharp advantages over the preexisting relay type of controllers. Relay type of controllers having complicated wiring so its drawbacks have been over by these PLCs. The PLC used here is Allen Bradley Micrologix 1100. It is having 10 DC inputs. The supply of 24VDC has to be given to the PLC. It can accommodate up to 16 I/O ports. For safe operation during emergency situation a separate RUN/STOP manual switch is provided in the module itself. Signal can be transmitted through serial port (RS 232).

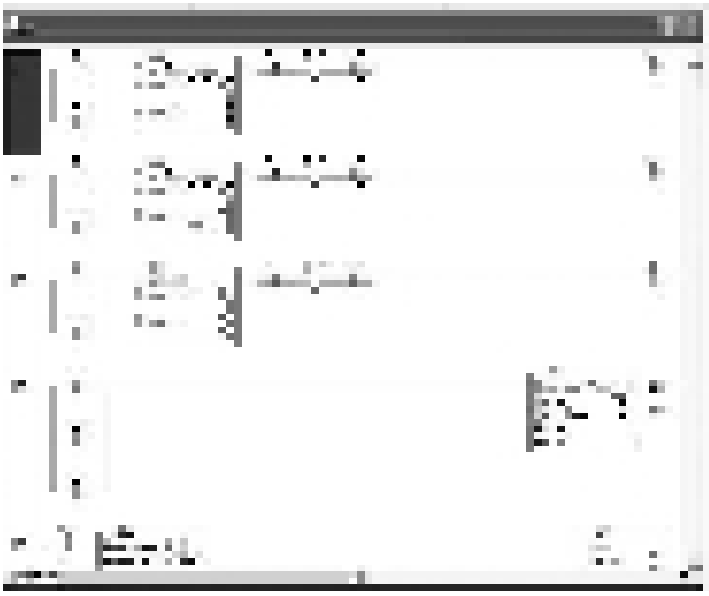
Ladder Logic

Here we discuss about the development of ladder logic network. Based on our requirements the logic has to be developed also depending on the need, the relevant PLC has been chosen. Here micrologix 1100 has been chosen for developing and to download ladder logic into the PLC. For the working model of an elevator various logics for different operations have to be developed and it is discussed in the following subtitles

Logic for Getting Input from Call Buttons and to Latch

As an initial move the ladder logic has to be developed for receiving the input signal from the call buttons and the same is used with the program to get the corresponding output based on this input. Once the PLC receives the signal the corresponding bit will be latched.

s.no.	Inputs	Operations
1	I:0.0/0	GND Floor
2	I:0.0/1	1 Floor
3	I:0.0/2	2 Floor
4	I:0.0/3	3 Floor
5	I:0.0/4	Gate open
6	I:0.0/5	Smoke detector
7	I:0.0/6	Temp. sensor
8	I:0.0/7	Weight sensor



Ladder logic Getting Input and to latched

When a particular switch from the corresponding floor has been pressed the

program in the PLC gets activated and the relevant bit will be latched. The latching will be there until that bit has been unlatched by another bit.
After getting the inputs from the call buttons the bits are latched. The various Bits used for latching the corresponding input signals from the call buttons are mentioned below.

s.no.	Inputs	Bit holds
1	I:0.0/0	B3:0.0
2	I:0.0/1	B3:0.1
3	I:0.0/2	B3:0.2
4	I:0.0/3	B3:0.3
5	I:0.0/4	B3:1.2
6	I:0.0/5	B3:1.3
7	I:0.0/6	B3:1.4
8	I:0.0/7	B3:1.7

Logic for Door Opening/ Closing
Once the operation of the elevator motor ceases the logic has to be developed in such a way that it facilitates the door opening. Based on the inputs from the call buttons, the floor sensors and the program downloaded in the PLC the door will open and close. That is the motor will operate either in forward direction or rotate in the reverse direction.
The various input and output ports used in this logic are:-

1) **Door opening/closing input - I:0.0/4**
2) **Door opening output – O:0.0/3**
3) **Door closing output – O:0.0/4**

According to our logic when both the forward and reverse motoring of the elevator motor stops the door opening logic gets latched.

Ladder logic for door opening/ closing

The ON-Delay Timer will be activated this will provide a delay of 5 seconds before the door closes. After the delay the door motor starts to rotate in the reverse direction thus initiating the door closing operation. At the end of door closing the sensor will give a signal to the PLC this will stop the door motor.

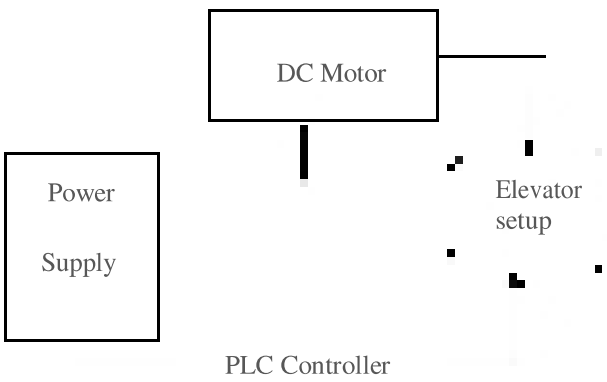
Smoke Detector

As a safety measure a smoke sensor has been fitted with the elevator cabin its logic has been described in the Figure

The input I:0.0/5 has been used as the input terminal for the smoke detecting sensor. Once this input has been activated the PLC will initiate reverse motoring and also it is designed to stop the elevator in the nearest down floor.

Hardware Describe

This section discuss about the design of an elevator by the calculation of certain parameters which defines the operation of the elevator. To meet the objectives of the project that has been derived from the previously completed theoretical studies a machine model has been designed. Then to validate and to implement the simulated model as a prototype certain calculations have been carried out to determine some critical parameters. The parameters includes the size of the cabin, maximum number of persons can be accommodated into the elevator, strength of the rope, type of motor used, motors power rating and torque rating.



Block Diagram of elevator

The important part of the system is the controller the type of controller used here is PLC. Therefore, the control precision of system was difficult. So there is a need to go for modern type of controllers like PLC. In this type of control there is provision to monitor the entire system by means of SCADA.

The main hardware components are used in this project:-

a. DC Motor
b. PLC Allen Bradley Micrologix 1100
c. Weight sensor
d. Smoke Detector
e. Limit switch
f. Output led's

Conclusion

Thus this chapter describes the entire circuit diagram and development of ladder logic. The developed ladder logic has been implemented by using RS logix 5000.Now Here the required inputs and outputs for elevators forward and reverse motoring, door opening and closing motor operation and various sensors present in every floor and at the end of both the door opening and door closing have been included in the logic and the program is interpreted.

So here we are using PLC as our controller which is far more sustainable then today's microcontrollers as more advancement can be done like the speed of the motor can be controlled by the PLC

References

[1] Dae-Woong Chung, Hyung-Min Ryu, Young-Min Lee, Lo-Won Kang, Seung-Ki Sul, Seok-Joo Kang, Jun-Ho Song, Joong-Seok Yoon, Kil-Haeng Lee and Jong-Ho Suh (2001) 'Drive systems for high-speed gearless elevators', IEEE Industry Applications Magazine, vol. 7, pp 52-56.

[2] Darshil, Sagar, Rajiv, Pangaokar and S.A. Sharma (2008) 'Development of a PLC Based Elevator System with Colour Sensing Capabilities for Material Handling in Industrial Plant',Joint International Conference on Power System Technology and IEEE Power India Conference ,pp 1-7.

[3] Eunsoo Jung, HyunjaeYoo, Seung-Ki Sul, Hong-Soon Choi and Yun-Young Choi, (2012) 'A Nine-Phase Permanent-Magnet Motor Drive System for an Ultrahigh-Speed Elevator', IEEE Transactions on Industry Application, vol. 48, pp 987-995.

[4]Gieras.J.F.,Hartzenberg.P.D.,Magura.I.J.andWing.M.(1993) 'Control of an elevator drive with a single-sided linear induction motor', Fifth European Conference on Power Electronics and Applications, IET Conference Publications, p 353-358.

[5] Hong Sun Lim and Krishnan.R. (2007) 'Ropeless Elevator With Linear Switched Reluctance Motor Drive Actuation Systems', IEEE Transactions on Industrial Electronics, vol. 54, pp 2209-2218.

[6] Hong Sun Lim, Krishnan.R. andLobo.N.S.(2008) 'Design and Control of a Linear Propulsion System for an Elevator Using Linear Switched Reluctance Motor Drives', IEEE Transactions on Industrial Electronics, vol. 55, pp 534-542.

[7] Jae Sung Yu, Sun Mo Hwang and Chung-Yuen Won (2009) 'Performances of fuzzy-logic-based vector control for permanent magnet synchronous motor used in elevator drive system', 30th Annual Conference of IEEE Industrial, [8]Jayawardana.H.P.A.P.,Amarasekara.H.W .K.M.,Peelikumbura.P.T.S., Jayathilaka. W.A.K.C.,Abeyaratne.S.G.andDewasurendra.S.D. (2011) 'Design and implementation of a statechart based reconFigureurable elevator controller', 6th IEEE International
Industrial and Information Systems, IEEE Conference Publications, pp 352-357.
.

Applications and Security Threats of Near Field Communication

LEENA GOYAL[1], MUDIT KUMAR[2]

[1]Department of Computer Science & Engineering,Vivekananda Global University,Jaipur
[2]Department of Computer Science & Engineering,Vivekananda Institute of Technology,Jaipur

E-mail: goyal.leena@vgu.ac.in

Abstract : Near Field Communication (NFC) is a new technology in the field of communication. It supports users in many applications so that their life becomes easy. Communication has gone through many years to provide this amazing facility to users.NFC devices can receive and transmit data at the same time. They can function as a smart contactless card, a passive RFID tag and as smart medium to exchange data between various devices. NFC devices can be used to exchange data such as text, images etc. just by holding device near various smart tags or by holding two smartphones closer. NFC also solves problems like long duration of connection establishment and high power consumption.The paper discuss about various security threats and their protective measures. Besides these threats, NFC is a promising technology that facilitates a wide variety of users in various applications.

Keywords : NFC (Near Field Communication), RFID, Applications, Security Threats, Communication

Khoj
An Interdisciplinary
Journal of Research
ISSN : 2349-8749
Vol. 2, No. 1
2015
pp. 49-55

Introduction

Near Field Communication is an innovation in communication field. It is an emerging technology and a great achievement. It allows devices to communicate and transfer data packets by just placing them close. The technology has provided a new way of communication which left other technologies behind. Near Field Communication technology is a wireless communication technology and it is growing very fast to let world use it in their day to day operation [2].

NFC has a lot of applications in everyday life. We will not be need to carry cards, different electronic such as access cards, debit cards / credit cards and identity. These cards will be in the cell phone, and will use them anywhere we want.

Let's take an example if you have a laptop and cell phone equipped with NFC, then you can easily download data from Internet into your cell phone by simply touching your cell phone with laptop. Like that you may take pictures from your cell phone and if you want to show those pictures to your friends on big screen (TV) then you may just touch your phone with TV and show them. Or if you want to print those

pictures then by touching the cell phone with NFC equipped printer will give you the prints of those pictures. This principle works with any kind of devices equipped with NFC to communicate with each other. There is no need to set up the communication link initially. Suppose you want to transfer a file from one laptop to other by using novel technologies, like Bluetooth or Wi-Fi. You need to manually set up the communication link between laptops. But if you are using NFC enabled laptops, then you may transfer the file by just touching both laptops. In another situation you may establish the link using NFC and once communication link is established Bluetooth or Wi-Fi can be used to transfer data.Advantage of using this method is to transfer larger data or continuing the communication session if devices go away after touching each other.

Nfc Modes of Communication

1). **Card Emulation Mode**: This mode is used when the NFC device works as a smart card, for e.g., an access card or a rail pass or ticketing. The device in this mode can send messages. This mode can also be specially configured to send messages that will enable the NFC device to act as contactless credit card [4].

2). **Reader Emulation Mode**: This mode is used when the NFC device is used to read data from passive NFC tags. This mode allows just one way communication from the passive NFC tag to the NFC device. The NFC tag can just send out the signal to NFC device but cannot receive the signal. For example, if a NFC tag is attached to a poster, the NFC smartphone can "tap" the tag to access the information stored in the tag (e.g. coupons, maps, product information, etc.) easy and conveniently [4].

3). **Peer-to-Peer Mode**: Peer to peer mode enables two NFC devices to share data between them. This mode enables a link-level communication between two NFC devices. Due to the low transfer speed of NFC if large amounts of data need to be sent, peer to peer mode can be used to create a secondary high speed connection (handover) like Bluetooth or Wi-Fi. In this case, the NFC is used to negotiate the optimal communication protocol and transfer authentication data for the secondary protocol [4]. The file or data is then sent over the high capacity protocol (i.e. Bluetooth, Wi-Fi, etc.)

NFC Applications

Near Field Communication has provided a long list of applications to facilitate their users. The technology has attracted many users by providing an ability to perform a complex task in just a second by just swiping NFC enabled mobile phones in front of NFC enabled mobile readers. Following are some applications of Near Field Communication:

A. Mobile Payments (m-payments)

Mobile payment concept has originated from an idea which states that the user does not require carrying neither wallet nor any credit card. He would be able to make

payments for his goods by their mobile phones. The idea is supported by mobile applications e.g. Google Wallet, which are specially developed for making mobile payments. The application gets installed in mobile phone to work in collaboration with NFC enabled payment system to facilitate payments [3]. Mobile payment along with NFC technology would support a wide chain of businesses. As an example of Mobile payment, Google Wallet from Google has been used in 2012 London Olympics. Google estimates that a massive number of retailers and users would use NFC enabled systems in near future and the number of users will substantially grow over years.

B. Credit Cards Replacement

Customers use credit cards to make payments. They prefer to acquire credit cards from different vendors. Carrying multiple credit cards can be a hoax for users. In case, user loses his credit cards mistakenly, then it would result in loss of time and money. Another problem with credit card is due to magnetic strip and chip. The magnetic strip and chip used in cards have a limited lifetime and are also vulnerable to demagnetizing and breakage. To avoid all of this chaos, we can use card emulation mode of NFC to reduce credit cards usage.

C. Advertising

Near Field Communication technology has served its benefits in advertising too. Two components are used in advertising, one is a NFC enabled mobile phone that operates as NFC reader, used to read the information and the other one is NFC tags in smart posters. NFC enabled mobile phone reads advertising information from NFC tags installed in smart posters. NFC reader collects all information required to provide service. Information may contain a website URL or a phone number, etc. By just swiping a phone, we would get all necessary information, be it a movie, pictures, interviews, etc.

Advertisers use NFC tags in banners to deliver information about available offers, coupons, product launches, brand interaction service, etc. to customers. It can also be used in acquiring feedback from users by just transferring information from one NFC device to other by keeping them close to each other.

D. Educational purpose

Implementing NFC technology in school and college campus, students with NFC enabled mobile phone and notice board, can make students life easy. They can instantly receive information from notice board[3]. They can also get updates about their schedules, coursework, etc. The researchers have also thought of developing a NFC based system to provide university based services including an automated attendance system and Smart Posters in campus.

E. Electronic Ticketing

Electronic Ticketing, a NFC application, brings a new phase in transportation. A recent example of electronic ticketing system is implemented in German city Frankfurt. The transport authority has merged to “tap-inpayment system, to allow

commuters to access travel schedules and other related information. Aconite and Procama has also implemented electronic ticketing system in South Africa. Electronic Ticketing accomplished with NFC enabled mobile phones and tags[5]. User needs to swipe mobile phone at NFC enabled ticket collector. Ticket collector deducts fare amount from associated credit card and provide relief to travellers from making manual payments[3].

F. Medical Healthcare Applications

In medical field, NFC tags can be used as patient ID. Doctors can use it to maintain patient's diagnosis files from remote storage location. It allows doctors to quickly observe patient's prescription and medical history, due tests and procedures[3].

G. Visiting Cards

NFC technology can be used to provide user's contact information. User will provide his contact information in a file and simply transfer it by just tapping two smart phones[2].

H. Parking Lots

NFC technology has found its application in parking lot as well. Parking service provider uses NFC technology to transfer information about vacant space, parking lot number, map and other information. User can tap his phone on NFC tag to provide information about the location of his parked car. The information transfer would also help users to locate their car in parking lot easily by using map and parking lot number.

I. Keyless Entry

Keeping door keys every time may be tedious and loosing or misplacing keys can be very frustrating sometime. NFC technology is being used to open closed door of hotels. NFC enabled mobile phones and NFC reader in door lock accomplishes the process.

J. Device Pairing

NFC technology provides its abilities in configuring two devices, belonging to same group, for communication purpose. NFC technology allows easy exchange of data to serve the purpose. NFC devices must be brought closer, and with the help of NFC protocol, it establishes a connection to transfer data between devices. NFC reduces user's overhead because of navigating through menus and selecting devices from available devices[5]. Users can send small files over NFC as its less bandwidth is not suitable for sending image files. Other application examples of NFC technology are E-passports, identity cards, Security clearance or authorized access, starting car engine by waving mobile, etc.

Threats to Near Field Communication

NFC has facilitated in various application fields with his capabilities. It has grown to an extent that every user is using it in their day to day operations to make life

easy. Along with these much advantages, there are some threats that inadvertently come by using NFC technology. These threats resist users to use NFC technology. Following are some threats to NFC technology are mentioned:

A. Eavesdropping

Eavesdropping attack looks for confidential information. It is the simplest form of attack and allows other vulnerable attacks to occur. NFC is a wireless communication that uses RF (radio frequency) waves. Wireless communication is more vulnerable as compared to wired communication, so NFC does. Attacker can interrupt Near Field Communication very easily. It just requires equipments that receives RF signal and can extract information from it. Attacker may use same equipments that a receiver uses to receive signal and decode important information. Device's operating mode also affects attack. Active device produces its own RF field for communication and Passive device uses other device's RF field for communication. Communication from passive device is much harder to eavesdrop as compared to communication from active devices. Briefly, data communicating in active mode is more susceptible to get eavesdrop from adistance of 10m, as compared to data communicating in passive mode reduces this distance significantly to 1m only. Hence, data communication in passive mode is safer as compared to active mode.

B. Data Corruption

Data Corruption involves data manipulation in between its transmission. Attacker corrupts data to make it unreadable by receiver. In Near field communication, Data corruption disturbs communication. It is performed very easily by transmitting valid frequencies of data spectrum at specified time period. Attacker calculates the time period. He must have wide knowledge about modulation scheme and coding used for transmission purpose[5].

C. Data Modification

Data corruption attack only corrupts data and make it unreadable, but does not allow attacker to manipulate it. Data modification attack alters data's content and its meaning. Data modification attack is performed by applying amplitude modulation to signal. Strength of amplitude modulation on data signal determines the probability of data modification.

D. Data Insertion

Data Insertion attack inserts its own data message in data transmission between two devices. Data insertion attack is possible when device take much time to respond [5]. If device 1 transmits data to device 2 and device 2 takes sufficient time for responding, then in between attacker can reply to device 1, making illusion that device 2 has sent the reply. Data insertion attack can be performed from both sides. If attacker and device, both reply at same time, the data will get overlapped and corrupted.

E. Man-in-the-Middle-Attack(MIM Attack)

Man-in-the-middle attack states a situation where two parties communicate via third party, without knowing about the existence of third party in between the communication path. It is also considered as interception. In NFC communication, if devices operate in active-passive mode, then it would not be possible to conduct this attack. Contrary to it, if both devices operate in active mode, then there is probability of attack's occurrence. Practically, man-in-the-middle attack is not possible because devices regularly change their states to active/passive mode.

F. Denial of Service

If a user touches NFC device with an empty or corrupted tag, then an error message would get produce and occupy tag memory space to an extent that it would not be able to accommodate authentic messages, resulting system would stop working. The situation is considered as Denial of Service where device is not available to operate. It also refers as Interference. Precaution to the attack, there must be a mechanism that turn on NFC devices to resume its functionality. NFC is being used in many important applications. Threats to NFC applications could lead to great business loss. NFC application developers must find some way to protect NFC communication to make it reliable to use.

Protective Measures for Securing Near Field Communication

It's important to secure a technology like Near Field Communication which provides a wide range of applications to their users. Threats mentioned earlier made NFC technology vulnerable and restricts users to use it. Therefore, there must be some countermeasures for handling these threats. Following are some measures that can helps in securing NFC[5].

A. Eavesdropping

Near Field Communication cannot be protected against eavesdropping. Eavesdropping can be restricted on passive mode of communication. But, it is not possible to enforce passive mode of communication only i.e. it will restrict application's functioning. So, we can just try to use NFC's passive mode of communication for its protection.

B. Data Corruption

Data Corruption attack can be restricted by observing RF field on which data is being transmitted. NFC devices must look for RF field's power as significantly high power is required to corrupt data. By this way, attack can be detected.

C. Data Modification

For protecting NFC communication from data modification attack:

- Impossible for attacker to modify data in this case. But it can create room for other attacks like eavesdropping.

- they must stop transmission upon detecting attack.

D. Data Insertion

Data Insertion attack can be protected by three methods:

- response to other device. By this way, attacker would not get a change to insert his data on communication channel.
- unauthorized activities. As, channel is open and it is starting point of transmission, any activity like insertion can be easily detected.
- protecting NFC

E. Man-in-the-Middle Attack (MIM Attack)

For protecting NFC communication from man-in-the-middle attack, active-passive communication mode must be used. By using this mode, only active devices would generate RF field for valid recipients and dont let attacker to send its data in between. Moreover, NFC devices can also pay their attention to observe RF field to detect any disturbance by attacker.

F. Denial of Service

For eliminating denial of service attack, a precautionary mechanism must be placed that turn on NFC devices to resume their functionality if in case their services got terminated due to some reason.

Conclusion

Near Field communication technology enables its users to visualize and experience a new and exciting world. It has facilitated its users with a variety of applications. As, there exits two sides of coin, NFC technology also suffers from some cons as well. There are some threats that restrict users to use it. The paper describes various applications of NFC. It also explains number of threats and its respective countermeasures to protect NFC technology. These solutions could be used to provide security to applications using NFC technology and also attract more users to use it without any problem. Moving forward, the paper would be very helpful for new learners to understand NFC technology, its applications, threats and security constructs used for protecting it. It also encourages researchers to invent some better remedies for securing NFC from threats to build user's confidence in technology to use it further.

References:

[1] Hussein Ahmad Al-Ofeishat, Mohammad A.A.AlRababah, "Near Field Communication (NFC)", International Journal of Computer Science and Network Security, VOL.12 No.2, February 2012

[2] Chetna Bajaj, Department of Computer Science & Engineering, "Near Field Communication (NFC)", International Journal of Advanced Research in Computer Science and Software Engineering

[3] M. U Yaqub and U.A Shaikh,"Near Field Communication, its application and implementation in K.S.A" 2012.

[4] PankajAgrawal and SharadBhuraria, "Near Field Communication", SETLabs Briefings, VOL 10 No1, 2012

[5] E. Haselsteiner and K. Breitfuß, "Security in Near Field Communication, Strength and Weaknesses", Workshop on RFID Security 2006.

Cognitive Radio: Analysis of Spectrum Sensing Techniques a Review

MEETU NAG[1], O.P.SHARMA[2]

[1]Department of Electrival Engineering, Vivekananda Institute of Technology, Jaipur
[2]Department of Electronic & Communication Engineering, Poornima College of Engineering, Jaipur

E-mail:meetunag@gmail.com

Abstract : With the emergence of wireless communication systems, the requirement for radio spectrum is increased. Cognitive Radio (CR) technology deals with the requirement and scarcity of the radio spectrum. Spectrum sensing is of significant importance in CR networks. Spectrum sensing helps to detect the available spectrum. In this paper, review of spectrum sensing techniques is presented. The challenges and issues involved in spectrum sensing techniques are also discussed in detail.

Keywords : Cognitive Radio, Active Spectrum Access, Spectrum Sensing.

Introduction

In wireless communication systems, the usage of radio spectrum is increased day by day. To deal with the scarcity of radio spectrum, Cognitive radios are designed in order to provide reliable communication for all users of the network. In CR network, the secondary users (SU) are allowed to use the vacant frequency bands of the primary user. CR provides a sharing between primary user (PU) and secondary user (SU). The Cognitive Radio[1] automatically examines its radio spectrum environment. There are various method where secondary (unlicensed) systems are allowed to effectively utilize the unused primary (licensed) bands frequently called as white spaces. Cognitive radio defines a cyclic chain for detection of the radio spectrum. It includes four major parts such as available free Radio Spectrum, Spectrum Sensing by suitable detector, Proper feedback Channel and Spectrum Controller. Spectrum Sensing techniques[3,4] includes primary transmitter detection, cooperative detection and interference detection for sensing the suitable vacant primary user for signal transmission. Below is shown the cyclic flow of the signal processing in cognitive radio network.

Khoj
An Interdisciplinary
Journal of Research
ISSN : 2349-8749
Vol. 2, No. 1
2015
pp. 56-63

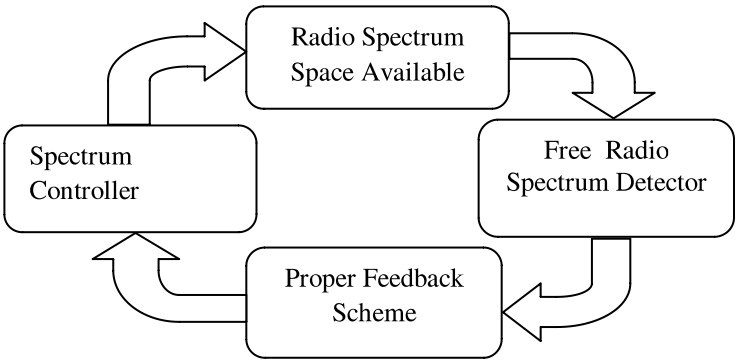


Figure1: Signal Processing Cycle for Cognitive Radio Network

Organization of paper: In Section II, various challenges are discussed which generates in the sensing the proper spectrum for cognitive radio.. Spectrum mobility issues are discussed in section 3. Need of spectrum sensing and spectrum mobility approaches to take advantage of a mixture of different strategies for spectrum selection is described in section 4. Section 5 illustrates classification of various spectrum sensing techniques in detail and their comparison. Conclusion of the paper is presented in Section 6.

Challenges in Spectrum Sensing

There are various challenges that obstacle the spectrum sensing such as noise uncertainty, effectiveness of signal detector, sensing interference etc[5,8].

A Noise Uncertainty

Noise uncertainty defines that how the primary signal is effectively detected in the cognitive radio network maintaining the minimum signal to noise ratio.

$$\delta_{minimum} = \frac{P_T L(S+D)}{P_{Noise}} \qquad \text{(i)}$$

Where

P_{Noise} is the noise power,

P_T is transmitted power of the primary user,

S is the interference range of the secondary user; D is maximum distance between primary transmitter and its related receiver.

The above equations show that the uncertainty in the noise is inversely proportional to the noise power, which should be the known quantity and defined by the receiver side.

B. Challenges in Spectrum Sensing

Main Challenge behind sensing the spectrum is

- First, an unlicensed user should know exactly the location of the licensed receiver.
- Second, if a licensed receiver is a passive device, the transmitter may be aware of the type of the receiver.
- Thirdly, in cognitive radio network due to the presence of various secondary systems, there is more interference between the secondary users. To deal with this uncertainty a sensitive signal detector is required.

Spectrum Conditions

In a cognitive radio network allows the unlicensed user to change its operating spectrum conditions.

A Frequency Band

A cognitive radio defines the available frequency bands so that it can switch immediately to other frequency band. It periodically observe the channels condition and provides the result on demand for changing the operating environment.

Spectrum Sensing

A major challenge in cognitive radio is that the secondary users need to detect the presence of primary users in a licensed spectrum and quit the frequency band as quickly as possible if the corresponding primary radio emerges in order to avoid interference to primary users. This technique is called spectrum sensing. Spectrum sensing and estimation is the first step to implement Cognitive Radio system[5].

A. Classification of Spectrum Sensing Techniques

Spectrum Sensing is brodlly classified in three such as Non- Cooperative Sensing, Cooperative Sensing and Interference based Sensing.

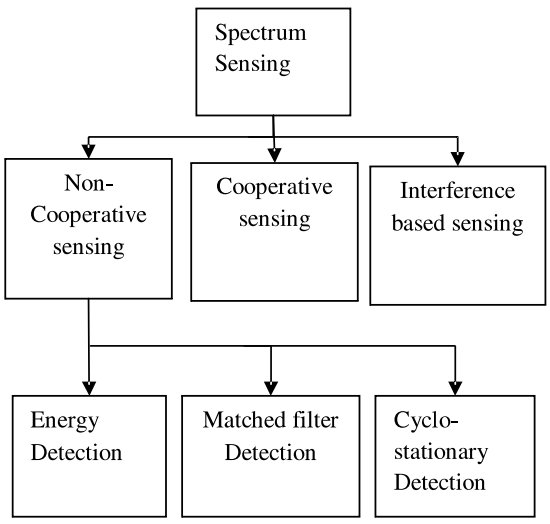


Figure 2: Classification of spectrum Sensing techniques.

Non Cooperative sensing is further classified into energy detection, matched filter detection and cyclo-stationary feature detection[14].

Non Cooperative Sensing

A. Energy Detection

It is a non coherent detection method that detects the primary signal based on the sensed energy[1].In this technique there is no requirement of prior knowledge about the usage of primary user. It works in accordance to the current status of the primary user. Energy detection (ED) is the most popular sensing technique in cooperative sensing[15,17]. The block diagram for the energy detection technique is shown. In this method, signal is passed through band pass filter of the bandwidth W and is integrated over defined time interval.

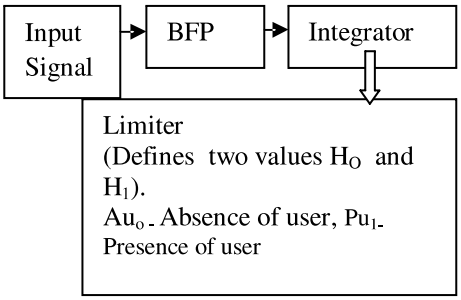


Figure 3: Energy detector block diagram [1]

The output from the integrator block is then compared to a predefined threshold limit. This limiter defines the absence and presence of the primary user. The threshold value can set to be fixed or variable based on the channel conditions. It only shows the presence of the signal by comparing the received energy with a known threshold value. Signal detection can be formalized as a

(ii)

(iii)

Where y (n) is the sample to be analyzed at each instant n and v (n) is the noise of variance .

Let y (n) be a series of received samples n $\in$ {1, 2….N} at the signal detector, then a decision rule can be stated as,

Au.....if Es<v (iv)

Pu_1.....*if Es<v* (v)

Where Es = $E[y(k)]^2$ is the estimated energy of the received signal and v is chosen to be the noise variance .

ED has a number of disadvantages

i) Sensing time taken to achieve a given probability of detection may be high.

ii) Detection performance is subject to the uncertainty of noise power.

iii) ED cannot be used to distinguish primary signals from the CR user signals.

As a result CR users need to be tightly synchronized and refrained from the transmissions during an interval called Quiet Period in cooperative sensing.

iv) ED cannot be used to detect spread spectrum signals[9].

B. Matched Filter

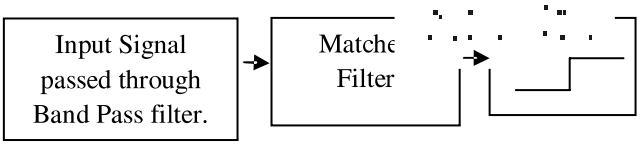


Figure 4: Block diagram of matched filter [1]

A Matched filter is a linear filter which maximizes the output signal to noise ratio for a given input signal. In this prior knowledge of primary user is required for detection of secondary user using Matched filter whose impulse response is the mirror and time shifted version of a reference signal. The operation of matched filter detection is expressed as:

Where 'Q' is the unknown signal and is convolved with the 'h'.

Advantages: Matched filter detection needs less detection time [9].

Disadvantages: Matched filter detection requires a prior knowledge of every primary signal. If the information is not accurate then it is not the efficient system.

C. Cyclo-stationary Feature Detection

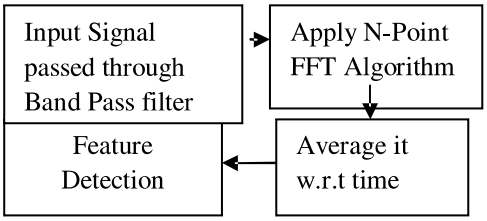


Figure 5: Cyclo-stationary feature detector block diagram

Cyclo-stationary feature detection is robust to noise uncertainties and performs better than energy detection in low SNR regions. but requires a priori knowledge of the signal. Cyclo-stationary feature detection is capable of distinguishing the CR transmissions from various types of PU signals. This eliminates the synchronization requirement of energy detection in cooperative sensing.

Comparision of on Cooperative Techinque

The comparison of various transmitter detection techniques for spectrum sensing is

shown in figure 6. Matched filter based detection is complex to implement in CR, but has highest accuracy. Similarly, the energy based detection is least complex to implement in CR system and least accurate compared to other approaches. And other approaches are in the middle of these two.

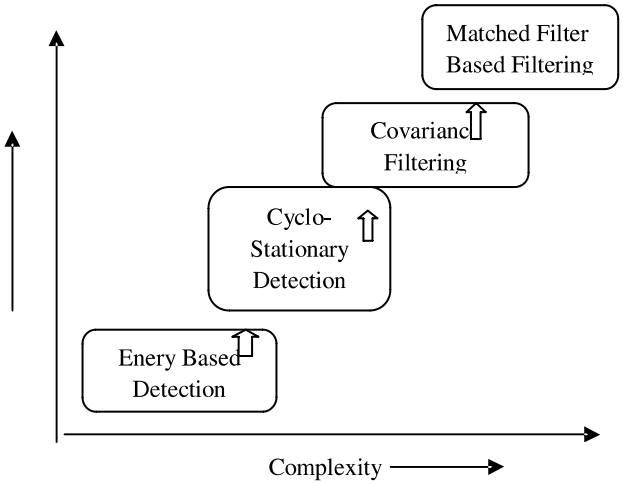


Figure 6: Sensing accuracy and complexity of various sensing methods.

Cooperative Techniques

High sensitivity requirements on the cognitive user can be achieved if multiple CR users cooperate in sensing the channel. Various topologies are currently used and are broadly classifiable into three regimes according to their level of cooperation[9,25,26,28].

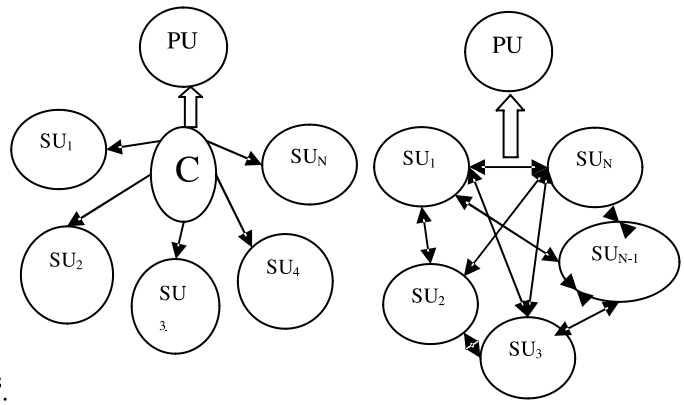


Figure 7: Cooperative sensing techniques: Centralized coordinated, Decentralized Coordinated [9], [29].

A.Centralized Coordinated Techniques
In such networks, one CR that detects the presence of a primary transmitter or receiver and informs to the controller (C). The CR controller notifies all the CR users in its range by means of a broadcast control message.

B. Decentralized Coordinated Techniques
In this type of coordinated technique various algorithms have been proposed which increasing the sensing capability of the free primary user.

C.Benefits of Cooperation
Improve multipath fading, shadowing and building penetration losses, impose high sensitivity requirements inherently limited by cost and power requirements[9].

D.Disadvantages of Cooperation
The cognitive radio users need to perform sensing at periodic intervals due to mobility, channel impairments etc. This considerably increases the data overhead; large sensory data: since the cognitive radio can potentially use any spectrum hole, it will have to scan a wide range of spectrum, resulting in large amounts of data

Interference Based Detection
A. Primary Receiver Detection
Primary receiver emits the local oscillator (LO) leakage power from its RF front end while receiving the data from primary transmitter. For this a sensor node is placed near to a primary user's receiver to detect the leakage power. The local sensor then reports the sensed information to the CR users so that they can identify the spectrum occupancy status.

Conclusion
Spectrum is a very priceless resource in wireless communication systems. Cognitive radio technology provides maximum usage of spectrum. The use of spectrum sensing method shows efficient use of available spectrum and limited interference with the licensed primary users. This paper presents the advantages and disadvantages of different spectrum sensing methods, and compare them on the basis of operation, accuracy, complexity and implementations and defines various issues related to primary signal detection time, hardware requirements and computational complexities.

References
[1] Shahzad A. et. al. (2010), "Comparative Analysis of Primary Transmitter Detection Based Spectrum Sensing Techniques in Cognitive Radio Systems,'' Australian Journal of Basic and Applied Sciences, 4(9), pp: 4522-4531, INSInet Publication.
[2] Weifang Wang (2009), "Spectrum Sensing for Cognitive Radio'', Third International Symposium on Intelligent Information Technology Application Workshops, pp: 410-412.
[3] V. Stoianovici, V. Popescu, M. Murroni (2008), "A Survey on spectrum sensing techniques in cognitive radio" Bulletin of the Transilvania University of Brasov, Vol. 15 (50).
[4] Tevfik Yucek and Huseyin Arslan (2009), "A Survey of Spectrum Sensing Algorithms for Cognitive Radio Applications", IEEE Communication Surveys & Tutorials, VOL. 11, NO. 1, pp: 116-130.

[5] D. B. Rawat, G. Yan, C. Bajracharya (2010), "Signal Processing Techniques for Spectrum Sensing in Cognitive Radio Networks'', International Journal of Ultra Wideband Communications and Systems, Vol. x, No. x/x, pp:1-10.
[6] Ekram Hossain, Dusit Niyato, Zhu Han (2009), "Dynamic Spectrum Access and Management in Cognitive Radio Networks", Cambridge University Press.
[7] D.D.Ariananda, M.K.Lakshmanan, H.Nikookar (2009), "A Survey on Spectrum Sensing techniques for Cognitive Radio", Wireless VITAE'09, Aalborg, Denmark, pp: 74-79.
[8] Amir Ghasemi, Elvino S. Sousa (2008), "Spectrum Sensing in Cognitive Radio Networks: Requirements, Challenges and Design Trade-offs Cognitive radio communication and networks", IEEE Communication Magazine, pp: 32-39.
[9] Ian F. Akyildiz, Brandon F. Lo, Ravikumar (2011), "Cooperative spectrum sensing in cognitive radio networks: A survey, Physical Communication", pp: 40-62.
[10] Yonghong Zeng, Ying Chang Liang, Anh Tuan Hoang, and Rui Zhang (2010), "A Review on Spectrum Sensing for Cognitive Radio: Challenges and Solutions'', EURASIP Journal on Advances in Signal Processing Volume 2010, Article ID 381465, pp: 1-15.
[11] Beibei Wang and K. J. Ray Liu (2011), "Advances in Cognitive Radio Networks: A Survey'' IEEE Journal of Selected topics in Signal processing, VOL.5, NO.1, pp: 5-23.
[12] Simon Haykin, David J. Thomson, and Jeffrey H. Reed (2009), "Spectrum Sensing for Cognitive Radio'', IEEE Proceeding, Vol. 97, No.5, pp: 849-877.
[13] Bruce A. Fette, (2006), Cognitive Radio Technology, Newnes Publisher.
[14] Takeshi Ikuma and Mort Naraghi-Pour (2008), "A Comparison of Three Classes of Spectrum Sensing Techniques", IEEE GLOBECOM proceedings.
International Journal of Next-Generation Networks (IJNGN) Vol.3, No.2, June 2011 50
[15] Ekram Hossain, Vijay Bhargava (2007), "Cognitive Wireless Communication Networks", Springer.
[16] Linda Doyle (2009), Essentials of Cognitive Radio, Cambridge University Press.
[17] D. Cabric, A. Tkachenko, and R. Brodersen, (2006) "Spectrum sensing measurements of pilot, energy and collaborative detection," in Proc. IEEE Military Commun. Conf., Washington, D.C., USA, pp: 1-7.
[18] S. t. B. S. M. Mishra, R. Mahadevappa, and R. W. Brodersen (2007), "Cognitive technology for Ultra wideband / WiMAX coexistence," in Proc. IEEE Int. Symposium on New Frontiers in
Dynamic Spectrum Access Networks, Dublin, Ireland, Apr. pp: 179-186.
[19] A. Tkachenko, D. Cabric, and R. W. Brodersen, (2007), "Cyclostationary feature detector experiments using reconfigurable BEE2," in Proc. IEEE Int. Symposium on New Frontiers in Dynamic Spectrum Access Networks, Dublin, Ireland, Apr, pp: 216-219.
[20] R. Tandra and A. Sahai, (2005), "Fundamental limits on detection in low SNR under noise uncertainty," in Proc. IEEE Int. Conf. Wireless Networks, Commun And Mobile Computing, vol. 1, Maui, HI, June , pp: 464–469.
[21] R. Tandra and A. Sahai (2007), "SNR walls for feature detectors", in Proc. IEEE Int. Symposium on New Frontiers in Dynamic Spectrum Access Networks, Dublin, Ireland, Apr, pp: 559–570.
[22] Brodersen, R., Wolisz, A., Cabric, D., Mishra, S., Willkomm, D. (2004), "CORVUS: A
Cognitive radio Approach for Usage of Virtual Unlicensed Spectrum", Berkeley Wireless Research Center, white paper.
[23] Nabeel A., Hadaller, D., Keshav S. (2006), "GUESS: Gossiping Updates for Efficient Spectrum Sensing", ACM MobiCom Workshop, pp: 12-17.
[24] Thanayankizil L., Kailas, A., (2008), "Spectrum Sensing Techniques (II): Receiver Detection and Interference Management", http://aravind.kailas. googlepages.com
[25] F. Zeng, Z. Tian, C. Li (2010), "Distributed compressive wideband spectrum sensing in cooperative multi- hop cognitive networks", in: Proc. Of IEEE ICC 2010, pp: 1-5.
[26] Q. Zou, S. Zheng, A. Sayed (2009), "Cooperative spectrum sensing via sequential detection for cognitive radio networks", in: Proc. Of IEEE 10th Workshop on Signal Processing Advances in Wireless Communications, 2009. SPAWC'09, pp: 121-125.
[27] M. Di Renzo, L. Imbriglio, F. Graziosi, F. Santucci, (2009), "Distributed data fusion overcorrelated log- normal sensing and reporting channels: application to cognitive radio networks", IEEE Transactions on Wireless Communications pp: 5813-5821
[28] M. Di Renzo, L. Imbriglio, F. Graziosi, F. Santucci (2009), "Cooperative spectrum sensing over correlated log-normal sensing and reporting channel", in: Proc. of IEEE GLOBECOM, pp:1-8.
[29] A. Min, K. Shin, (2009), "An optimal sensing framework based on spatial RSS profile in cognitive radio networks", in: Proc. of IEEE SECON, pp: 1-9.

Development of low cost experiments for under-graduate laboratories: Study of Electro Maganetic Induction in Metallic Rings

[1]SAJAL SHARMA, [2]R.K.KHANNA AND [2]Y.K.VIJAY

[1]Department of Physics, Maharaja`s College, University of Rajasthan, Jaipur
[2]Department of Physics, Vivekananda Global University, Jaipur

E-Mail : rkkhanna.iitm@gmail.com

Abstract : Electro-magnetic induction is a part of science courses at school and college level. But not adequate facility is available in most of the schools and college to study these effects quantitatively. The purpose this work is to develop a simple apparatus to study electro-magnetic effects in a metallic rings of different conductors and of different shape. Results indicate that the induction depends on shape and cause change in the temperature of the material. Our aim is disentangling the different theories "knotted" by textbooks and pointing out the different models underlying these different theories. This case study takes into account ideas, models, devices and theoretical problems connected to the study electromagnetism. Special attention is paid on the problem of shape.

Khoj
An Interdisciplinary
Journal of Research
ISSN : 2349-8749
Vol. 2, No. 1
2015
pp. 64-74

Introduction

Experiment presented reported in the paper are based on-

1.1 Faraday's Laws

1.1(a) Faraday's First Law: Any change in the magnetic field of a coil of wire will cause an emf to be induced in the coil. This emf induced is called induced emf and if the conductor circuit is closed, the current will also circulate through the circuit and this current is called induced current.

1.1(b) Faraday's Second Law: It states that the magnitude of emf induced in the coil is equal to the rate of change of flux that linkages with the coil. The flux linkage of the coil is the product of number of turns in the coil and flux associated with the coil.

.

$$E = N\frac{d\phi}{dt}$$

Where flux in Wb = B.A
B = magnetic field strength
A = area of the coil

1.1(c) How to Increase Emf Induced in a Coil:

• By increasing the number of turns in the coil i.e N- From the formulae derived above it is easily seen that if number of turns of coil is increased, the induced emf also gets increased.

• By increasing magnetic field strength i.e B surrounding the coil- Mathematically if magnetic field increases, flux increases and if flux increases emf induced will also get increased. Theoretically, if the coil is passed through a stronger magnetic field, there will be more lines of force for coil to cut and hence there will be more emf induced.

• By increasing the speed of the relative motion between the coil and the magnet - If the relative speed between the coil and magnet is increased from its previous value, the coil will cut the lines of flux at a faster rate, so more induced emf would be produced

1.2 Lenz's Law:

Lenz's law states that when an emf is generated by a change in magnetic flux according to Faraday's Law, the polarity of the induced emf is such, that it produces an current that's magnetic field opposes the change which produces it.

The negative sign used in Faraday's law of electromagnetic induction, indicates that the induced emf ( ) and the change in magnetic flux ($_B$) have opposite signs.

Where = Induced emf and $_B$ = change in magnetic flux
N = No of turns in coil

1.2(a) Reason for Opposing Cause of Induced Current in Lenz's Law:

• As stated above, Lenz's law obeys the law of conservation of energy and if the direction of the magnetic field that creates the current and the magnetic field of the current in a conductor are in same direction, then these two magnetic fields would add up and produce the current of twice the magnitude and this would in turn create more magnetic field, which will cause more current and this process continuing on and on leads to violation of the law of conservation of energy.

• If the induced current creates a magnetic field which is equal and opposite to the direction of magnetic field that creates it, then only it can resist the change in the magnetic field in the area, which is in accordance.

2.0 Details of Apparatus:
2.1 Induction Coil:

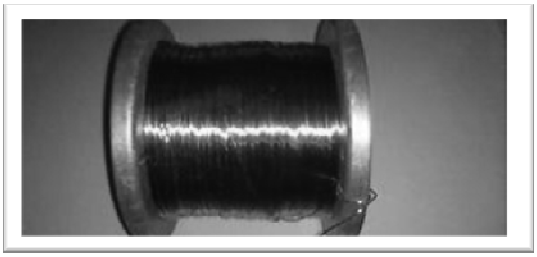


Fig.1-COPPER COIL (Gauge 22, Waight-1.4 Kg)

Firstly we prepared a solenoid as shown in Fig. 1, binding the copper wire. In the centre a plastic pipe of about one feet length was tightly fixed in this solenoid. This pipe was feed tightly with the cycle wheel spokes for better magnetic coupling. A very was used to feed the induction coil with variable voltage/current .These were measured with the help of meters continuously. Temperature variation in the sample was monitor with the help of thermo couple setups. Details of apparatus are shown in fig.2 .This apparatus works on the basis of famous scientist "FARADAY LAW" that any change in the magnetic field of a coil of wire will cause an emf to be induced in the coil. This emf induced is called induced emf and if the conductor circuit is closed, the current will also circulate through the circuit and this current is called induced current. Measuring rings of different sample were placed in the extended long pipe of one foot and are of diameter equal to the diameter of the extended coil (just loose fit to avoid the friction)

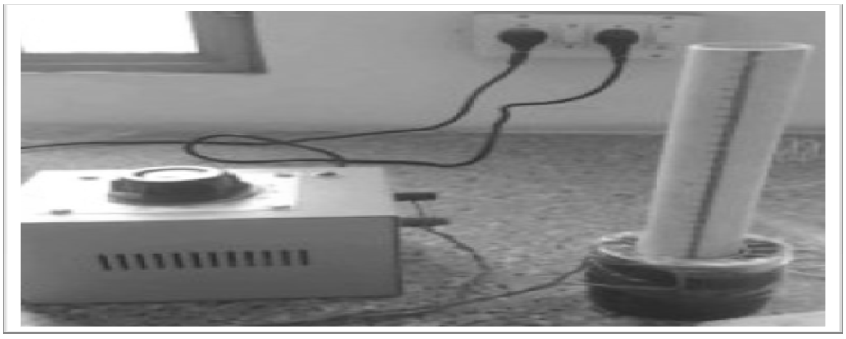


Fig.2-Apparatus developed for induction study

3. SAMPLES UNDER STUDY:

3.(a) ALUMINUM RINGS:

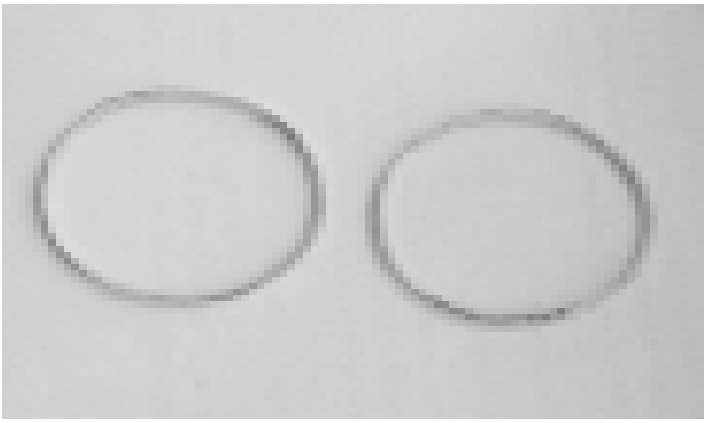


Fig.3- ALUMINUM RINGS

Material-Aluminum,Diameter-4.5 cm,NO. Of Rings- 5,Weight of each-1.120 gm and total weight was : 4.520 gm,Magnetic Properties –Paramagnetic,Mass Magnetic Susceptibility-7.8,Molar Magnetic Susceptibility-2.1,Specific Heat-904 J(Kg K)

3. (b) COPPER RINGS:

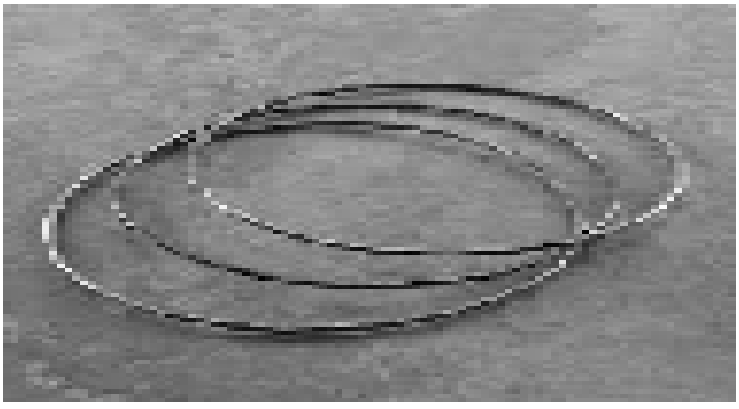


Fig.4-COPPER RINGS

Material- Copper,Diameter- 4.5cm, NO. Of Rings- 2,Weight- One-1.560gm and total weight was : 3.120 gm,Magnetic Properties-Diamagnetic,Mass Magnetic Susceptibility= -1.08,Molar Magnetic Susceptibility=6.86

3.(c) Aluminum Disk:

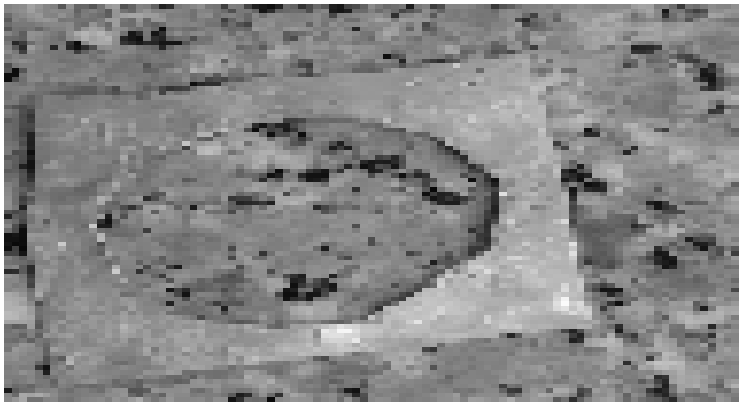


Fig.5- ALUMINUM DISK

Material-Aluminum,Diameter Of Circle-4.5cm,Disk Length- 6.5 cm,NO. Of Disk-4,Weight- One- 2.560 gm and total weight was : 10.120 gm,Magnetic Properties – Paramagnetic,Mass Magnetic Susceptibility-7.8,Molar Magnetic Susceptibility-2.1,Specific Heat-904 J(Kg K)

4. MEASUREMENT AND OBSERVATION

4.1 Observation - WITH ALUMINUM RINGS:

TABLE 1.1- INDEX OF Al. RINGS AT 140 VOLTAGES ON THE

INDUCTION COIL:

S. NO.	NO. OF RINGS	HEIGHT VARIATION (cm)
1.	1	1
2.	2	3
3.	3	4
4.	4	5
5.	5	6

TABLE 1.2-INDEX OF ALUMINUM RINGS AT 160 VOLTAGES ON THE INDUCTION COIL:

S. NO.	NO. OF RINGS	HEIGHT VARIATION (cm)
1.	1	2
2.	2	4
3.	3	5
4.	4	6
5.	5	7

TABLE 1.3-INDEX OF ALUMINUM RINGS AT 220 VOLTAGES ON THE INDUCTION COIL:

S. NO.	NO. OF RINGS	HEIGHT VARIATION (cm)
1.	1	4
2.	2	6
3.	3	8
4.	4	9
5.	5	10

4.2 Observation - Temperature variation and induction in rings

TABLE 2.1- INDEX OF 2 ALUMINUM RINGS AT 160 VOLTAGES ON THE INDUCTIONCOIL:

S. NO.	TEMPRATURE (C)	HEIGHT VARIATION (cm)
1.	35'	5

2.	37	4
3.	39	3
4.	41	3
5.	43°	3

TABLE 2.2- INDEX OF 4 ALUMINUM RINGS AT 160 VOLTAGES ON THE INDUCTIOCOIL:

S. NO.	TEMPRATURE)	HEIGHT VARIATION (cm)
1.	35	7
2.	37	6
3.	39	5
4.	41	5
5.	43	5

4.3 Observation - Temperature and time:

TABLE 3.1- INDEX OF 2 ALUMINUM RINGS AT 160 VOLTAGES ON THE INDUCTIOCOIL:

S. NO.	TIME (sec.)	TEMPRATURE (c)
1.	30	40
2.	50	43
3.	70	
4.	90	
5.	120	

4.4 OBSERVATION - WITH COPPER RINGS:

TABLE4.1- INDEX OF 2 COPPER RINGS ON THE

INDUCTIONCOIL:

S. NO.	VOLTAGE (volt)	HEIGHT VARIATION (cm)
1.	140	0
2.	160	0.5
3.	180	1
4.	200	1.5
5.	220	2

4.5 OBSERVATION - WITH ALUMINUM DISK:

TABLE 5.1- INDEX OF 1 ALUMINUM DISK ON THE

INDUCTIOCOIL:

S. NO.	VOLTAGE (volt)	HEIGHT VARIATION (cm)
1.	140	0
2.	160	0.5
3.	180	1
4.	200	2
5.	220	3

TABLE 5.2- INDEX OF 4 ALUMINUM DISK ON THE

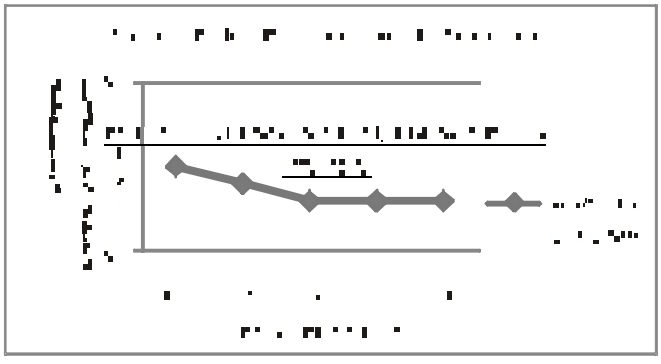
INDUCTIOCOIL:

S. NO.	VOLTAGE (volt)	HEIGHT VARIATION (cm)
1.	140	2
2.	160	3
3.	180	4
4.	200	5
5.	220	6

Discussion

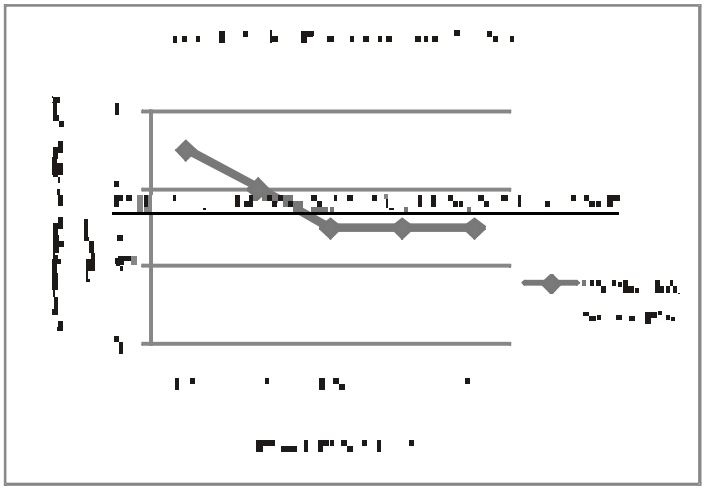
Induced effects in different samples are measured in terms of lift against gravity due to electromagnetic induction. Study of the results presented in above mentioned tables indicates that this lift is different for as number of rings increases and it decreases with more rings. This is due more weight involved in the experiment. Temperature of rings found to increase and finally attend constant value. This rise in temperature is due to the flow of induced currents in the rings and depends on the resistivity of the materials.

CURVE 1:

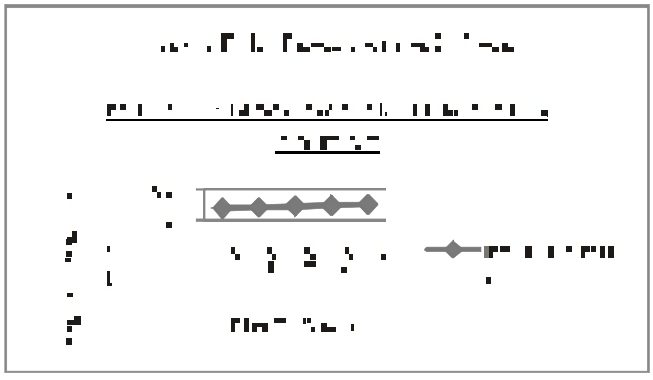


Curve 1shows the Effect of temperature on the sample got saturated after some time. Rings variation is more at normal room 35°c temperature and as the room temperature increases, it decreases the rings variation of height to 35°c-39°c. After sometime rings variation value remain same irrespective of temperature.

CURVE2:



Curve 2 shows the Effect of temperature on the sample got saturated after some time. Rings variation is more at normal room 35°c temperature and as the room temperature increases, it decreases the rings variation of height to 35°c-39°c. After sometime rings variation value remain same irrespective of temperature. It also shown that increase no. of rings does not effect on measurement.



Curve 3 shows that as time increase, it increases the temperature, at 30-50 sec. temp. 40°c and that's per 20sec. 3°c temp. Increase last at 120sec. temp. 52°c .

Conclusion

The apparatus developed and presented is low cost and easy to assemble. It can be use for the inside of electromagnetic inductions effects demonstration and quantitative measurements. Results indicate that the electromagnetic induction is

proportional to the current in the induction coil. Height variation which is proportional to the induced voltage is material dependent. Interesting observations had been made which shows the induction depends on shape and cause change in the temperature of the material. Effect of temperature on the sample got saturated after some time. This project related experimental work is quite interesting and helps to clarify the basic concept of electromagnetic induction.

Acknowledgements

Authors are thankful to the management of VGU for allowing to do this project by the student of other institution and providing facilities. This work is done under the DST Inspire project.

Reference

[1]. H.H SUNG, Zero-voltage switching induction heating power supply, Power System
[2] Electromagnetic induction principle by Faraday, Michael; Day, P. (1999- 02-01)
[3] Lenz's law was first proposed by Heinrich Lenz (1804–1864)
[4] University Physics , Harris Benson, John Wiley(1996)
[5] Berkeley Physics Course, McGraw Hill(1995) a. Vol. 1- Electricity and Magnetism (E.M. Purcell)

Kerr Electro-Optical Study at 632.8 nm for Water-Dioxane

R.K.KHANNA[1] AND GEETA GARG[2]

[1]Department of Physics, Vivekananda Global University, Jaipur
[2]Department of Physics, Govt. College, Ajmer

E-Mail: rkkhanna.iitm@gmail.com, geeta.goyal1981@gmail.com

Abstract : The Kerr constant of water and water-dioxane mixture were measured using 2 s electronic pluses up to 70 MV cm^{-1} at 632.8 nm. Details of experimental setup and signal detection technique are presented. Results are presented for pure water and water-dioxane system over their complete concentration range. Measured value of Kerr constant of deionised water is 1.47 to 1.52 x 10^{-7} and dioxane is 0.056 x 10^{-7} at 25° C. Conductivity of the system under study was simultaneously measured and results are reported here.

Introduction

Most isotropic liquids become birefringent when subjected to a strong electric field and phenomenon is known as Kerr effect[1].The origin of such effect is the preferred orientation of the molecules of the fluid in a permanent electric field. Such orientation makes the medium of which these molecules are part, optically anisotropic. The induced birefringence is a quadratic function of field strength i.e.

$$n_p - n_s = \lambda \mathbf{B} E^2$$

(1) Where n_p and n_s are the refractive indices for radiation with electric vector parallel and perpendicular to the applied field, is the wavelength of light used. B is known as Kerr constant. This equation for the purpose of Kerr constant measurement[2] can be written as

$$\delta = 2\pi BLE^2$$

(2) Where . is relative retardation between parallel and perpendicular components of light for birefringent liquid sample of length L. Depending upon the nature of sample . can be positive or negative and hence B.

Many organic liquids and their solutions in non-polar liquids have been subjected to dielectric[3-5], ultrasonic[6] and electro-optical Kerr constant measurements[7-10].These measurements have been successfully used to explore molecular structure and inter-molecular interactions[11-14]. Initially this technique was restricted to study for non-conducting or/and very low conducting systems[15,16]. With the development of low field pulse techniques macro-molecules of biological interest in conducting and non-conducting media, have been subjected to these measurements in order to elucidate the behaviour of complexes formed in the solutions[17-19]. In the case of

Khoj
An Interdisciplinary
Journal of Research
ISSN : 2349-8749
Vol. 2, No. 1
2015
pp. 75-81

simple molecules in conductive media like water, this technique remains virtually unused because of associated problem in measurements.

Due to importance in many branches of science as well as in our everyday life, liquid water has been the subject of intensive theoretical and experimental investigations[20]. Over the years, spectroscopy has served as one of the most important means to extract its molecular level information. The frequency-domain methods, e.g., depolarized Raman scattering (DRS)[21,22], microwave[23] and IR absorption[24-26], and more recent time-domain techniques, e.g., optical Kerr effect (OKE) spectroscopy[27,28] have been used to probe the inter- and intra-molecular dynamics and their role in connection with thermodynamic and structural properties of liquid water. Molecular dynamics investigations of structural, electronic and dynamical properties of water in supercritical carbon dioxide had been made by Saharay and Balasubramanian[29]. Their results shows a blue shift in the bending mode of water and CO_2 molecules which are present in the first neighbour shell of water are found to influence results.

The water- dioxane system is one of considerable interest since their physical properties like freezing point; boiling point, heat of vaporization etc are quite similar[30]. Dioxane is in many respects a remarkable substance. In accordance with its symmetrical structure dioxane has a very small dipole moment which possibly even may be equal to zero[31]. Yet dioxane is completely miscible in all proportions with such a highly polar compound as water and quite large quantities of strong electrolytes are needed to salt it out.

Apparatus

2.1 General

The essential requirements for the experimental set up in this study was the high sensitivity to measure the low Kerr constant of liquid like dioxane and its ability to cope with relatively high conductive liquids like water. A schematic diagram of the experimental arrangement is given in Figure 1. The light source is a 2 mW cw He-Ne laser (. =632.8 nm). The polarizer and analyzer are Glen Thompson prisms. The beam successively passes through the Kerr cell, firstly filled with the standard liquid CS_2 and then filled with the sample liquid under study.

The Kerr cell must be kept in optical alignment with its electrodes parallel. The polarizer and analyzer are crossed and set in such a way, so that the plane of polarization of the light makes an angle 45^0 with the direction of electric field between the plates in the cell. The light transmitted by the analyzer prism (during the application of the electric field) is measured by the photomultiplier tube. The noise level (optical) is reduced by enclosing the whole arrangement with in a black light box[32].

2.2 Kerr cell

A diagram of the Kerr cell is shown in Figure 2. It is constructed from Pyrex glass with stainless steel electrodes and Teflon spacers, locators etc. The overall length of the cell is 150 mm while the diameter is about 40 mm. The side tubes allow entry of the high voltage and also filling of the cell. The ends of the cell are constructed from Pyrex optical flats which must be carefully fused to the main body of the cell at 90^o to the cell axis. The cell temperature is controlled by passing liquid at the appropriate temperature through the outer glass jacket. The electrodes which are of semicircular cross-section are highly polished. They are separated by 1-3 mm and are of 90 mm in length for the cell used in the present study.

The cell design allows filling of the cell while keeping the electrodes vertical under partial vacuum, thus avoiding bubble trapping in the electrode gap, particularly in the measurement of water[33].

Experimental Method

The water used for the study was double distilled and further purified by passing through an ion exchanger resign deioniser. Dioxane used in this study was of

reagent grade and obtained from BDH Ltd. It is used directly without further purification. The conductivity of dioxane was about 2 x 10^{-9}.

For the determination of Kerr constant the optical intensity measuring technique has been used. Bean and Stevenson[36] replaced the optical components of ellipticity by measurements of optical intensities for the study of Kerr effect using photo-cells or photo-multiplier tubes.

The intensity of light passing through an analyzer[37] in the Kerr effect study is

$$I = I_o \left[Cos^2(\alpha - \beta) - Sin\,2\alpha \cdot Sin\,2\beta \cdot Sin^2\left(\delta/2\right) \right]$$

(3) Where and ▮ are the angles made by the planes of vibration of the transmitted light of polarizer and analyzer with the line of force of the applied electric field between the Kerr cell electrodes containing sample under study.

If during the experiment polarizer and analyzer are adjusted in such a way as to make angle = ▪/4 and = -▪/4 (which is usually the case for birefringence measurement experiments) then one get from above equation

$$I = I_o Sin^2 \delta/2$$

When ▪ is small $I \approx I_o \left(\delta/2\right)^2$

(4) From Eqs, (2) and (4), we get

$$I = I_0 \pi^2 B^2 L^2 E^4$$

(5) According to this equation, plot I v/s E^4 is a straight line with zero intercept. The slope
of this curve is

$$Slope = M = I_0 \pi^2 L^2 B^2$$

(6) The strong electric fields, first in increasing order and then in decreasing order are applied to the Kerr cell, firstly filled with the CS_2 and then with the sample under study. Curve I v/s $E^{4,}$ is plotted for different observations taken at different value of electric field for CS_2 and sample liquid separately and then slopes are determined. A representative plot is shown in Figure 4.

According to Eq. (6), for carbon disulphide and sample under study -

$$(M)_{cs_2} = I_0 \pi^2 L^2 B_{cs_2}^2 \quad (7)$$

$$(M)_{liq} = I_0 \pi^2 L^2 B_{liq}^2 \quad (8)$$

From Eqs. (7) and (8),

$$B_{liq} = \left[\frac{(M)_{liq}}{(M)_{cs_2}}\right]^{1/2} B_{cs_2}$$

(9) Now from the known values of Kerr constant of carbon disulphide (Bcs_2 =3.24 x 10^{-14} mV^{-2}) and ratio of slopes M_{liq} and $Mcs_{2,,}$ the value of Kerr Constant of liquid sample under study was estimated. In the analysis, account has been taken of any residual birefringent present in the optical system. The estimated uncertainty in the Kerr constant was within 3%.

Discussion of Results

1, 4- Dioxane is clear, colourless, flammable, hydroscopic liquid and its molecular formula is $C_4H_8O_2$. 1, 4- Dioxane often called dioxane because the other isomers are rare[42]. Dioxane is fully miscible in water and known to forms azeotrope with it[43]. Physical properties of dioxane are such as molar mass (M) 88.11 $gmol^{-1}$, boiling point (bp) 101.1^{0}C, melting point (mp) 11.8^{0}C, density at 20 C(d_4^{20}) 1.0336g/mL and refractive index at 20 C (n_d^{20}) is 1.4224.

1, 4 -Dioxane is commonly used as a solvent. Acute inhalation exposure to high levels has caused vertigo, headache, anorexia etc [44]. Dioxane-water mixture represent an important case since the dioxane oxygen's have exposed ps hybrids and the molecule is likely to form strong hydrogen bonds at approximately the same angle as the hydrogen bonds in water [45]. Measurements of electro-optical Kerr effect of dioxane dissolved in water have been under taken in order to find the effect of these hydrogen bonds on the measured value of Kerr constant. Measured results on water dioxane system are plotted and shown in Figure 5

Inspection of results shown in Table 2 and Figure5, for water-dioxane system indicate that the value of Kerr constant decreases slowly up to about 0.06 mole fraction of dioxane in water and then it start increasing showing three peaks at 0.07 , 0.18 and 0.26 mole fraction of dioxane in water. With a fractional increase in dioxane concentration, it starts decreasing approaching the value of pure dioxane. Variation of conductivity of this system as a function of dioxane mole fraction in water is shown in Figure 6.

The conductivity of the mixture also increases first sharply up to 0.03 mole fraction of dioxane in water and then rapidly decreases up to 0.18 mole fraction with the addition of dioxane in water. Finally it reaches the value of dioxane, nearly zero. There is marked increase in the value of conductivity of system, many folds as compared to pure water, up to about 0.18 mole fraction of dioxane.

The marked sharp peak of Kerr constant B v/s f (mole fraction of dioxane in water) curve at about 0.18 mole fraction (see Table 2 and Figure 5) suggests the possibility of the formation of a particular configuration in water-Dioxane system with high anisotropy. Nature of this complex requires further investigations employing different techniques High field, non- linear dielectric measurements[46] suggested the one form of hydrogen bonding between water and dioxane is

The peak value of B at 0.18 mole fraction i.e. near composition $(C_4H_8O_2)_2.H_2O$ indicates that this transition is specially favoured by a hemihydrates complex.

The turning point in the G v/s f graph [Figure 6] display the water-dioxane system at 0.94 mole fraction of water is similar to one observed for water- alcohols system by Brown and Jones[49]. They correlated this behaviour with the structure enhancing role of small addition of solute in water and cluster formation. Observed behaviour in the present measurement on water-dioxane system may be weakly suggested due to formation of clusters. Kerr constant studies alone on this water-dioxane system may not be sufficient and additional studies based on spectroscopy etc are further require confirming reported finding and the nature of complexes and clusters.

Acknowledgement

One of the authors RKK thanks the VGU management for encouraging research work. GG thanks to the Principal of Government College, Ajmer for providing facilities for doing this work.

References

[1] Winkler K (2000) J. Chem. Phys. 113 4674
[2] Buckingham A D and Orr B J Q (1967) Rev. Chem. Soc. 21 195
[3] Krishna T V, Sastry S S and Murthy V R K (2011) Indian J. Phys. 85 1495
[4] Chavan S D, Watode B D, Hudge P G, Suryawanshi D B, Akode C G, Kumbharkhane A C and Mehrotra S C (2010) Indian J. Phys. 84 419

[5] Joshi Y S, Hudge P G and Kumbharkhane A C (2011) Indian J. Phys. 85 1603
[6] Nath G and Paikaray R (2009) Indian J. Phys. 83 1309
[7] Bursulaya B D and Kim H J (1997) J. Phys. Chem. 101 10994
[8] Skaf M S and Vechi S M (2003) J. Chem. Phys. 119 2181
[9] Perry A, Ahlborn H, Space B and Moore P B (2003) J. Chem. Phys. 118 8411
[10] Neto J M and Villaverde A B (1996) J. Phys: Condens. Matter. 8 2791
[11] Prezhdo O V, Switek L, Zubkova V V and Prezhdo V V, (2005) Acta Phys. Polonica A 108 429
[12] Hyun B R, Dzyuba S V, Bartsch R A and Quitevis E L (2002) J. Phys. Chem. A 103 7579
[13] Lavrenko P N, Kolomiets I P, Andreeva L N, Belyaeva E V, Gribanav A V, Kalnin K K and Makarova N N (2006) Poly. Sci. Series A 48 547
[14] Wiewior P P, Shirota H and Castner E W (2002) J. Chem. Phys. 116 4643
[15] Lazarevic Z, Radosavljevic R, Pesic M and Osmokrovic P (2006) J. Opto. Electro. Advan. Materi. 8 1273
[16] Singh G, Choudhary A, Vijaya Prakash G and Biradar A M (2010) Phys. Rev. E 81 051707
[17] Foggi P, Righini R and Williams J H (1994) J. Phys. Chem. 98 7692
[18] Scodinu A and Fourkas J T (2003) J. Phys. Chem. B 107 44
[19] Xiao D, Rajian J R, Li S F, Bartsch R A and Quitevis E L (2006) J. Phys. Chem. B 110 16174
[20] Flriano W B and Nascimento M A (2004) Braz. J. Phys. 34 1
[21] Mizoguchi K, Hori Y and Tominaga Y (1992) J. Chem. Phys. 97 1961
[22] Heisler I A and Meech S R (2010) Science 327 857
[23] Mashimo S, Miura N and Umehara T (1992) J. Chem. Phys. 97 6759
[24] Osawa M, Tsushima M, Mogami H, Samjeske G and Yamakata A (2008) J. Chem. Phys. C 112 4248
[25] Rao G R (2004) Bul. Mater. Sci. 27 497
[26] Kindt J T and Schmuttenmaer C A (1996) J. Phys. Chem. 100 10373
[27] Hunt N T, Jaye A A and Meech S R (2007) J. Chem. Phys. 9 2167
[28] Zhong Q and Fourkas J T (2008) J. Phys. Chem. B 112 15529
[29] Saharay M and Balasubramanian S (2009) Indian J. Phys. 83(1) 13
[30] Rabani E, Gezelter D and Berne BJ (1997) J. Chem. Phys. 107 6867
[31] Surprenant K S (2000) Ullmann's Encyclopedia of Industrial Chem.
[32] Kolling O W and McMillan D (1964) J Trans. Kasas Academy Sci. 67 31
[33] Khanna R K and Sharma P K (1988) Czech. J. Phys. 38B 346
[34] Le Fevre C G and Le Fevre R J W (1972) Physical Method Chem. Vol. I Pt. IIIC
[35] Khanna R K, Dempsey E and Parry Jones G (1978) J.Phys E: Sci. Instrum. 11 1210
[36] Beams J W and Stevenson E C (1931) Phy. Rev. 38 133
[37] Konak A C Czeh. (1974) J. Phys. 24 10
[38] Orttung W H and Meyers J A (1963) J. Phys. Chem. 67 1905
[39] Hebner Jr R E (1975) Bull. Am. Phys. Soc. 20 684
[40] Aroney M J, Battoglia M R, Ferfoglia R, Millar D and Pierens R K (1976) J. Chem. Soc. Faraday Trans. II 72 724
[41] Kreilein M M, Eppich J C and Paquelte L A (2005) Organic Syntheses 82 99
[42] Thalhammer F, U Wallfaher and J Sauer (1990) Tetrahedron Lett. 31 6851
[43] Harvey D F, Grenzer E M and Gantzel P K (1994) J. Am. Chem. Soc. 116 6719
[44] Cincinnati O H (1999) Am Con. Govt. Indu. Hygienists (ACGIH) Biological Exposure Indices
[45] Chaudhari A (2010) Int. J. Quantum Chem. 110 1092
[46] Bradley P A, Jones G P, Kolodziej H A and Davies M (1975) J.C.S. Faraday – II 71 1200
[47] Cennamo F and Tartaglione E (1966) Nuovo Cimento 11 401
[48] Khanna R K, Dempsey E, Parry Jones G and Davies M (1978) Opt. Commun., 27 88
[49] Brown B L and Parry Jones G (1975) J.C.S. Faraday-II 71 1877

Optical Transmittance Study of Selenium Thin Films

KSHITIJ GOVIL[1], R.K.KHANNA[2] AND Y.K.VIJAY[2]

[1]Department of Physics, Manipal University, Jaipur
[2]Department of Physics, Vivekananda Global University, Jaipur

E:mail : rkkhanna.iitm@gmail.com

Abstract : Selenium is an element of the chalcogen family, and its amorphous form has wide chemical applications. Six electrons in the outer valence shell of these chalcogen is a common factor, and lend semi-conducting and varied optical properties to selenium.
We investigate through, the use of light emitting diodes, as sources of consistent and high chromaticity radiation spanning various bands in the optical spectrum, and use it to study the transmittance properties of thin film optical filter in a spectrophotometric set up. Results of the study are presented. We propose a low cost set up in instrumentation of new age spectrometers, and hope to work on improving it in the future. Thin film filters of a variety have been used to validate the setup.

Khoj
An Interdisciplinary Journal of Research
ISSN : 2349-8749
Vol. 2, No. 1
2015
pp. 82-90

Introduction

1.1 Propagation of Light in Matter

Materials that transmit light are usually non-ferromagnetic. Typically, metals (that exhibit ferromagnetism), absorb (then re-emit) most part of the electromagnetic spectrum (except X-rays and ▪-radiation).This is owed to their partially filled energy bands, and the utilization of incident energy to excite their electrons to higher levels. The speed of light in matter can be conveniently expressed as

$$v = \frac{1}{\sqrt{k_m k_e}} \cdot \frac{1}{\sqrt{\mu_0 \varepsilon_0}} = \frac{c}{\sqrt{k_m k_e}} \quad \text{; ..... (1)}$$

Where

k_m = Relative Permeability (Magnetic); k_e = The Dielectric Constant of the material; and μ_0 = Magnetic Constant (Vacuum Permeability)= 1.25663706 * 10^{-6} m kg s^{-2} A^{-2}

The dielectric constant is a measure of the response of the dipoles (permanent or induced) to an applied electric field. It is worth noting here that the dipoles may not have time to respond to high frequency fields, for e.g. to that of a light wave (at ▪= 10^{15} Hz)[1].

The propagation of light in matter is essentially a scattering phenomenon, i.e., is a result of the absorption of incident light, and then re-emission by atoms/molecules. It is also important to note that a wave scattered in the "transverse" direction causes complete destructive interference in that direction. This is the result of an alteration of the phase relationship. On the other

hand, a wave scattered parallel to the incident wave will result in a constructive interference pattern, with a phase different from the incident wave and a change in the velocity of light.

Another important phenomenon to be considered is that of dispersion. It is the result of the interference of the incident and scattered wave in a medium, when the electric field of light causes the atoms to oscillate with the frequency of the incident light. An interesting example being that the sunlight we are able to see, is not directly incident on our eyes, but dispersed from the air molecules just a few millimeters away. Dispersion is a direct result of the fact that different wavelengths travel at different velocities in a medium, for example, blue light travelling slower than the red wavelength[1, 2].

Further, when a beam of light encounters an interface, i.e. has to travel from one medium to another, both reflection and refraction occur. In case of the transmitted beam, refraction causes the beam to become bent (visibly broken), which as we have pointed out earlier, happens as the speed of light changes when it traverses through different media.

A very simple statement in the form of the "Snell's Law" explains the theory of light propagation between different media. We are told that the incident, the reflected and the refracted beam all lie in the same plane given by the plane of incidence, and,

$\theta_1' = \theta_1$…… (Incidence and reflection) Also,

$$n_1 Stn\theta_1 = n_2 Stn\theta_2 \ (Snell's\ Law)\ ;\ldots\ldots\ldots\ldots\ldots\ldots(2)$$

Where n_1 and n_2 are the index of refraction, which are themselves defined as the ratio of the speed of light in vacuum to that in the medium itself.

So $n = c/v$; …… (3)

C is the speed of light in vacuum and denotes the speed of light in the medium under consideration. Evidently, the index of refraction shall also be greater than unity as the speed of light in vacuum is the highest. The slower light travels in a medium, the higher the refractive index of the medium. By the above discussion, the refractive index of vacuum (and that of air too) is taken to be unity itself, and for a material like glass (Crown glass for example), the value of n stands at close to 1.52 .

It is also worth noting here that the index of refraction varies with the wavelength of the incident radiation too. It is for this reason that blue light bends at a far greater angle as compared to red light, (and travels slower) when traversing through the atmosphere. It is the same property that causes a prism to "disperse" light and resolve it into various component wavelengths .

The Scattering of light in all directions is better known as "diffuse" reflection, an example being that from a rough surface. The reflection from polished surfaces, essentially "mirror-like" reflections, is a result of the incident radiation with wavelengths greater than the size of the irregularities of the surface. This leads us to the important conclusion that the reflective properties of a surface also depend on the incident radiation (i.e. its wavelength)[3].

In the condition of grazing incidence, i.e., at angles of incidence b/w 60^o-90^o to the normal, the percentage of light reflected is fairly high, while at lower angles of incidence, a balance begins to develop between reflection and transmission (via refraction). In conjunction with the property of angular dependence of reflection and refraction, we come across the property of total internal reflection, wherein at a certain critical angle, all incident light is reflected.

1.2 Optical Transmittance

From really early times, thin metal layers, and their interference and transmittance have been a subject of interest. Sir Isaac Newton's Newton rings gave the earliest of quantitative methods of understanding the colors of light, which in those days was a difficult phenomenon. As literatures quote, during the 19^{th} century, when Fraunhoffer made the first ever anti-reflection coatings, he had done so merely by observing the effect on glass of prolonged exposure to atmosphere. He was also the first to distinguish differences between vertical and oblique incidence of light[7].

As of today, the knowledge of transmittance properties is being used to characterize materials, to understand their structure, and almost any research on thin films can attempt to study optical properties of such filters using complex measurements and set ups for transmittance analysis.

To understand the performance of any thin film filter, it is necessary to know that amplitude reflectance of light at any boundary between two media is given by $(1 - \eta)/(1 + \eta)$, where η is the ratio of the optical admittances at the boundary, which, in the optical region, is also the ratio of the refractive indices. On the other hand reflectance (the ratio of irradiances) is the square of this quantity. Also, there is a phase shift of 180^0 when the reflectance takes place in a medium of lower refractive index than the adjoining medium and of zero if the medium has a higher refractive index than the one adjoining it[7, 8].

We investigate through this project, the use of Light Emitting Diodes, as sources of consistent and high chromaticity radiation spanning various bands in the optical spectrum, and use it to study the transmittance properties of any thin film optical filter in a spectrophotometric set up. We hope to present an extremely low cost option in instrumentation of new age spectrometers, and hope to work on improving it in the future.

A brief account of the various instruments and their legacy is presented first. The as available models of the same are then discussed. A very simple but effective experimental setup has been devised and explained. Thin film filters of a variety have been used to validate the setup, and the "as is" results have been reported and discussed.

1.3 Spectrometry and Spectrometers

Spectrometry techniques involving UV-Visible radiation, nuclear magnetic resonance and the Infra-red are strong analytic techniques that allow both qualitative and quantitative measurements of the interaction of electromagnetic radiation with matter. Data is usually presented in the form of a plot, or sometimes as a spectrum of absorbed energy versus the incident radiation/energy. Fundamental information about the atomic and molecular levels, chemical bonding and reaction mechanisms, and even molecular geometry have been made easy with the introduction of commercial spectrometers. Spectral analysis stands out as a valuable and practical technique to characterize and analyze even newly synthesized compounds and optical characterization of thin film filters [3,4].

Sir Isaac Newton in 1666 worked on his ever famous "Rings" to study the nature of light, and concluded that light was composed of various wavelengths (colors), that could bend differently through a prism. Modern day Spectrometry owes its origin to this discovery.

Almost one and a half centuries later Sir William Wollaston improved upon the procedure using a narrow slit (as opposed to the round aperture), and presented a series of spectral lines as the images of the slit representing different colors and also observed the dark lines in the sun's spectrum. While Joseph Van Fraunhoffer worked tirelessly to improve upon this set up and observed over 500 dark lines in the solar spectrum, it was not until 40 years later that a satisfactory explanation was made handy[9,10].

In 1859, Gustav Kirchhoff, proposed a simple but strong explanation of the fraunhoffer lines. He stated that if any substance efficiently emitted a particular wavelength, it was equally capable of absorbing the same wavelength. So the solar dark lines (absorption) were characteristic of the part of the spectrum that the gases in the outer "cooler" layer of the sun, which they were capable of emitting if excited.

It shall not be an exaggeration to say that, 150 years down the road, all of the science of spectroscopy is but a diligent extension of this basic phenomenon.

Spectroscopic measurement instruments are designed over a wide range of applications and cost, catering to challenges primarily in chemical analysis. The severalaspects of spectroscopy measurements evolved at fairly spaced times during the 19th and 20th century. The modern day spectrometer broadly the following components:

- A source that generates a broad band of electromagnetic radiation
- A dispersion device that selects from the broadband radiation of the source a particular wavelength (or, more correctly, a waveband)
- A sample area
- One or more detectors to measure the intensity of radiation

Lenses or mirrors may be housed on a need basis to relay light through the instrument.

Amorphous Selenium

Selenium is an element of the chalcogen family, and its amorphous form has wide chemical applications. Six electrons in the outer valence shell of these chalcogen is a common factor, and lend semi-conducting and varied optical properties to selenium[5]. Selenium in solid state is known to exist in three forms, i.e., trigonal, monoclinic, and amorphous forms in nature. It is an excellent photoconductor, and its commercial applications along with its alloys lies in vidicon photoconductor material. Its films are easily grown using vapor deposition techniques, and it is interestingly cheap for large scale commercial productions. Selenium boasts of a low melting point, and high vapor pressure, and has taken lead in memory, rectifier and switching applications. Its semi-conducting properties are famously realized along with cadmium as CdSe thin films, which are a group II-VI semiconducting compound which crystallizes in two forms, i.e., a cubic form (c-CdSe) with sphalerite structure and a hexagonal form (h-CdSe) with wurtzite structure. At low temperatures, the wurtzite phase is known to exist which transforms to the sphalerite phase at 700-800^{o}C[11-18].

2.1Selenium Film Fabrication:

Vacuum Coating technique was used for fabricating amorphous selenium thin films of thickness varying from 20 nm to 145 nm on glass substrates. A stacked Silicon dioxide coated selenium thin film of 145 nm thickness each was also coated. Selenium coating was also done on eyewear quality (Essilor) ™ 40% blue polycarbonate substrate of 100 nm and 145 nm each.Figures below display the as grown films along with the vacuum coater set up.

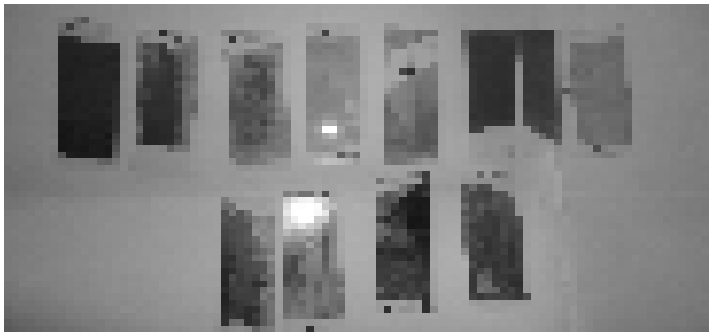


Fig.1. Selenium Amorphous thin films of varying thickness and ZnS 100 nm

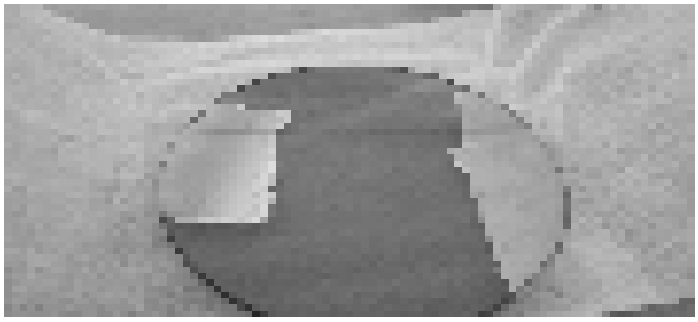


Fig.2. Selenium coating 145 nm(left) and 100 nm (right) on polycarbonate blue eyewear.

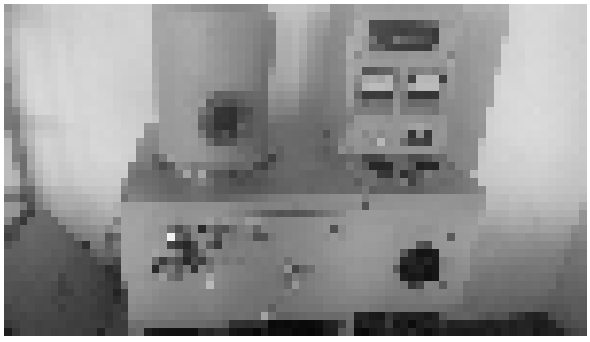


Fig.3. Vacuum coating machine front panel and dome

LED Interaction with Color Filters and Laboratory fabricated thin films
Building upon the previous work, we have followed suit and used other color filters and laboratory fabricated thin films of selenium to record the transmittance response of various color LEDs.

Fig.4. Yellow LED light on various color filters

It is hence noted that the yellow LED experiences minimum intensity attenuation to a yellow filter and the Indigo color happens to cut the maximum of the yellow wavelength thereby letting near zero intensity. As is the case with a yellow LED, even the red LED experiences maximum intensity attenuation by an indigo filter. Explicitly and convincingly so, the red and the yellow filters seem to be in exact confirmation of attenuation levels with respect of a Red LED.The green LED on various color filters yields interesting results for us to analyze. As opposed to the usual trend of the same color gel filter allowing maximum intensity of the color LED to pass through, in the case of a green LED, the response of a yellow color gel filter is better as compared to that of a green LED, in terms of transmittance. As may be appreciated, the percentage attenuation of the red and yellow light is significantly less in the case of Selenium Polycarbonate coatings, with the white following almost a middle path between the various filter responses. The Blue LED enjoys maximum "passage" through the polycarbonate blue coating, and a drastic fall in the same for selenium coatings.

Fig.5. Percentage Analysis of "As Grown" Amorphous Selenium Films

The as grown amorphous (not annealed) selenium films show a clearly dominant attenuation of the Blue LED light, and are fairly supportive (Transmitter) of the Red LED light. We may conclude the Selenium films with stacking of favorable may be used to attenuate the Blue Region effectively and hence the UV radiation also.
Then Silicon Di-oxide stacked selenium amorphous thin films shows a reasonably high support to the Blue LED light, thus indicating possible band pass properties at carefully grown "145 nm" thickness as a quarter wave stacking to progressively favor radiation at 580 nm. Also, the as grown selenium (with the exception of outliers on the graph), have shown reasonably consistent reduction of the transmittance from 20 nm to 100 nm. Careful growth and annealing of selenium

films with high precision nano thickness control can reveal the half transmittance thickness.

Discussion and Conclusion

It is worth noting that the conversion of Lux Intensity to watts is only described at 555nm, i.e. the green light wavelength, and hence more standard text is sought for other wavelengths.

The use of colored LEDs and color gel act as a good qualitative and low cost reference to identifying the transmittance properties of any thin film filter, and the same can be confirmed by employing the more complex and expensive analysis equipment if need be.

Though these are expected results, this confirms our procedure of using simple color filters to detect/stop specific wavelengths/bands, especially while using a particular color/near band LED, as a spectrophotometric set up to test transmittance properties of any thin film/optical filter in general.

While the band that a film stops/transmits can be nearly "identified" by the various color LEDs, the approximate magnitude of attenuation can be arrived at using the flux meter reading itself. A further test with a diffraction grating can hence allow us to get a closer value of the transmittance properties of any random thin film. We propose a low cost set up in instrumentation of new age spectrometers, and hope to work on improving it in the future. Thin film filters of a variety have been used to validate the setup.

Acknowledgements

Kshitij Govil of Manipal University, Jaipur is thankful to the \Management of VGU for providing facilities to do this research work in the Physics Department of the University for a semester long. He is thankful to all the facility and technical staff of the Physics for the support without which this was not possible.

References

1. Holonyak, N. Jr., and S.F. Bevaqua. Coherent (visible) light emission from GaAs P junctions. Applied Physic Letters 1(4): 82–83 (1962). Thomas, N.C.,
2. ."The Early History Of Spectroscopy", Journal Of Chemical Education, Vol.68, No.8, August 1991, p.p.631-6343.
3. Richard P. Feynman, "Plenty of Room at the Bottom"; Talk at the American Physical Society, Pasadena, December 29, 1959
4. Drexler, K. Eric (1992). Nano-systems: Molecular Machinery, Manufacturing, and Computation. New York: John Wiley & Sons.
5. Zeng, S.; Baillargeat, Dominique; Ho, Ho-Pui; Yong, Ken-Tye (2014). "Nanomaterials enhanced surface plasmon resonance for biological and chemical sensing applications". Chemical Society Reviews (2008) 43 (10): 3426-3452.
6. Krames, M.R., Light-Emitting Diode Technology for Solid-State Lighting, The Bridge, Winter (2009)
7. Beardsley N. *et.al*. "Solid-State Lighting Research and Development Multi-Year Program Plan" , (2014)
8. R. N. Hall, G. E. Fenner, J. D. Kingsley, T. J. Soltys, and R. O. Carlson, "Coherent light emission from GaAs junctions" General Electric Research Laboratory, Schenectady, New York, Physical Review Letters, Sep. 1962, pp.366-368
9. Kim H.H., et.al., "Inverted Quantum Dot Light Emitting Diodes using Polyethylenimine ethoxylated modified ZnO", Scientific Reports, 5 : 8968 | DOI: 10.1038/srep08968, March 2015

10. Morgado J., et.al, "Organic Light Emitting Diodes", Instituto de telecomunicacoes, www.lx.it.pt POCI/QUI/58291/2004
11. Macleod H.A., "Thin Film Optical Filters", CRC Press 4th Edition, 2010
12. Young H.D., Freedman R.A., "University Physics with Modern Physics" 13th Edition, 2012
13. Thomas, N.C., "The Early History Of Spectroscopy", Journal Of Chemical Education, Vol.68, No.8, August 1991, p.p.631-634
14. Owen, T., "Fundamentals of Modern UV-Visible Spectroscopy", Agilent Technologies Primer, 2000
15. Mulama A.A. *et.al.* "Investigation of the effect of film thickness on the optical properties of amorphous Se_{85}-xTe_{15}Sbx thin films" Africa Journal of Physical Sciences Vol.1 No.1 2014.
16. Singh M., Bhahada K.C., Vijay Y.K., "Variation of optical band gap in obliquely deposited selenium thin films", Indian Journal of Pure & Applied Physics Vol. 43, February 2005, pp 129-131
17. Tan W.C., "Optical Properties of Selenium Films", Thesis copyright Wee Chong Tan , Department of Electrical Engineering, University of Saskatchewan, Saskatoon, 2006.
18. Roy R., Choudhary V.S., Patra M.K., Pandya A., "Effect of annealing temperature on the electrical and optical properties of nano-crystalline selenium thin films", Journal Of Optoelectronics And Advanced Materials Vol. 8, No. 4, August 2006, p. 1352 – 1355

Metal Hydrides : Hydrogen Storage and Applications

MAHESH K. JANGID

Department of Physics
Vivekananda Institute of Technology, Jaipur

E-mail : jangid.mahesh@vitj.ac.in

Abstract : Metal hydrides are a safe alternative for hydrogen storage due to their long term stability and low hydrogen pressures. In addition, they have a high volumetric energy density that is about 60% higher than that of liquid hydrogen. The behavior of hydrogen in metals has attracted scientific attention for many decades and is interesting from both basic research and technological points of view. Metal hydrogen systems are utilized for energy-storage system, in sensor applications and in catalysis. The hydrogen solubility of M-H system is strongly affected by the morphology and microstructure and the stress between regions of different hydrogen concentration.

Introduction

One of the burning problems in science & technology as of today is a depleting sources of conventional energy. We are consuming more oil, gas, coal & wood then can be produced by nature. One negative factor of all these sources is that they add to the already polluted environment. Hydrogen is such a fuel when burnt in air produces a clean form of energy. Hydrogen is the most abundant element on earth, is of enormous importance as a feed stock in chemical industry with a world wide annual production of over million tons currently & an assumed potential for an accelerated growth. In recent years hydrogen is an anticipated to become the cleanest energy vector of the future & it has been projected as an energy carrier and petroleum substitute fuel[4-6].

One of the best merits of hydrogen as an energy vector is its high gravimetric energy density, i.e. its calorific value per unit weight. In future hydrogen become a complete substitute for the important fossil fuel petroleum. One of the most attractive features of hydrogen as a fuel is that its primary raw material is water. Thus it can be produced from water through solar energy or any other form of energy it can be described as a primary energy source even though it does not occur as such in nature. The non-polluting aspects of hydrogen are special significance for the most parts of the world[6,8].

Khoj
An Interdisciplinary
Journal of Research
ISSN : 2349-8749
Vol. 2, No. 1
2015
pp. 91-98

Hydrogen the most abundant element in the universe has great potential as an energy source. Storage of hydrogen in hydride form uses an alloy that can absorb and hold large amounts of hydrogen by bonding with hydrogen and forming hydrides[13]. Hydrogen is the ideal means of energy storage for transportation and conversion of energy in a comprehensive clean-energy concept. However, appropriate storage facilities, both for stationary and for mobile applications, are complicated, because of the very low boiling point of hydrogen (20.4 K at 1 atom) and its low density in the gaseous state (90 g/m^3). Furthermore, the storage of hydrogen in liquid or gaseous form imposes safety problems, in particular for mobile applications, e.g.the future zeroemission vehicle[16].

One of the striking properties of hydrogen in metals is its large mobility. At room temperature its diffusion coefficient can be as high as 10^{-5} cm^2/s i.e. a value almost comparable to diffusion in liquids. This high mobility exists because the hydrogen atoms occupy interstitial positions in the host lattice[14].

Among metal hydrides the Mg hydrides are considered as one of the most attractive hydrogen storage materials, mainly because of its high storage capacity (7.6 wt% in MgH_2 because magnesium reacts reversibly with hydrogen) lightweight and low cost[1]. However, because of its high thermodynamic stability (H = -75 kJ/mol) , high hydrogen desorption temperature (higher than 400^0C) and relatively poor hydrogen absorption/desorption kinetics at temperatures below 350^0C, the use of Mg in technological applications is impeded by Huiberts et al. in 1996. Recently, ball milling and mechanical alloying have been developed for processing nanocrystalline Mg (~10 nm) under a hydrogen gas environment in order to reach special advantages such as improving the thermodynamic and kinetic properties of hydriding[7].

Brief Review on Metal Hydrides

For many decades the great majority of experiments on metal-hydrogen systems were carried without actually looking at the samples. The electrical resistivity, specific heat, pressure-composition-isotherm, neutron and x-ray scattering carried out many authors. But optical measurements could only be carried out for certain hydrides. For example, Weaver et al. Measured in detail the reflectivity of dihydrides of Sc,Y and La but could not extend their interesting measurements to the trihydrides of Y and La. This is unfortunate since the pioneering work of Libowitz et al. on Ce-hydrides had demonstrated the existence of a metal-insulator transition between CeH_2 and CeH_3. In Y and La, however, hydrogenation from the dihydride to the trihydride leads irrevocably to the powdering of bulk samples[9, 10].

In 1995 the Amsterdam group observed the optical and electrical properties of metal-hydride films of yttrium and lanthanum near their metal insulator transition. The dihydrides are excellent metals and shiny,

while the trihydrides are insulators and transparent in the visible part of the optical spectrum. The metal insulator transition from a shiny to a transparent state is reversible and simply induced at room temperature by changing the surrounding hydrogen gas pressure or electrolytic cell potential. Not only YH_x and LaH_x, but also all the trivalent rare-earth hydrides and even some of their alloys exhibit switchable optical and electrical properties. In the transparent state they have characteristic colours: for example, YH_3 is yellowish, LaH_3 red, while some alloys are colourless[11,15].

One of the most surprising results of these early measurements was, however, that the films retained their structural integrity even though they expanded by typically 15% during hydrogenation of the pure parent metal to the tri-hydride. This meant that for the first time physical properties, such as electrical resistivity, Hall effect, optical transmission, reflection and absorption, were mean able to experimental investigations. This leads to the discovery of new phenomenon in the electrical, optical and magnetic properties of these materials. Furthermore, the possibility to fine tune their properties by alloying and the ease to change continuously their hydrogen content made them especially attractive for fundamental condensed matter physics[3,10].

M.Singh et al done lot off work on bylayer thin films metal hydride, they have observed variations of electrical resistivity in thin films with hydrogenation and structural variations[5,8].

In 1996 Huiberts et al.discovered the dazzling optical changes of yttrium and lanthanum upon the absorption of hydrogen. On exposure to hydrogen, a switchable mirror thin film changes from reflecting to transparent while undergoing a metal-to-insulator transition. All rare earth and Mg alloyed rare earth metal hydrides possess these properties. In 2001, Richardson et al found that alloys composed of Mg and transition metals like Ni, Co, Fe and Mn are also switch reversible, while in bulk samples hydrogenation requires high temperatures (500 to 600K) and pressure of 10^5 to 10^6Pa, for thin film it occurs readily at room temperature at low pressures when they are capped with a thin Pd layer. This class of materials does not involve rare-earth metals and might therefore be more resistant to oxidation. This is especially important for applications[2,9].

Hydriding of Metal

There are two possible ways of hydriding a metal, direct dissociative chemisorption and electrochemical splitting of water. These reactions are, respectively[20].

$$M + \frac{x}{2} H_2 \leftrightarrow MH_x$$

and

$$M + \frac{x}{2} H_2O + \frac{x}{2} e^- \leftrightarrow MH_x + \frac{x}{2} OH^-$$

where M represents the metal. In electrochemical splitting there has to be a catalyst, such as palladium, to break down the water.

A schematic of hydrogen chemisorption is shown in Fig. 1. As shown in the figure, the molecular hydrogen reaches a shallow potential minimum near the surface and the atomic hydrogen a deeper minimum almost at the surface. In the metal lattice hydrogen has periodic potential minimums in the interstitial sites of metal lattice. This behavior is explained below and is visualized in Fig. 2. As a hydrogen molecule approaches the metal surface, weak van Der Waal's forces begin to act upon it drawing it closer. The molecule reaches the potential well Ep at distance Zp, and very large forces would be required to force it any closer the surface in a molecular form. However, the dissociation energy of hydrogen molecule is exceeded by the chemisorption energy. Thus the hydrogen molecule dissociates and individual hydrogen atoms are attracted to the surface by chemisorptive forces and they reach the potential well ECH. From this point sometimes even the ambient temperature's thermal energy is enough to increase the vibrational amplitude of hydrogen atoms which can thus reach and enter the metal surface[18].

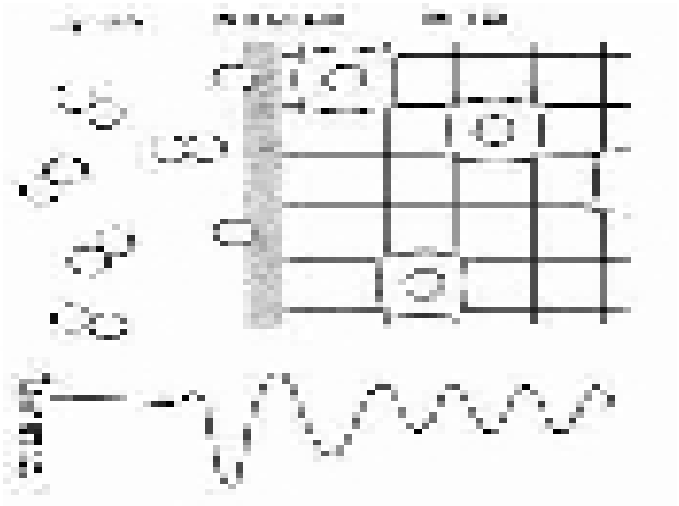


Fig. 1 Schematic diagram of hydrogen chemisorptions on metal [19]

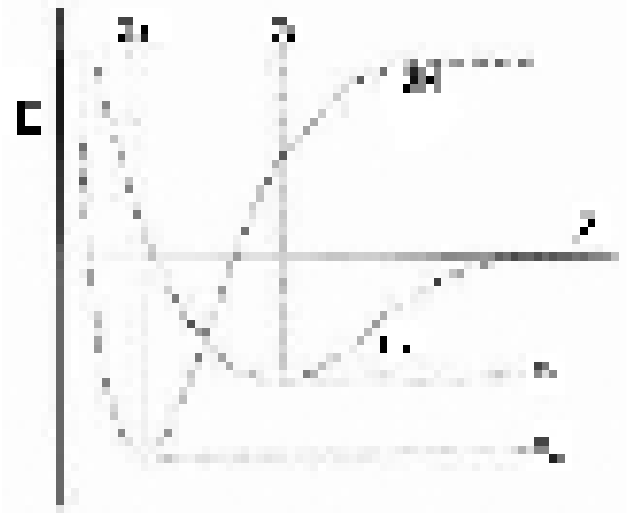


Fig. 2 Potential wells of molecular and atomic hydrogen [21]

Applications of metal hydride devices

1. Switchable mirrors as indicator layers

The hydrogen transport is possible through thin film metal hydride systems. Because thin film metal hydrides could not reduced in power form at higher concentration and also provide us fact charging-discharging rate of hydrogenation but bulk hydrogen system reduced to power of high hydrogen concentration, So understanding and manipulation of hydrogen transport through film is important for the control and optimization of coatings and thin film devices such as hydrogen detectors, metal hydride switchable mirrors or tunable magnetic elements. The fact that switchable mirror films have optical properties that depend strongly on hydrogen concentration offers the possibility to use them as two dimensional hydrogen concentration indicators[8,9].

2. Smart Windows

Smart coatings can play an important role in reducing the energy consumption of building and cars. In the USA about 30% of the primary energy consumption is used for heating /cooling/lighting of residential and office building several active and passive window coating have been proposed so far. In general one would like to regulate the solar power input, while maintaining visibility. Hence the optical properties of the visible range should be different from those of the long wavelength range of the solar spectrum. To minimize heat input while maintaining outward visibility one could use windows reflectivity light between 0.5-1.65 eV. This would reduce the cooling need for buildings considerably. The fact that switchable metal hydride are able to block incoming radiation over the

whole solar spectrum, make them of interest to use in cars i.e. to reduce the thermal load of parked cars[9].

3. Switchable Absorbers:

Devices based on MgNi films have a potential as variable reflectance coatings. Recently Van Mechelen et al. showed that these materials have an optical absorption contrast over the solar range of a factor 2, comparing the metallic Mg_2Ni to the black $Mg_2NiH_{0.8}$ state. As the black body emissivity at 100 ^{0}C is smaller than 15% for this material, the black state is an interesting heat absorber. There is a present need for such variable reflectance metal hydride (VAREM) coatings particularly for use in combined photovoltaic cells/thermal solar collector devices. The variable reflectance metal hydride (VAREM) insert in between photovoltaic cell and thermal solar collector. When the thermal load of the system becomes too high, the variable reflectance metal hydride (VAREM) is also beneficial to heat collecting wall inside buildings: These so called Trombe-walls allow an optical use of solar energy during all parts of the day in all seasons[9].

4. Fiber Optic Hydrogen Sensors

Presently, most of the hydrogen sensors available commercially are based on electrical measurements at the sensing point. This might be undesirable in potentially expensive & explosive environments. These disadvantages can be circumvented by using optical detectors in which the end of an optic fiber is coated with a hydrogen sensitive layer. The changes induced in the optical properties of this layer during absorption of hydrogen are detected optically at the other end of the fiber. Compared to other hydrogen sensors, optical fiber sensors have the advantage to be simple yet very sensitive, cheap, insensitive to electromagnetic noise, explosion safe, and to allow multiple sensing with one central (remote) detector. They are low cost and more resistant to corrosion than standard electrical wires[9].

5. Hydrogen storage systems for portable applications

The “hydrogen economy” concept dictates that appliances, which need electricity and / or power be, whenever possible, fed by hydrogen-consuming fuel cells. This calls for hydrogen-powered cars, trucks and electrical utility generators, down to mobile phones, laptop computers and camcorders. The scale of these applications is so wide as to make it virtually impossible to use only one system for all of them. The ton-wise hydrogen consumption of a Megawatt generator places different demands on hydrogen storage than what is necessary to power a mobile phone, which consumes just a couple of watts. Mobile hydrogen storage has been widely analyzed, not only by the scientific community, but also at the

political and industrial levels in lands as wide apart in interests as the USA, Iceland or Germany. In the former, a comprehensive set of requirements has been drafted, in order to steer research towards practical systems, with the potential to be sold to customers all over the country.

6. Metal hydrides for vehicular applications

In vehicular applications, a hydride storage tank can be used in many ways, such as for:

- Fuel supply;
- Air conditioning;
- Water condensation;
- Storing and recovering waste heat from engine;
- Auxiliary heating purposes.

7. Metal hydrides for thermal storage

Devices based on MgNi films have a potential as variable reflectance coatings. Recently Van Mechelen et al. showed that these materials have an optical absorption contrast over the solar range of a factor 2, comparing the metallic Mg_2Ni to the black $Mg_2NiH_{0.8}$ state. As the black body emissivity at 100^oC is smaller than 15% for this material, the black state is an interesting heat absorber. There is a present need for such variable reflectance metal hydride (VAREM) coatings particularly for use in combined photovoltaic cells/thermal solar collector devices. The variable reflectance metal hydride (VAREM) insert in between photovoltaic cell and thermal solar collector. When the thermal load of the system becomes too high, the variable reflectance metal hydride (VAREM) is also beneficial to heat collecting wall inside buildings: These so called Trombe-walls allow an optical use of solar energy during all parts of the day in all seasons[17].

References

1. 'Optical propertiesof MgH_2 measured in situ by ellipsometry and spectrophotometry' J.Isidorsson, I.A.M.E.Giebels, H.Arwin and R.Griessen Netherlands, Physical Review B 70 115112 (September 2003).
2. 'Mg-Ni-H films as selective coatings:Tunable reflectanceby layered hydrogenation' J.L.M.van Mechelen, B.Noheda, W.Lohstroh, R.J. Westerwaal, J. H. Rector,B. Dam and R. Griessen, Netherlands, Applied Physics Letters Vol.84 NO. 18 (May 2004).
3. 'Temperature dependence of magnetoresistance and Hall effect in Mg_2NiHx films' S.Enache, W.Lohstroh, and R.Griessen, Netherlands, Physical Review B 69 115326 (March 2004)
4. 'The kinetics of Cr Over layer coated on TiNi thin films for hydrogen absorption' M. Singh et al, Indian journal of Pramana 6,1,75 (2007).
5. 'Thickness dependent hydrogenation of obliquely deposited FeTi Thin films' M. Singh et al, International Journal of Hydrogen Energy 17, 29-35 (1992).
6. 'The effect of selenium layer coating and temperature dependence on TiNi thin films obliquely deposited for hydrogen absorption mechanism' M.Singh et al, Int.J.of hydrogen energy 16,477(1991)

7. 'Microstructural development in nanocrystalline MgH_2 during H-absorption/ desorption cycling'. D.Fataya, T. Spassovb, P. Delchevb, G. Ribarika, A. Revesza, Bulgaria International J. of Hydrogen Energy 32 (Feb 2007) 2914-2919.
8. 'The temperature dependence of FeTi and FeTiSz thin films obliquely deposited for the hydrogen absorption -desorption mechanism' M.Singh et al, International J. of Hydrogen Energy 16, 485-490 (1991).
9. 'Optical properties of metal-hydrides: switchable mirrors'. R.Griessen, I.A.M.E. Giebels, and B. Dam 15th June 2004.
10. 'Structural, optical, and electrical properties of $MgyTi_1$-yHx thin films'. D.M. Borsa, R.Gremaud, A.Baldi,H.Schreuders, J.H.Rector, B.Kooi, P.Vermeulen, P.H.L.Notten, B. Dam, and R.Griessen Physical Review B75 205408 (May 2007).
11. 'Structural and optical properties of Mg_2NiH switchable mirrors upon hydrogen loading'. W.Lohstroh, R.J.Westerwaal, J.L.M.van Mechelen,C.Chacon, E.Johansson, B. Dam, and R.Griessen, Netherlands, Physical Review B 70 165411(October 2004).
12. 'Localbonding structure in mechanically activated TiH_2 and TiH_2+graphite mixture' E.Z.Kurmaeva, O.Morozovab, T.I. Khomenkob, H. Osawae, T. Takeuchif, S. Shine, Germany, Japan International J. Of Alloys and Compounds 395(Jan 2005) 240-246.
13. 'Thermo dynamical, structural, hydrogen storage properties and simulation studies of P–C isotherms of (La,Mm) Ni_{5-y} Fe_y'. Rajesh Kumar Singh, M.V. Lototskyb, O.N.Srivastava, India International J.of Hydrogen Energy 32 (March-07) 2971-2976.
14. 'Switchable mirrors for visualization and control of hydrogen diffusion in transition metals' Remhof, S.J.van der Molen, A.Antosik, A.Dobrowolska, N.J.Koeman, and R. Griessen Physical Review B 66 020101(24 June 2002).
15. 'Isotope Effects in Switchable Metal-Hydride Mirrors'. A.T.M.van Gogh, E.S.Kooij, and R. Griessen Physical Review V 83 Number 22 (29 November 1999).
16. 'Highly absorbing black Mg and Rare–Earth-Mg switchable mirrors.' I.A.M.E. Giebels, J. Isidorsson, and R. Griessen, Netherlands, Physical Review B 69 205111 (May 2004).
17. Griessen R, Giebels IAME and Dam B. Optical properties of metal-hydrides: switchable mirrors, Ph.D thesis, 2004.
18. Carter T and Cornish L. Engineering Failure Analysis 2001; 8: 113-121.
19. Fischer P, Yvon K, Hydrogen in Intermetallic Compounds I, Ed. Schlapbach, Springer-Verlag, Germany 1988.
20. Sandrock GJ. Alloys and Compounds 1999; 293-295: 877- 888.
21. Christmann K. Hydrogen. Atomistics of Fracture Conference Proceedings, Eds. Latanision and Pickensr, Plenum, NY, USA 1981.

Numerical simulation of flow around a passenger car with back spoiler: A CFD analysis

REEMA JAIN[1], MANISH DADICH[2], RAKSHIT POKHARNA[3] AND SACHIN SHARMA[3]

[1]Department of Mathematics,Vivekananda Global University, Jaipur
[2]Department of Mechanical Engineering, Global Institute of Technology, Jaipur
[3]Student (4th Sem. Mechanical Engineering), Global Institute of Technology, Jaipur

Email : jain.reema@vgu.ac.in

Abstract : In the automotive industry is in continuous change. One aspect that is very important is the aerodynamic development of new vehicles, and this can be done experimentally or by numerical simulation. Due to the high costing of a general wind tunnel it becomes very difficult to carry out the simulation experimentally. Rapid developments in computational methods and computer hardware, lots of research has been carried out to study the aerodynamics behaviour of a car computationally. In this paper we will evaluate, using the computational fluid dynamics (CFD) software FLUENT, the flow around two different shaped cars, with or without back spoiler located at the rear end of a car. The study focuses on drag and lifts calculations using CFD-based velocity and pressure results. A two dimensional geometrical model of a passenger car was modelled. Spoiler was positioned on the rear end of the car. The wind speed is varied up to a certain limit in this study.

Keywords : CFD, Lift, Drag, Spoiler and Wind Tunnel

Khoj
An Interdisciplinary
Journal of Research
ISSN : 2349-8749
Vol. 2, No. 1
2015
pp. 99-105

Introduction

At present, high car speed in cities becomes more popular around the world and make huge accidents around the world. Aerodynamic characteristics of passenger car is therefore inevitably of significant interest. Well design of car back side obviously provides a reduction in car racing accident and fuel consumption. Because experimental study on aerodynamic of passenger vehicle is cost effective, considerable efforts have been invested to study vehicle aerodynamics computationally. In his study, different meshes, differencing schemes and turbulence models were used to avoid possible misleading in CFD analysis. Various researchers showed that the CFD results were encouraging for the Reynolds-Stress

model as importance of having anisotropic formulation of turbulence. The quality of k-e results is certainly very case dependent. It can only accidentally produce good results which may happen when the flow does not separate or slightly separates from the surfaces and where vertices are present on such positions that have no strong influence on the pressure distribution on the car. Author found that by adding a cover over the bed of the pickup truck can improve pressure recovery at the back of the tailgate and hence helps to reduce drag. This paper presents a numerical analysis of flow around modified racing car with spoiler positioned at the rear end using commercial fluid dynamics software FLUENT. The study focuses on CFD-based lift and drag prediction on the car body and an improvement in the design due to spoiler configurations.

CFD Model Setup

Figure 1 and Figure 2 show 2-D geometrical models of passenger car with and without spoiler respectively. Geometry of the wind tunnel was added around car body. Both cad designs were created in Auto CAD 2014 software and have the same symmetry plane with the racing car model as shown in Figure 3. A fine tetrahedral mesh was created in Ansys ICEM CFD which was shown in figure 4. This fine mesh is necessary to be able to capture aerodynamic effects around this important region. A size function in ICEM was applied to whole domain for adding more cells nearer to the racing car and lesser cells towards the less important areas at the outer edges of the wind tunnel.

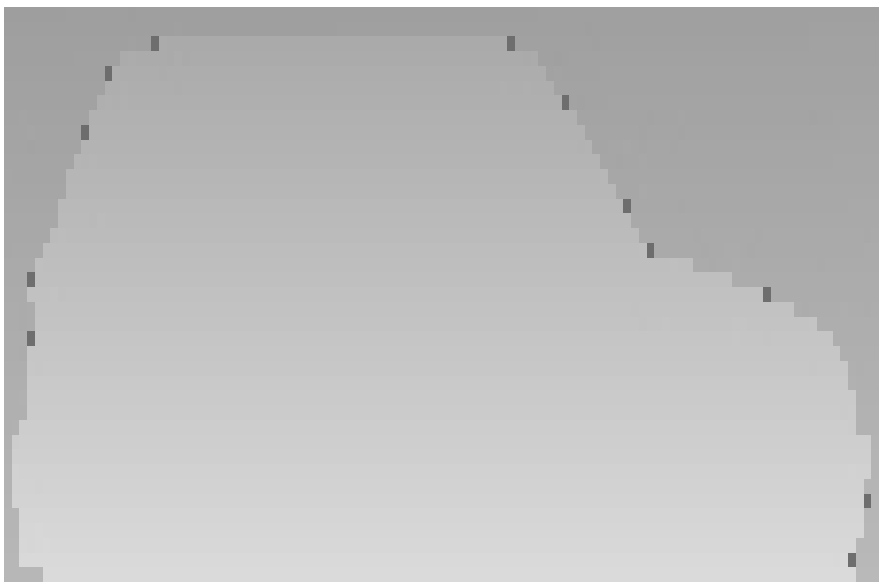


Fig. 1 Car geometry without Back Spoiler

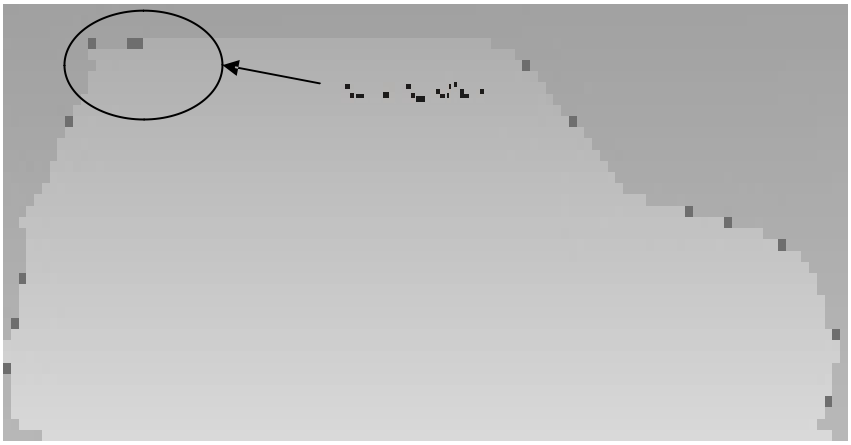


Fig. 2 Car geometry with Back Spoiler

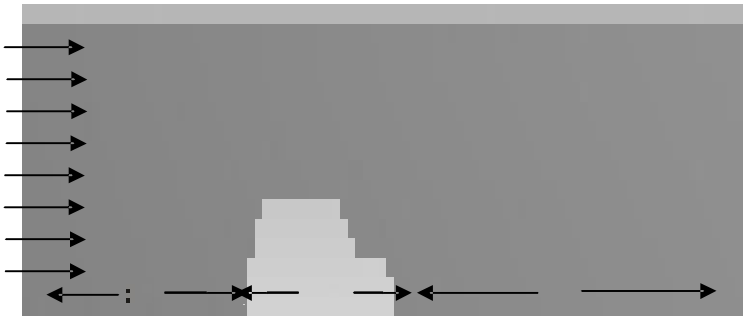


Fig. 3 Wind Tunnel for CFD Analysis

Boundary conditions for the domain were configured in ICEM CFD. The velocity of the air at the inlet was set in the range of 60 km/hr to 120 km/hr. The outlet boundary was set as pressure outlet at 0 Pa (gauge pressure). Surface of the racing car was set as wall. The density and viscosity of air are 1.225 kg/ m^3 and 1.7894 10^{-5} kg/ms respectively. As suggested by Basra 1999, the Reynolds-Stress model was used to capture turbulent flow. Residual conditions were all set to 10^{-3} for convergence criteria. Spoiler was positioned at the rear-end at 1 constant height and was adjusted to wind collision angles of -10 to -2 degrees at 2 degree increments.

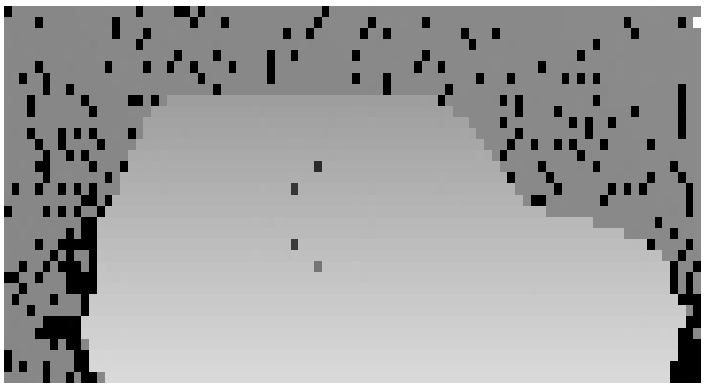


Fig. 4 Meshing of CFD domain

Various Cases for CFD Simulation
Case 1:
Air Velocity 50 km/h (14 m/s) in x direction, angle 0, 10, 20

Case 2:
Air Velocity 70 km/h (20 m/s) in x direction, angle 0, 10, 20

Case 3:
Air Velocity 100 km/h (28 m/s) in x direction, angle 0, 10, 20

Case 4:
Air Velocity 120 km/h (34 m/s) in x direction, angle 0, 10, 20

Results
3.1 Effects of passenger car speed on car body at 0degree(Velocity Contours)

Fig. 5 (a) Velocity Contours of Car with Back Spoiler having velocity 50 km/h

Fig. 5 (b) Velocity Contours of Car without Back Spoiler having velocity 50 km/h

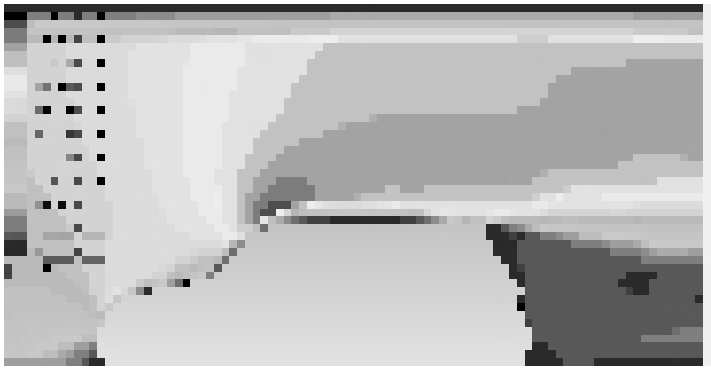


Fig. 5 (c) Velocity Contours of Car with Back Spoiler having velocity 70 km/h

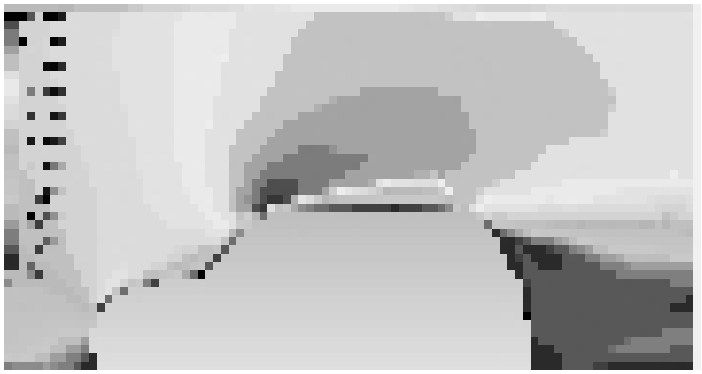


Fig. 5 (d) Velocity Contours of Car without Back Spoiler having velocity 70 km/h

3.2 Effects of passenger car speed on car body at various angles (Pressure Contours)

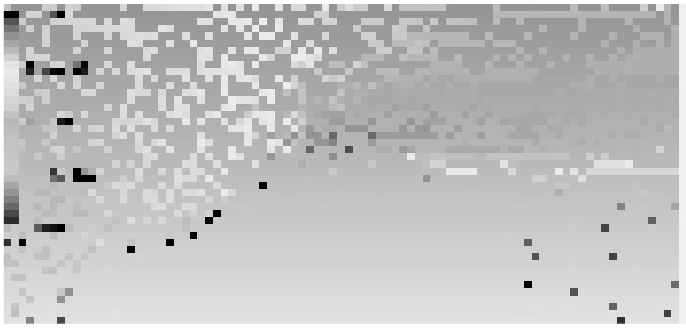


Fig. 6 (a) Vector of car with back spoiler having velocity 50 m/s

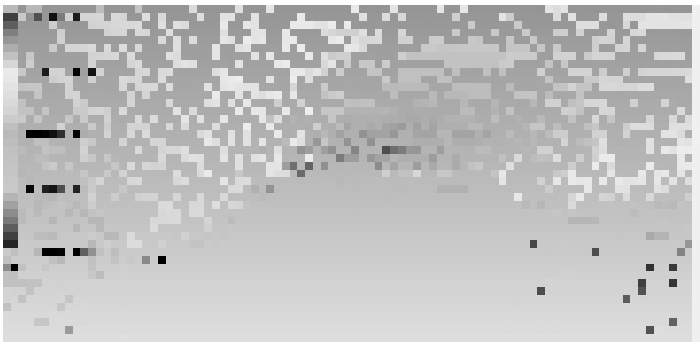


Fig. 6 (b) Vector of car without back spoiler having velocity 50 m/s

Pressure Distribution

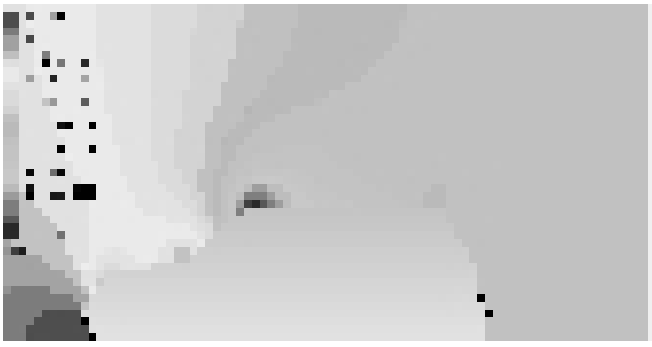


Fig. 7 (a) pressure Distribution at car having back spoiler at velocity 70 km/h

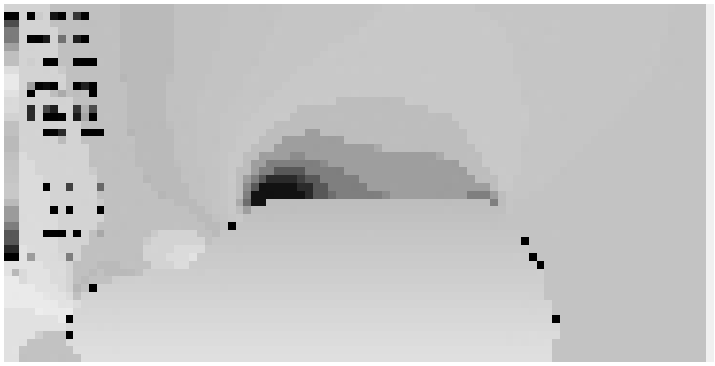


Fig. 7 (b) Pressure Distribution at car having without back spoiler at velocity 70 km/h

Conclusions

Computational Fluid dynamics simulation using FLUENT 14.5 to predict flow around passenger car has been achieved. It is clear from the results obtained that at a certain height of spoiler and wind collision angle, the change in CD is negligible as the speed of the passenger car increases. However the downward force acting on the passenger car with the spoiler at the rear-end increases significantly lower as the speed of the passenger car increases. Moreover the lower spoiler height tends to gives both higher CD and CL. Finally it was found that at a particular passenger speed and spoiler height, CD and CL increase as the angle of wind collision increases.

References

[1] B. Basara, Numerical Simulation of Turbulent Wakes around a Vehicle, "ASME Fluids Engineering Division Summer Meeting", California, USA, 1999

[2] Jeff MaungKyaw, Computational Analysis of the Flow about a Pickup Truck Model, Michigan, USA, 2004.

Treatement Of Industrial Wastewater Using Solar Photolysis

Dr. RUPALI SHRIVASTAVA[1], Dr. SHARMILA POKHARNA[2]

[1]Department of Chemistry, Vivekanand Global University, Jaipur, Rajasthan,India
[2]Department of Chemistry, Anand International College of Engineering, Jaipur, Rajasthan,India

E-mail: shrivastava. rupali@vgu.ac.in

Abstract : The objective of this research was to study utility of photosensitization process for the removal the dyestuff from textile industry wastewater. The treated water can be made suitable to be reused in the same industry or for domestic purpose and/ or irrigation. In this study, the photocatalytic decolorization of five collected samples from the source point outlet of textile industry to 500m away from the source were studied. For method development commercial samples of different azo and cremazole textile dyes commonly used in textile industries of Sanaganer region in Rajasthan were used. Photocatalytic activity of titanium dioxide, zinc oxide and manganese oxide were examined under natural weathering conditions in presence of sunlight. The effect of various operational parameters such as catalyst concentration, type of catalyst, type of dye, pH, temperature and time were investigated.

Photolysis and photocatalytic treatments were carried out over a suspension of titanium dioxide, zinc oxide and manganese oxide under solar irradiation. The progress of treatment stages was followed spectrophotometrically at different wavelength. Under optimal conditions, the extent of decolorization was 90% after different periods of time ranging from 10 to 100 minutes. The decolorization percentages differ with the difference in type of dye used in textile industry. The results indicate clearly that titanium dioxide could be used efficiently in photocatalytic treatments of textile industrial wastewater and reduce the levels of BOD , COD, turbidity, TDS and alkalinity.

Key Words : Solar photolysis, Photocatalytic reactions, Industrial wastewater, Titanium dioxide, Zinc oxide, Decolorization efficiency.

Khoj
An Interdisciplinary Journal of Research
ISSN : 2349-8749
Vol. 2, No. 1
2015
pp. 106-112

Introduction

In India water shortage is being recognized as one of the most serious political and social issues. In this research paper we have tried to use availability of sunlight as a key for solving this problem to some extent. Quite a large amount of water could be saved by recycling industrial wastewater by applying photosensitization process.

Textile industries are dispersed widely in Sanganer region of Jaipur which consume huge amount of water and industry effluents are mostly discharged into the environment after minimal pretreatment with a high amount of pollutants[1]. The release of these coloured waste waters in the environment is a considerable source of non esthetic pollution and eutrophication and can originate dangerous byproducts through oxidation, hydrolysis and other chemical reactions taking place in the waste water phase[2].

Out of different physical, chemical and biological as well as the various combinations of pre-treatment and post-treatment techniques used for industrial wastewaters treatment photocatalytic degradation processes are gaining importance[3-4]. Photocatalytic processes have benefit that it result in complete mineralization with operation at natural conditions of temperature and pressure[5]. After studying previous investigation reports[6-7]on decolorization photodegradation, and phytoremediation of many water soluble toxic compounds in industrial wastewater it was found that the treated wastewaters could be recycled in the same industry or reused in another industry or for agricultural fields. The efficiency of these methods of treatments is between 70-95 %.

Experimental

For the present study of assessment of water quality, Sanganer industrial area, Jaipur, Rajasthan state was selected(longitude $95^0$24 E; latitude $27^0$18 N). This area is principally involved in manufacturing and trade of textile products principally cotton for more than 50 years. The area lack proper drainage system and as a result of this, all the industrial waste water effluents are drained into the Amanisha canal which effects the near by irrigation agricultural products and the quality of ground water. Water samples from these areas were collected and designated S1 –S_5. Samples were collected from the source point outlet of finishing unit at Sanganer industrial estate (S_1), 100 m away from source point(S_2), 200m away from source point(S_3), 400m away from source point (S_4) and 500m from source point. Standard procedure (spot sampling) were followed during sampling. All the samples of the effluent were collected in sterile, dry and properly stopper polypropylene bottles. Temperature of the effluent was determined at the spots, whereas, the rest of physiochemical parameters were determined using standard methods, instantly after bringing the samples in the research lab.

Method development for photoreduction of textile dyes was carried out using UV-Visible double beam spectrophotometer. TiO_2 P2570% , MnO and ZnO were taken of AR grade. Dyes as direct dyes Violet and Congo Red and Cremazoles- Orange 3R and Blue S1 were used as dying agent at random basis from local Sanganer textile industry. Dye solutions were prepared by dissolving 10mg dye powder in 100ml of distilled water. max of individual dyes were determined in the range of wavelength from 300 nm to 750 nm, the results ar shown in table 1.

Dye	¶ max.
Violet dye	545 nm
Congo red	495nm
Blue S1	570nm
Orange 3R	490nm

Table 1: ¶ max of individual dyes

Result and Discussion

Physiochemical status of colored effluent samples collected from AMANISHA NALA showed a considerably high load of pH, TSS, TDS, BOD, COD, turbidity, color intensity, alkanity and temperature compared to prescribe National Environmental quality Standards(NEQS). However there was observed a significant decline in the values of the physiochemical parameters from source to sink. Apparently, the effluent sample collected were blue to black in color, giving pungent smell and varying temperature[28-51^{0}C]. The variance in values is shown in Table II.

TABLE II
Physiochemical characterization of textile effluent samples compared with National Environmental Quality Standards (NEQS)

PARAMETERS	UNITS	NEQS LIMIT	SAMPLE(1)	SAMPLE(2)	SAMPLE(3)	SAMPLE(4)	SAMPLE(5)
PH	-	**6-9**	**11.9**	**9.2**	**8.9**	**7.7**	**6.63**
Alkalinity	-	**200**	**640**	**520**	**430**	**350**	**230**
TDS	mgL^{-1}	**2000**	**3540**	**2562**	**1853**	**1448**	**1231**
TSS	mgL^{-1}	**40**	**76**	**62**	**53**	**48**	**42.8**
BOD	mgL^{-1}	**80**	**1088**	**713**	**503**	**342**	**160**
COD	mgL^{-1}	**250**	**1650**	**1420**	**1122**	**934**	**700**
Turbidity	NTU	**5**	**36**	**32**	**29**	**26**	**25**
Electric conductivity	µs/m	**0.5**	**3.84**	**2.43**	**1.07**	**1.01**	**0.083**
Temperature	^{0}C	-	**49.0**	**31.8**	**35.7**	**29.5**	**21.0**

For method development, photodegradation percentage of the dye was followed spectrophotometrically by a comparison of the absorbance, at specified interval

times, at known wavelengths. 1 ml of each of the photocatalyst (TiO_2, ZnO, MnO) were separately introduced in 25ml of standard dye sample and were kept for photoreduction at room temperature in visible radiation . The graphs 1-4 , represent the colour degradation of commercial dyes namely violet , congo red, blue S1 and orange 3R with respect to time with all the three types of photocatalyst titanium oxide, zinc oxide and manganese oxide.

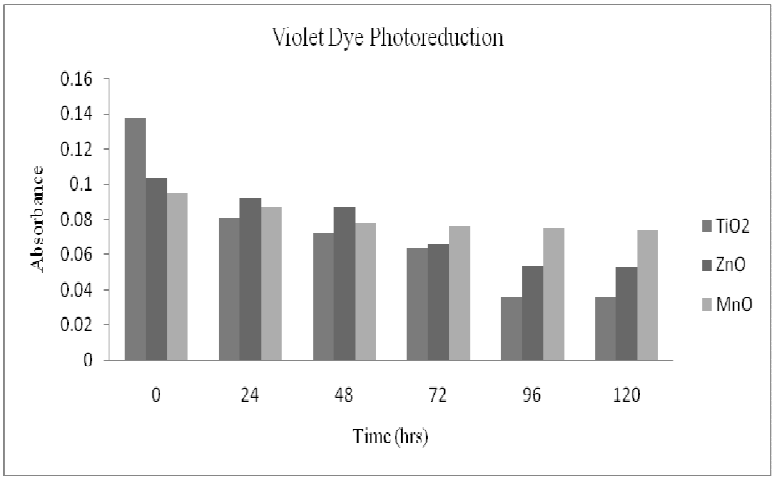


Figure 1: Violet Dye Photoreduction

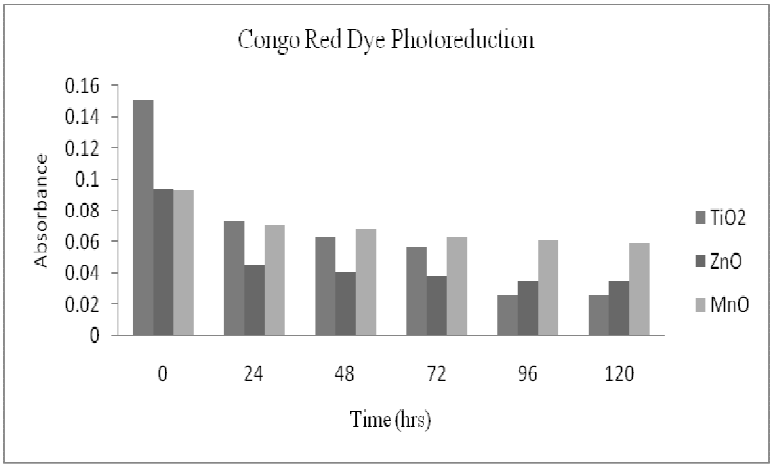


Figure 2 : Congo Red Dye Photoreduction

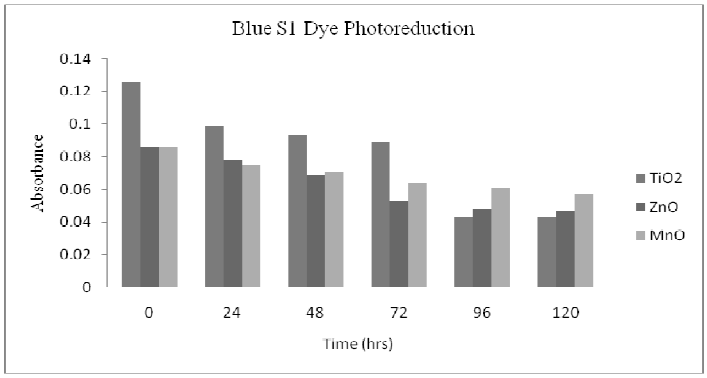


Figure 3: Blue S1 Dye Photoreduction

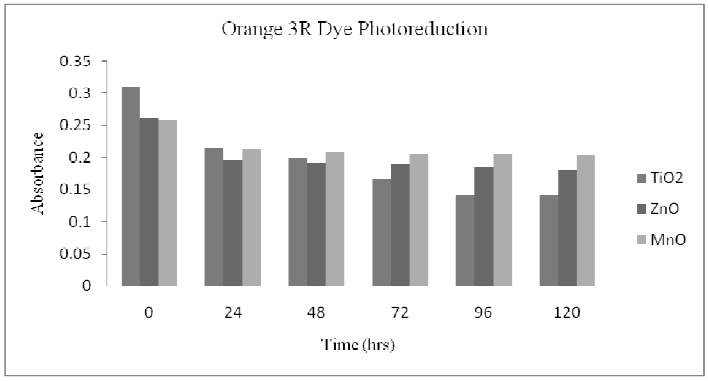


Figure 4: Orange 3R Dye Photoreduction

Results show that 88% decrease in colour intensity was observed in 96 hours and at 1.0ml of 0.02M concentration of titanium oxide. Based on the above study TiO_2 was used for the treatment of textile industry effluents sample S1. For this effluent sample (1) was diluted to 10 times and in 25 ml of this sample 1.2ml of 0.2M TiO_2 is added. Then it was placed in sunlight for photocatalysis for 96 hrs. After treatment different parameters were studied again by same procedure. Results of photocatalysis are summarized in table III.
These results favor the use of TiO_2 for photocatalytic reduction and the developed method can be applied for decolouration of textile effluent.

TABLE III . Study of Physiochemical parameters of textile effluent after photocatalysis

Parameters	Units	NEQS limit	Sample(1)	
			before photocatalysis	after photocatalysis
PH	-	**6-9**	**11.9**	**7.7**
Alkalinity	mgL^{-1}	**200**	**640**	**40**
TDS	mgL^{-1}	**2000**	**3540**	**51.47**
TSS	mgL^{-1}	**40**	**76**	**20.25**
BOD	mgL^{-1}	**80**	**1088**	**88.56**
COD	mgL^{-1}	**150**	**1650**	**89.64**
Turbidity	NTU	**5**	**36**	**24**
Electric conductivity	µs/m	**0.5**	**3.84**	**0.62**
Temperature	^0C	**18**	**49**	**21.6**

Conclusion

(i) Solar photocatalytic treatment has proved as an efficient technique for decolorization of industrial wastewater through a photocatalytic process and the transformation is practically complete in a reasonable irradiation time.

(ii) Results presented in this paper indicated that visible light / TiO_2 system could be efficiently used for treatment of textile industrial wastewater. The results indicate that the complete removal of color could be achieved in a relatively optimum time under solar irradiation.

(iii) In most of the regions of India, intense sunlight is available throughout the year and hence, it could be effectively used for photocatalytic degradation of pollutants in industrial wastewater.

(iv) Screening of effluent from textile industry has shown a detailed picture of physiochemical and microbial parameters. Study of five different samples collected from source to sink of effluent showed a considerable high values of temperature, pH, electric conductivity, BOD, COD, TSS, TDS, turbidity and color intensity as

compared to the desired values. The decline in physiochemical parameter values after photoreduction show the effect of decolorization ability of TiO_2.

(v) The procedure used in this research can be used as an efficient technology for solar photocatalytic degradation of the colored wastewater discharged from the textile industry under Indian climatic conditions.

References

1) Bekbolet, M. and Ozkosemen, G. 1996. A preliminary investigation on the photocatalytic degradation of a model humic acid. *Journal of Water Science and Technology*. 33:189-194.

2) Linsebigler, A.L. and Lu, G. Yates, 1995. Photocatalysis on surfaces: Principles, mechanisms, and selected results. *Journal of Chemical Reviews*. 95: 735-758.

3)Minero, C., Maurino, V. and Pelizzetti, E. 1997. Photocatalytic transformations of hydrocarbons at the sea water/air interface under solar radiation. *Journal of Marine Chemistry*.58:361-372.

4) Ohno, T., Sarukawa, K., Tokieda, K. and Matsumura, M. 2001. Morphology of a TiO_2 photocatalyst (Degussa, P-25) consisting of anatase and rutile crystalline phases. *Journal of Catalysis*.20:82-86.

5) Ollis, D.F., Pelizzetti, E. and Serpone, N. 1991. Photocatalyzed destruction of water contaminants. *Journal of Environmental Science and Technology*.25: 1522-1529.

6) Walhman, A. 2000. The theory of dying(and the secrete of life). *Journal: Soc. dyers color*.116: 140-143.

7) Yosuff .R.O. and Sonibare .J.A. 2004. Characterization of textile industries' effluents in Kaduka, Nigeria and pollution implications. *The international Journal of Environmental science and Engg*. 12: 212-221.

Exposure to highly hazardous esticides A major public health concern

Dr. DEEPLATA SHARMA AND NEHA CHOUDHARY

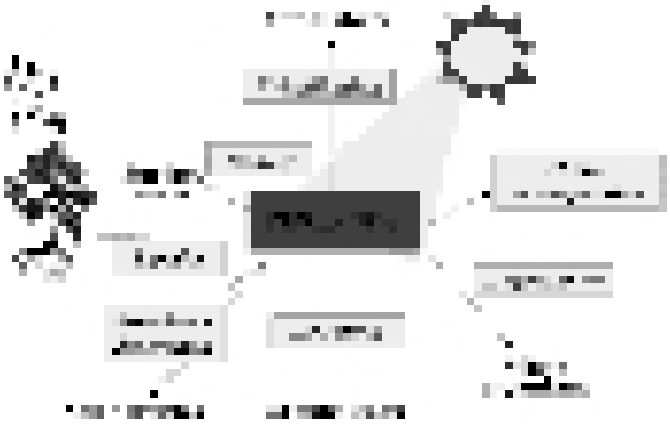
Department of Chemistry, Vivekananda Institute of Technology, Jaipur

E-mail: neha_ch2301@yahoo.com, deeplata2407@gmail.com

Highly hazardous pesticides may have acute or chronic toxic effects and pose particular risk to children. Their widespread use has caused health problems and fatalities in many parts of the world, often as a result of occupational exposure and accidental or intentional poisonings. Environmental contamination can also result in human exposure through consumption of residues of pesticides in food and, possibly, drinking-water. Although developed countries have sophisticated systems already in place to register pesticides and control their trade and use, this is not always the case elsewhere. Guidance and legal frameworks on the use, management and trade of pesticides—including highly hazardous pesticides—as well as proper storage and handling are available from international organizations and international conventions; these should be implemented globally.

Pesticides are used in agriculture, horticulture and public health for the control of pests such as insects and rodents, disease organisms and disease vectors. They are biologically active compounds designed to kill target organisms. They are also used in veterinary and human medicine to control parasites. Some older pesticides are both persistent and bioaccumulative. Highly hazardous pesticides are defined by the FAO/WHO Joint Meeting on Pesticide Management as having one or more of the following characteristics: acute toxicity (classes Ia and Ib of the World Health Organization [WHO] Recommended Classification of Pesticides by Hazard); carcinogenicity; mutagenicity; reproductive toxicity; listing under the Stockholm Convention on Persistent Organic Pollutants, the Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Pesticides and Industrial Chemicals in International Trade or the Montreal Protocol on Substances that Deplete the Ozone Layer; or evidence of severe or irreversible adverse effects on human health[1-5].

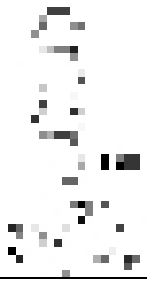
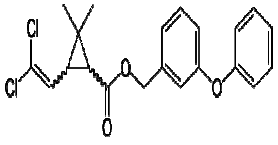
Khoj
An Interdisciplinary
Journal of Research
ISSN : 2349-8749
Vol. 2, No. 1
2015
pp. 113-119



List of pesticides

Table-1 list of pesticide with their chemical structure

S. No	Name of pesticide	Formula of pesticide	Structure of pesticide
1	Parathyroid	$C_{13}H_{10}O_4$	
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	$C_4H_{10}NO_3PS$	
11	Endosulphan	$C_9H_6Cl_6O_3S$	

Sources of exposure to highly hazardous pesticides

Agriculture and public health

The greatest exposure to highly hazardous pesticides is for agricultural and public health workers during handling, dilution, mixing and application. Exposure is mainly by the dermal route for preparation of sprays and by the dermal and inhalation routes during application. Ingestion might occur through consumption of contaminated food during or following work or through oral contact with contaminated hands. Contaminated clothing is a significant source of exposure. Bystanders might be exposed to the sprayed pesticides dermally and via inhalation. Stocks of obsolete pesticides still represent a hazard in many countries, in particular if storage or disposal is inappropriate[6]. Occupants of homes sprayed with highly hazardous pesticides might be exposed through residues on internal surfaces and contamination of food and water[7].

Domestic use

The general population controls pests in gardens or smallholdings or in their houses. Products intended for domestic use are generally weaker than professional products, so exposure of the general population to highly hazardous pesticides is lower. In countries where regulation is poor, agricultural-strength pesticides may regularly be used in the home.

Food and drinking-

Water Residues of highly hazardous pesticides can be found in food and environmental media. The general population is exposed mainly through consumption of residues of pesticides in food and, sometimes, drinking-water.

Exposure of children

Children regularly undertake agricultural labour in many areas of the world. Children are particularly at risk of being exposed to highly hazardous pesticides because of their immature behavior. Young children playing may be exposed to pesticide containers, to residues on surfaces and through ingestion of contaminated soil.

Health effects Unintentional and self-inflicted (suicides) acute poisonings by pesticides are a serious public health problem in many parts of the world. Available data are too limited to estimate the global health impacts of highly hazardous pesticides. However, the global impact of self-poisoning from preventable pesticide ingestion was estimated to amount to 186 000 deaths and 4 420 000 disability-adjusted life years (DALYs*) in 2002[12]. The acute hazard is highly variable depending on the pesticide and includes peripheral and central neurotoxicity and reduced blood clotting capacity. The specific pesticide formulation can significantly affect both exposure and toxicity[13].

Chronic exposure to highly hazardous pesticides can result in effects on skin, eyes, nervous system, cardiovascular system, gastrointestinal tract, liver, kidneys, reproductive system, endocrine system and blood[10].Children are more vulnerable to the effects of pesticides because of their smaller size and hence greater exposure (on a milligram per kilogram body weight basis), different metabolism and still

developing internal organs. Although the evidence is less clear, some highly hazardous pesticides may also affect the immune system, and some obsolete pesticides may cause cancer, including childhood cancer[10].

Risk mitigation recommendations

WHO produces extensive evaluations of the hazards and risks of pesticides, guidance values and advice on medical treatment of poisoning. Its output includes JMPR evaluations (in partnership with FAO), cancer classifications in International Agency for Research on Cancer (IARC) monographs, International Chemical Safety Cards (in partnership with the International Labour Organization), Poison Information Monographs, Environmental Health Criteria documents and Concise International Chemical Assessment Documents[10]. In addition, the WHO Pesticide Evaluation Scheme (WHOPES) evaluates new public health pesticides and makes recommendations for their proper use, produces training packages on their sound management and provides guidance on pesticide regulation[7,13].This material provides the basis for mitigating health risks from pesticides in general, including from highly hazardous pesticides.

Elimination and replacement of pesticide use

Eliminate the use of persistent highly hazardous pesticides. Several pesticides are classified as persistent organic pollutants (POPs) under the Stockholm Convention. International efforts are being made to eliminate their use. National effort is required from governments to implement these conventions locally. Trade and transport of these POPs and other specified highly hazardous pesticides require prior informed consent (PIC) under the Rotterdam Convention[3, 4.] Eliminate the use of pesticides regarded as obsolete under the WHO classification scheme. National action is required[2] Consider opportunities for integrated pest and vector management rather than relying primarily or solely on pesticide use[18].

Regulation, monitoring and surveillance

Establish national regulation of the purchase and use of pesticides—including highly hazardous pesticides—and follow guidance[18] on its structure and function. Adequate personnel, appropriately trained, should be available to implement and enforce the regulation[19-21]. Monitor exposure and conduct health surveillance of users of pesticides and vulnerable populations nationally.

References

1. FAO/WHO (2008). Second session of the FAO/WHO meeting on pesticide management and 4th session of the FAO panel of experts on pesticide management. Recommendations. Rome, Food and Agriculture Organization of the United Nations; Geneva, World Health Organization.
2. WHO (2009). The WHO recommended classification of pesticides by hazard and guidelines to classification 2009. Geneva, World Health Organization, International Programme on Chemical Safety.
3. Stockholm Convention on Persistent Organic Pollutants (POPS). Geneva, Secretariat of the Stockholm Convention.
4. Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Pesticides and Industrial Chemicals in International Trade. Geneva and Rome, Secretariat of the Rotterdam Convention.

5. The Montreal Protocol on Substances that Deplete the Ozone Layer. Nairobi, Secretariat of the Montreal Protocol.
6. WHO/UNEP (2006). Sound management of pesticides and diagnosis and treatment of pesticide poisoning. A resource tool. Geneva, World Health Organization and United Nations Environment Programme.
7. WHO (2010). Technical guidance for management of public health pesticides. Geneva, World Health Organization, WHO Pesticide Evaluation Scheme (WHOPES)
8. FAO/WHO (2009). JMPR: Joint FAO/WHO Meeting on Pesticide Residues. Rome, Food and Agriculture Organization of the United Nations; Geneva, World Health Organization.
9. FAO/WHO (2010). Pesticide residues in food: Maximum residue limits / extraneous maximum residue limits. Rome, Food and Agriculture Organization of the United Nations and World Health Organization, FAO/WHO Food Standards Programme, Codex Alimentarius Commission .
10. IPCS (2010). INCHEM: Chemical safety information from intergovernmental organizations. Geneva, World Health Organization, International Programme on Chemical Safety.
11. WHO (2008). Guidelines for drinking-water quality, 3rd edition incorporating 1st and 2nd addenda. Vol. 1. Recommendations. Geneva, World Health Organization.
12. WHO (2006). Preventing disease through healthy environments: Towards an estimate of the environmental burden of disease. Geneva, World Health Organization.
13. WHO/FAO (2006). Manual on development and use of FAO and WHO specifications for pesticides. March 2006 revision of the first edition. Rome, World Health Organization and Food and Agriculture Organization of the United Nations.
14. FAO (2003). International code of conduct on the distribution and use of pesticides—Revised version. Rome, Food and Agriculture Organization of the United Nations.
15. WHO (2001). Preventing health risks from the use of pesticides in agriculture. Geneva, World Health Organization (Protecting Workers Health Series, No. 1;
16. WHO (2006). Safer access to pesticides: Community interventions. Geneva, World Health Organization.
17. FAO (1990). Guidelines for personal protection when working with pesticides in tropical climates. Rome, Food and Agriculture Organization of the United Nations.
18. WHO (2008). WHO position statement on integrated vector management. Geneva, World Health Organization (WHO/HTM/NTD/VEM/2008.2.

Instructions for Authors: Manuscripts are invited from academicians, research students, and scientists for publication consideration. Papers submitted to journal are accepted on the basis of the following criteria:

Documents Format	Paper Size 7.25 x 9.5 Inch
Font	Times New Roman
Use one column format (Justify the columns)	4.75 Inches width (12.06cm) 7.25 Inches height (18.41cm)
Top Margin	0.7 Inches (1.78cm)
Bottom Margin	0.7 Inches (1.78cm)
Left Margin	0.7 Inches (1.78cm)
Right Margin	0.35 Inches (0.89cm)
Position figures and tables at the top and bottom of columns. Figure captions should be below the figure and centralized. Table captions should be above the tables and centralized.	
Title of Paper	20 Point (Regular)
Author's Name	11 Point (Bold)
Author's Affiliation	10 Point (Regular)
Section Heading Subheading	10 Point, (Capitalization each word) (Bold) 10 Point other letters 10 Point (Capitalization each word) (Bold) (Italic)
Abstract	10 Point (Bold)
Text & Equations	10 Point (Regular)
References, Tables, Table Name Figure Captions, Footnotes	8 Point (Regular)

Any kind of feedback to make this journal an even enriched experience for both authors and readers are most welcome.

VIVEKANANDA GROUP OF INSTITUTIONS

• Arise • Awake • Achieve •

Transforming **TALENT** into Excellent
TECHNO-MANAGERS

RPET Code: -12

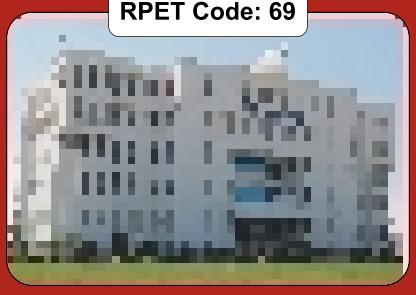
Marudhar Engineering College, Bikaner

S.K. Institute of Pharmacy, (SKIP) Bikaner

Marudhar Engineering College

Raisar.NH-11,Jaipur Road Bikaner | Tel: 0151-2746922-23 Tele Fax: 0151-2746979
E-Mail:info@marudhar.ac.in | www.marudhar.ac.in

RPET Code: 69



VIVEKANANDA INSTITUTE OF TECHNOLOGY
Approved by AICTE New Delhi and affiliated to RTU Kota)
www.vitj.ac.in | info@vitj.ac.in

RPET Code: 70

VIVEKANANDA INSTITUTE OF TECHNOLOGY (EAST)
Approved by AICTE New Delhi and affiliated to RTU Kota)
www.vitej.ac.in | info@vitej.ac.in

VIVEKANANDA GLOBAL UNIVERSITY (VGU)
(Estd by Act No. 11/2012 of Rajasthan Govt. and covered u/s 2(f) of UGC Act 1956)
www.vgu.ac.in | info@vgu.ac.in

VIT Campus

• Arise • Awake • Achieve •

Sector - 36, NRI Road, Sisyawas,
Jagatpura, Jaipur - 303 012 (Rajasthan) INDIA

0141-4077999, 9549360111 / 222 / 333 | Fax: 0141-4077900
Toll Free - 1800-3-131415
e-mail: info@vgu.ac.in vivekanandajournal@gmail.com
www.vitj.ac.in, www.vitej.ac.in, www.vgu.ac.in