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STUDY ON MICROALBUMINURIA AND ITS ASSOCIATION WITH CARDIOVASCULAR COMPLICATIONS IN PATIENTS OF TYPE 2 DIABETES MELLITUS.

DAYANAND PASWAN* AND R. B. THAKUR**

Abstract

Background: Microalbuminuria was originally established as a predictor of renal failure and an independent risk factor for cardiovascular disease in patients with diabetes mellitus as well as in general population. The aim of our study is to assess the relationship between microalbuminuria and development of cardiovascular complications in patients of type 2 diabetes mellitus.

Methods: 117 patients, 84 men and 33 women with age > 45 years and duration of type 2 diabetes > 5 years were hospitalized in the Department of Internal Medicine in the Darbhanga medical college and Hospital, Laheriasarai between October 2004 and September 2005. These patients were divided into two groups: without (Group A: 86 patients) and with (Group B: 31 patients) microalbuminuria and each group was evaluated for fasting and post prandial blood sugar, 12 lead standard Electrocardiogram, lipid profile, renal profile, urine R/M, C/S and Micral test.

Results: In this study microalbuminuria was found in 26.5% of patients. Males were found more prone to develop microalbuminuria as compared to females (74% Vs 26%). Microalbuminuria was not dependent on the duration of DM in Group B patients. The glycemic control in both the patient groups was poor. Group A patients had a mean fasting blood sugar of 126.56+40.03 mg/dl and mean post-prandial blood sugar of 211.88+25.16 mg/dl. Similarly the values in Group B were 124.72+30.52 mg/dl and 216.32+17.88 mg/dl respectively. The lipid profile was also comparable in both the groups and didn't show any increase in total cholesterol or LDL level. When ECG changes were compared, only 17% Group A patients showed the changes as compared to 83% in Group B. In Group A only patients with > 50 years of age showed ECG changes and the incidence increased as age increased. But invariably all age group patients showed ECG changes in Group B. This study also showed that microalbuminuric male patients had increased chances of developing ECG changes and hence cardiovascular complications as compared to female patients.

Conclusion: In patients with type 2 diabetes and microalbuminuria the ECG changes were significantly more frequent compared with patients with type 2 diabetes and normoalbuminuria and males were more prone than females. So microalbuminuria can be considered to have a good predictive value as an early marker for cardiovascular complications in type 2 DM patients.

Key words: microalbuminuria, type 2 diabetes, cardiovascular complications, ECG: electrocardiogram.

Diabetes mellitus is a clinical syndrome characterized by absolute or relative deficiency of insulin, resulting from diversity of etiologies like environmental and genetic, acting concomitantly. The global prevalence of Diabetes mellitus (DM) is predicted to touch~ 330 million by 2025[1], with ~57.2 million in India only.[2] Type 2 diabetes is an independent risk factor for both microvascular and macrovascular diseases affecting almost all vital organs of body directly or indirectly.[3-5] The major cause of morbidity and mortality in patients suffering from DM is complications from cardiovascular involvement.[6] CHD (CORONARY HEART DISEASE) is probably

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the most common cause of mortality in diabetic patients with cardiovascular complications. Diabetic nephropathy resulting from microvascular disease in patients with type 2 diabetes has a cumulative prevalence of 30–40 % and is currently the leading cause of end stage renal disease (ESRD).[7,8] The early clinical evidence of nephropathy is the appearance of low but abnormal levels (30–300 mg/day) of albumin in the urine, referred to as microalbuminuria. This microalbuminuria has become a prognostic marker for cardiovascular disease (CVD) and the finding of microalbuminuria is an indication for screening for possible vascular disease and aggressive intervention to reduce all cardiovascular risk factors.[9] Epidemiological and experimental data show that microalbuminuria is associated with an increased risk for all–cause and cardiovascular mortality, cardiac abnormalities, cerebrovascular disease, and, possibly, peripheral arterial disease in patients with Type 2 diabetes mellitus.[10,11] So this study aims to evaluate the association of microalbuminuria and development of cardiovascular complications in Type 2 diabetes patients.

Material and Methods

This study was carried out in patients with type 2 DM attending the diabetic clinic, or the general medicine OPD/ward of Darbhanga medical college and Hospital, Laheriasarai. Those patients having age >45 years with h/o DM > 5 years were hospitalized and randomly selected into two groups:

Gr. A : Normoalbuminuric
Gr. B : Microalbuminuric

Exclusion Criteria

1. Pregnancy
2. Evidence of UTI
3. Known case of diabetic nephropathy
4. Patients having active infections
5. Smokers
6. H/O hypertension for >2 yrs
7. H/O MI or chest pain with recorded ECG abnormality
8. Presence of other conditions responsible for proteinuria e.g. CHF.

Laboratory Tests

Laboratory tests include :

1. Complete blood count
2. Blood sugar estimation: A. Fasting B. 2 hrs Post prandial by O- toluidin method
3. Glycated hemoglobin estimation using ion exchange resin method
4. Renal profile i.e. blood urea and serum creatinine
5. Lipid profile comprising total cholesterol, HDL, LDL and triglyceride
6. Urine examination including routine/microscopy, culture/sensitivity and MICRAL TEST.[12]
7. 12 lead ECG interpreted by Minnesota code.[13-15]

Micral Test II

This test is a reliable dipstick immunologic test for routine screening for micro-albuminuria, developed by Boehringer Mannheim, Germany.

Principle: The Micral Test is an immunochemical strip specific for albumin. Albumin in the sample was bound by a soluble conjugate of antibodies and marker enzyme b-galactosidase. Conjugate-albumin complexes are separated and enzyme b-galactosidase reacts with a substrate to produce a red dye. The re-agent part of the test strip should be dipped into the urine for 5 seconds and then laid down horizontally and read after 5 minutes. The intensity of the colour produced is proportional to the albumin concentration in the urine. The colour formed is compared with the reference chart on the vial. There are five colour blocks, reflecting categories of albumin concentrations of 0, 10, 20, 50, 100 mg/L. A measurement of M 20 mg/L was considered positive. All visual assessments of the strips were performed by the same person trained to perform this test. Cross reaction with other human proteins have been found to be <0.05%.

Sample Collection

Patients were advised to take adequate rest and to avoid strenuous physical exercise. All drugs were stopped 2 days prior the day of sample collection. Minimum fluid intake of 1.5 to 2 liters /day was also advised. Morning sample of urine was collected in a clean container and tested for proteinuria. If test couldn't be done immediately then sample was stored in a refrigerator at 2-8^0 C, but the test was conducted only on same day. Continuous three morning samples were taken and patients were diagnosed microalbuminuric when two out of three samples were positive. Urine for R/M and C/S was also collected by appropriate methods on the same day.

Electrocardiogram

Standard 12 lead ECG was done in every patient and kept in record for further analysis. ECG was interpreted by Minnesota code for ischemic analysis.

Coronary probable:

1. Major Q wave/QS pattern
2. Decreasing R wave amplitude in chest leads
3. Complete left bundle branch block

Coronary possible:

1. Minor Q wave/QS pattern
2. ST segment and junction depression
3. T wave changes

Results

In this present study 117 patients having type 2 DM were randomly selected. They were tested for microalbuminuria by Micral test and according to the results categorized into 2 groups i.e.

Group A (n=86) Normoalbuminuric

Group B (n=31) Microalbuminuric

In this study microalbuminuria was found in 26.5% of patientswith age >45 years and having type 2 DM for >5 yrs duration. Both groups were comparable when age and sex distribution was considered. Males were more prone to develop microalbuminuria as compared to females (74% Vs 26%). Majority of patients had the disease for <10 years duration. Microalbuminuria was not dependent on the duration of DM in Group B patients. The glycemic control in both the patient groups was poor. Group A patients had a mean fasting blood sugar of 126.56+40.03 mg/dl and mean post-prandial blood sugar of 211.88+25.16 mg/dl. Similarly the values in Group B were 124.72+30.52 mg/dl and 216.32+17.88 mg/dl respectively. Both the groups showed

comparable results. The lipid profile was also comparable in both the groups and didn't show any increase in total cholesterol or LDL level. When ECG changes were compared, only 17% Group A patients showed the changes as compared to 83% in Group B. In Group A only patients with > 50 years of age showed ECG changes and the incidence increased as age increased. But invariably all age group patients showed ECG changes in Group B. This study also showed that microalbuminuric male patients had increased chances of developing ECG changes and hence cardiovascular complications as compared to female patients.

Discussion

The present study provides evidence, that low–grade urinary albumin excretion is an independent risk factor for CVD in patients with type 2 DM. The prevalence of microalbuminuria in patients with diabetes is high (~30%)[8,16] and it is similar to our finding in the present study (26.5%).

Our study showed that microalbuminuria was not dependent on duration of diabetes. Microalbumiuria is an early predictor of renal failure in patients with diabetes and the early detection and good glycemic control may delay it.

Ischemic changes in 12 lead ECG were more frequent in gr. B patients as compared to Group A patients which showed strong association of microalbuminuria with cardiovascular complications.[17-19] This study also showed that in Group B, male patients had increased chances of developing ECG changes and hence cardiovascular complications as compared to female patients.

So to conclude, the ECG changes were significantly higher in the microalbuminuric group than the normoalbuminuric group indicating its good predictive value as an early marker for cardiovascular complications in type 2 DM patients.

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Declaration

The Declaration of the author for publication of Research Paper in The Indian Journal of Research Anvikshiki ISSN 0973-9777 Bi-monthly International Journal of all Research: We, *Dayanand Paswan and R. B. Thakur, M.D, Department of general medicine, Darbhanga medical college and Hospital (Laheriasarai) India. & Professor, Department of general medicine, Darbhanga medical college and Hospital (Laheriasarai) India.* the authors of the research paper / article entitled STUDY ON MICROALBUMINURIA AND ITS ASSOCIATION WITH CARDIOVASCULAR COMPLICATIONS IN PATIENTS OF TYPE 2 DIABETES MELLITUS. declare that , We take the responsibility of the content and material of our paper as We have written it and also have read the manuscript of our paper carefully. Also, We hereby give our consent to publish our paper in The Indian Journal of Research, Anvikshiki ISSN 0973-9777 Bi-monthly International Journal of all Research , This article / research paper is our original work and no part of it or it's similar version is published or has been sent for publication anywhere else. We authorise the Editorial Board of The Indian Journal of Research Anvikshiki ISSN 0973-9777 Bi-monthly International Journal of all Research to modify and edit the manuscript. We also give our consent to the Editor of The Indian Journal of Research Anvikshiki ISSN 0973-9777 Bi-monthly International Journal of all Research to own the copyright of our research paper / article.

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AXIALLY SYMMETRIC FORCES AND CRYSTAL DYNAMICS OF NOBLE METALS Cu, Ag AND Au

SITA RAM BAHADUR THAPA*

Abstract

Phenomenological model used earlier for the study of lattice dynamics of p-block metals Al and Pb , is now used to study the lattice dynamics of face centered cubic metals copper, silver and gold. The model used considers the potential energy of lattice due to (i) ion-ion interaction and (ii) ion-electron interaction. Potential energy due to ion-ion interaction has been calculated applying axially symmetric model which assumes the restoring force between the ions have the character of bond-bending and bond-stretching. The secular equation obtained on the basis of present model is solved to calculate the phonon frequencies of normal modes of the vibration of lattice. The frequencies calculated have been employed to obtain the phonon dispersion curves, specific heats and Debye characteristic temperature of monovalent metals Cu, Ag and Au. The theoretical results for dispersion curves, specific heats and Debye characteristic temperature of above metals have been compared with experimentally observed values. The agreement between calculated and experimental results is found to be satisfactory.

Key Words: Axially symmetric model, Debye characteristic temperature, Lattice specific heat, Phonon frequencies, Screened coulomb potential.

Introduction

The theoretical and experimental studies of lattice dynamics of face centered cubic metals have been carried out for many decades in the past. Basic theory was put forward as early as 1912by Born and Von Karman but the measurement of experimental phonon frequencies became available as late as 1962(Woods et al) onwards. Several successful models were developed based upon either phenomenological formulations or on first principles.

The existence and interpretation of experimental phonon dispersion curves of metals have shown that the conduction electrons play an important role in the determination of lattice vibration frequencies of metals. This suggests that for good agreement between theoretical and experimental phonon frequencies, interaction of conduction electrons should be taken into account. But it is hard to take into account of the influence of conduction electrons in the vibration frequencies of metals exactly. It is very difficult to develop a realistic model on first principles. In recent years the lattice dynamics of face centered cubic metallic crystals have received extensive attention from physicists applying pseudo potential theories. Such theories involve function

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with or without exchange and correlations among conduction electrons. Although many advances have been made for calculating the dielectric screening function, yet no satisfactory dielectric function has been made available. Even the use of second order perturbation theory is found inadequate in the determination of lattice dynamics of metals. A numerical calculation of phonon frequencies of metals from this theory requires long and tedious calculations. In view of these facts phenomenological model in the study of lattice dynamics of metals are still of interest.

Thus much attention has been paid to develop phenomenological models in which such interactions are taken into account approximately. For a successful phenomenological model two basic elements which must be considered are (i) ion-ion interaction and (ii) ion-electron interaction. There are several schemes for ion-ion interaction like Born and Von Karman (1912) and Lehman et al (1962).Ion-electron interactions are successfully evaluated by several workers like Sharma and Joshi (1963), Kreb (1964) and Thakur and Singh (1986). Lattice dynamics of noble metals were used by Vyas et al (2001) using three body forces. Jun et al (2006) calculated phonon dispersion curves of Cu, Ag and Au by considering the modified analytic embedded atom. Lattice dynamics with second neighbour interactions and surface defects was studied by Camtos et al (2009). Surface defects are known not to influence bulk properties very greatly. Thapa et al (2000) have successfully predicted the phonon dispersion curves of p-block metals Al and Pb by adopting formalism of Lehman et al(1962) for ion – ion interaction and formalism of Thakur and Singh(1986) for ion – electron interaction. The success of proposed model encouraged to extend this model to study lattice dynamics of noble metals Cu, Ag and Au. They are all monovalent and possess face centered cubic structure and studied extensively giving availability of theoretical and experimental results of phonon frequencies , lattice specific heats and Debye characteristic temperatures for purpose of comparison.

Method

Total potential energy of any atom is sum of potential energy due to axially symmetric forces among ions and potential energy due to ion electron interaction Axially symmetric formalism for lattice dynamics of solid developed by Lehman et al (1962) is based on the assumption that the interaction potential between two atoms, which have been displaced from the equilibrium in crystal consists of two quadratic terms. The first term is proportional to the square of the component of relative displacement along the vector joining the equilibrium positions of two atoms and gives rise to the bond stretching or central force. The second term is proportional to the square of the component of relative displacement perpendicular to the vector joining the two atoms in equilibrium position and causes bond bending force.

Since all directions perpendicular to the line joining equilibrium positions of two atoms are assumed to be equivalent, the interaction potential and corresponding forces are axially symmetric.

The theoretical model used is already reported by Thapa et al (2000). The secular determinant which determines the angular frequency of modes of vibration in the crystal is given by

$$|D(q)-m\omega^2 I| = 0 \quad \text{——————————————————————————} (1)$$

Where m is ionic mass and I is unit matrix.

Following relations for elastic constants and phonon frequencies are reported by Thapa et al (2000).

$$C_{11}=1/2a\ [2\alpha_1+4\alpha_2+2\beta_1+k.2a] \quad \text{——————————————————————} (2)$$
$$C_{12}=1/2a\ [\alpha_1-5\beta_1-4\beta_2+k.2a] \quad \text{——————————————————————} (3)$$
$$C_{44}=1/2a\ [\alpha_1+3\beta_1+4\beta_2] \quad \text{——————————————————————} (4)$$
$$\omega_L^2(X) =1/m\ [8\alpha_1+12\beta_1+D_{11}^{\text{i.e.}}(x)] \quad \text{——————————————} (5)$$
$$\omega_T^2(X) =1/m\ [4\alpha_1+16\beta_1+D_{33}^{\text{i.e.}}(x)] \quad \text{——————————————} (6)$$

Subscripts L and T represent longitudinal and transverse waves respectively, k is Bulk modulus of electron

gas, 'a' is semi lattice constant. D_{11} i.e. and D_{33} i.e. are elements of dynamical matrix corresponding to ion-electron interaction which are same as that reported by Thakur and Singh(1986).

The value of Bulk modulus k is restricted by the relation $C_{12} - C_{44} = 4k$ ————(7)

β_1 = bond bending force constant corresponding to first nearest neighbour.
β_2 = bond bending force constant corresponding to second nearest neighbour.
α_1 = bond stretching force constant corresponding to first nearest neighbour.
α_2 = bond stretching force constant corresponding to second nearest neighbour.

Input data for evaluating force constants α_1, α_2, β_1 and β_2 are given below in table 1, 2 and 3. Evaluated values of model parameters are given in table 4.

T A B L E 1 *(Elastic constants of Cu, Ag and Au in unit of 10^{10} Nm $^{-2}$)*

Noble metals	Elastic constants(10^{10}Nm^{-2}) C_{11}	C_{12}	C_{44}	Reference
Copper	16.850	12.150	7.550	Svensson et al(1967)
Silver	12.399	9.367	4.612	Neighbours and Alers(1958)
Gold	12.234	16.314	4.195	Neighbours and Alers(1958)

T A B L E 2 *(zone boundary phonon frequencies of Cu, Ag & Au)*

Noble metals	Zone boundary phonon frequencies(10^{12}Hz) $(\upsilon_L)_x$	$(\upsilon_T)_x$	Reference
Copper	7.21	5.08	Miller and Brockhouse (1971)
Silver	4.96	3.41	Kamitakahara and Brockhouse (1969)
Gold	4.61	2.75	Lynn et al (1973)

T A B L E 3 *(Atomic mass, Semi-lattice constant, Screening multiplication constant, Inter-electronic spacing, Fermi surface wave vector of Cu, Ag and Au)*

Noble metals	Atomic mass (m)10^{-27} Kg	Semi Lattice constant (a)10^{-1}nm	Screening multiplication constant	Inter-electronic spacing (r_O) 10^{-1}nm	Femisurface wave vector k_F 10nm	Reference
Copper	105.476	1.807	0.340	1.413	1.358	Harrison(1980)
Silver	179.060	2.040	0.353	1.595	1.203	
Gold	316.965	2.035	0.353	1.592	1.204	

T A B L E 4 *(Evaluated values of Model parameters and electron Bulk modulus of Cu, Ag & Au)*

Noble metals	Force Constants (Nm^{-1}) α_1	α_2	β_1	β_2
Copper	20.0234	10.7859	1.7163	0.4832
Silver	17.7449	2.2292	0.7058	-0.2736
Gold	34.2044	0.2136	-2.6313	-2.3041

Using the evaluated values of force constants phonon dispersion relations of noble metals Cu, Ag and Au along symmetry directions [ξ00],[ξξ0] and [ξ ξ ξ] are computed.

The values of C_v at different temperature are obtained by formula from Thakur and singh(1986)

$$C_v = (3R/3000)\,\Sigma_{\upsilon} E(h\upsilon/kT)g(\upsilon)$$

$g(\upsilon)$ is frequency distribution function defined by $g(\upsilon)d\upsilon = 9N\upsilon^2 d\upsilon/\upsilon_D^3$, υ_D is Debye threshold frequency, $\upsilon_D = k\theta_D/h$.$E(h\upsilon/kT)$ is the Einstein function defined by

$E_x = (x^2e^x)/(e^x - 1)^2$ where $x = h\upsilon/kT$, υ is frequency, k is Boltzmann constant, h is Planck's constant, T is

temperature and N is number of atoms in the crystal. θ_D is Debye temperature. Calculation of C_v at different temperatures is done by dividing first Brillouin zone of the crystal into one thousand miniature cells which reduce to 48 non equivalent points under symmetry operations. Secular equation (1) is solved at these points by dividing the frequency spectrum in intervals of $\triangle\upsilon = 0.1T$ Hz.Debye temperature θ_D is calculated by standard table of $[C_v - \theta_D/T]$ from Saha and Srivastava (1965) by using computed values of C_v at different temperatures. Calculated results of phonon frequencies, specific heats and Debye temperatures of Cu, Ag and Au are compared with experimental results.

Results and Discussion

Copper : Experimental determination of phonon frequencies have been made for copper at 296 k by Svensson et al (1967), Sinha (1966) and Nicklow et al(1967) while Miller and Brockhouse (1971) measured phonon frequencies of copper by neutron scattering along symmetry directions. Their results do not show appreciable deviation and are nearly same. Calculation of phonon frequencies according to the adopted model are found almost same as that of calculated by Thakur and Singh (1986) using valence force field approximation.

The calculated results of phonon frequencies for copper along three symmetry directions on the basis of adopted model are plotted in fig(1) along with experimental results of Miller and Brockhouse (1971) giving a satisfactory agreement

The calculated lattice specific heat of Copper plotted against temperature is shown in fig.(2) with experimental results of Giaque and Meads(1941) giving satisfactory agreement. Debye characteristic temperatures obtained from lattice specific heat are plotted as a function of temperature in fig. (3) with experimental points of Giaque and Meads(1941)) for comparison. Agreement is satisfactory.

Silver : Phonon frequencies for silver are found experimentally by Drexel et al (1969) Kamitakahara and Brockhouse (1969)at room temperature.

The calculated results of phonon frequencies for Silver along three symmetry directions on the basis of developed model are plotted in fig. (4) along with experimental results of Kamitakahara and Brockhouse(1969).Agreement between theoretical results and experimental values is satisfactory.

The calculated lattice specific heats of silver plotted against temperature are shown in fig. (5) with experimental results of Meads et al (1941) giving satisfactory agreement. Debye characteristic temperatures obtained from lattices specific heat are plotted as a function of temperature in fig. (6) with experimental points of Meads et al (1941) for comparison. Agreement is satisfactory.

Gold : The calculated results of phonon frequencies for gold along three symmetry directions on the basis of adopted model are plotted in fig (7) along with experimental results of Lynn et al (1973) giving satisfactory agreement.

The calculated lattice specific heats of gold plotted against temperature are shown in fig.(8) with experimental results of Geballe and Giaque(1952) giving satisfactory agreement. Debye characteristic temperatures obtained from lattice specific heat are plotted as a function of temperature in fig.(9) with experimental values of Geballe and Giaque(1952). Agreement between theoretical results and experimental values is satisfactory.

Conclusions

The theoretical model developed to study the lattice dynamics of face centered cubic metals Al and Pb explains satisfactorily phonon dispersion results, Lattice specific heats and Debye characteristic temperatures of face centered cubic metals Copper, silver and gold. Hence axially symmetric model for ion-ion interaction and screened coulomb potential for ion-

electron interaction explains satisfactorily the lattice dynamics of noble metals copper, silver and gold. Systematically greater values of lattice specific heat and Debye characteristic temperature are observed in comparison to the experimental values. This discrepancy can be attributed to the approximate method of calculating the frequency spectrum and neglect of anharmonic effects.

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Declaration

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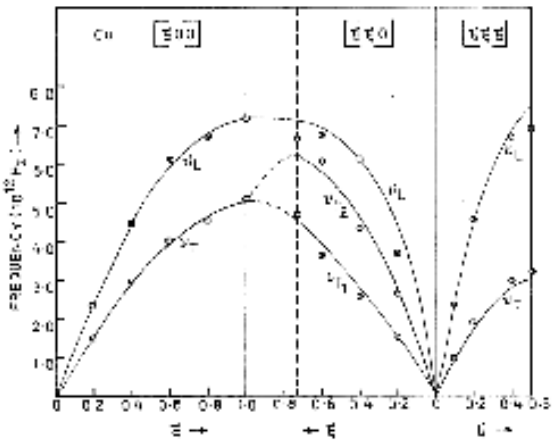

Fig. 1.Phonon dispersion curves for copper along symmetry directions. Experimental points (0) are due to Miller and Brockhouse (1971).

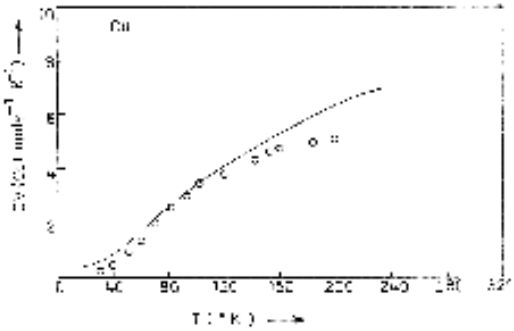

Fig 2.(C_v - T) curves for copper. Experimental points (0) are due to Giauque and Meads (1941).

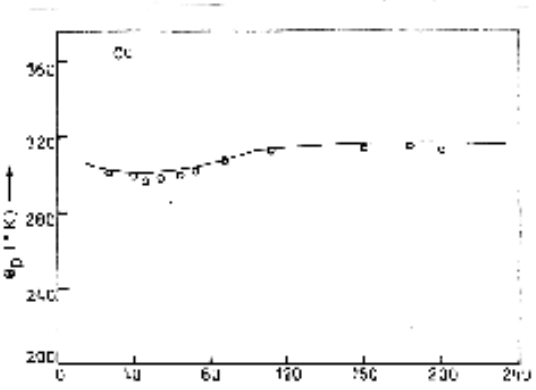

Fig 3.(θ_D -T) curves for copper. Experimental points (0) due to Giaque and Meads (1941).

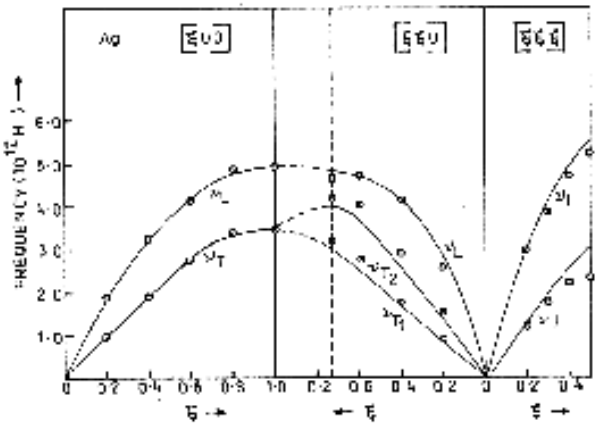

Fig.4.Phonon dispersion curves for silver along symmetry directions. Experimental points (0) are due to Kamitakahara and Brockhouse (1969).

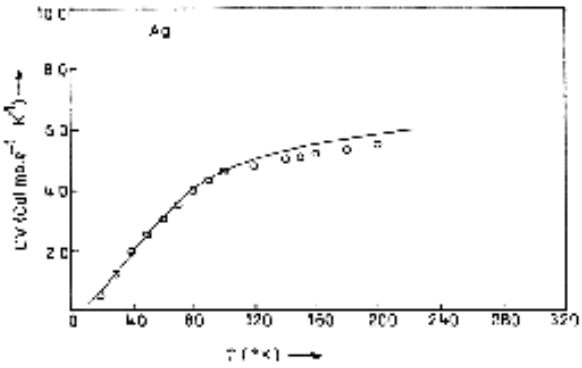

Fig 5.(C_v - T) curves for silver. Experimental points (0) are due to Meads et a. (1941)

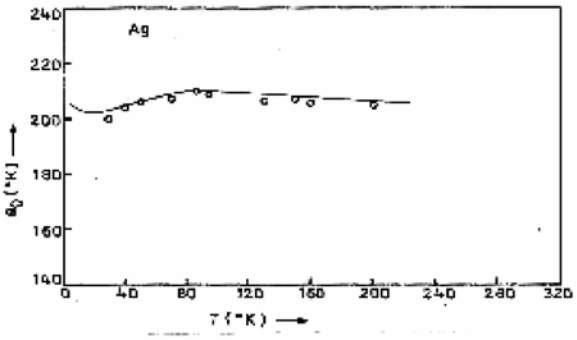

Fig.6.(θ_D -T) curves for silver. Experimental points (θ) due to Meads et al (1941).

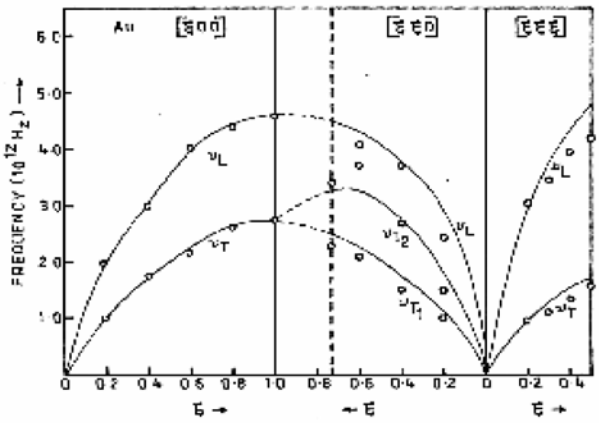

Fig.7.Phonon dispersion curves for gold along symmetry directions. Experimental points (0) are due to Lynn et al (1973).

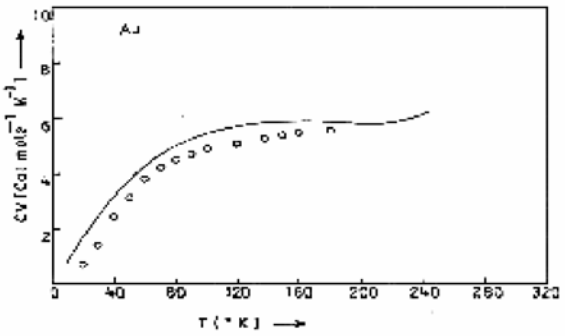

Fig. 8.(C_v - T) curves for gold. Experimental points (0) are due to Geballe and Giauque (1952).

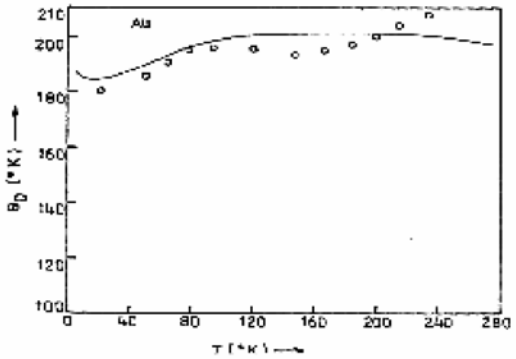

Fig.9.(θ_D -T) curves for gold. Experimental points (0) due to Geballe and Giauque (1952).

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POLYMERASE CHAIN REACTION

GHANASHYAM MAHATO*

"Science , like nothing elese among the institutions of mankind grows like a weed every year. Art is subject to arbitary fashion, religion is inwardly foucused and driven only to substation itself, law shuttles between freeing us and enslavtng us" (*Kary Mullis)*

1.Introduction

The investigation of genome was greatly enhanced during the early 1970S with the development of recombinant DNA technology. The technique permits us to obtain an unlimited supply of identical copies of a gene sequence or DNA segment. Wich is cloned in a prokaryotic or eukaryotic cell with the help of a vactor. tn 1985. yet another remarkable tool in molecular bilogy was discovered by kary mullis , which is known as polymerase chain reaction (PCR) nicked named now as people's choice reaction.

The methdlogy is so important that the journal chosen Taq polumerase as the molecule of the year 1989. Kary Mullis described PCR in his article published in April 1990 issue of Scientific American.The PCR is such a powerful technique that it may replace completely the gene cloning with vectors in due course.

2.History

The PCR is new one of the modern biology's most useful techniques and has been sued in virtually every area of molecular biology and biotechnology. Kary Mullis won the nobel prizel in Chemistry in 1993 for developing PCR. He invented PCR while working as a scientist for Cetus Corporation. He conceived the idea while cruising in a Honda Civic on Highway 128 from San Francisco to Mendocino in April 1983. Mullis scribbling. One basic ingredient of the PCR is that it amplifies DNA by constant repetation – rather like the computer programs. Kary Mullis was given a $ 10000 bonus by Cetus, who at first failed to realize the significance of the discovery. Later they sold the technology to Roche for $300,000,000

In 1999, Kary Mullis mentioned the computer connection again. "It is interesting that biochemistry developed alongside computers. If computers had not come along at about the same time as the structure of DNA was

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discovered, there would be no biochemistry. You always needed computer to process the information. Without it we would have rooms and rooms full of monks writing out the sequences''

3. parison of PCR and gene cloning

Parameter	PCR	Gene Cloning
1. Final result	Selective amplification of Specific sequence	Selective amplification of specific sequence
2. Manipulation	In vitro	In vitro & in vivo
3. selectivity of the specific segment from complex DNA	First step	Last step
4. Concentration of starting material	Nanogram (ng)	Microgram (µg)
5. Biological reigents Required	DNA, enzyme	Restriction enzyme , ligase, vectors, bacterial cell
6. Automation	Yes	No
7. Labour intensive	No	Yes
8. Error probability	Less	More
9. Applications	More	Less
10.Cost	Less	More
11.User's skill	Not required	Required
12.Time for a typical Experiment	Four hours	Two to four days

4. Principle of PCR

The dsDNA of interest is denatured is separate into two tndividual strands.Each strand is then allowed to hybridize with aprimer (renaturation) . the primer –template duplex is used for DNA synthesis by the enzyme thermo stable DNA polymerase(Taq DNA polymerase) isolated from thermaus aquaticas- a thermophilic bacterium grown in thermal spring.. The techenique became important with the discovery of Taq DNA polymerase by kary Mullis. It is athermo stable enzyme that retains it activity even after DNA denaturation by heat at 94°C . initially DNA plification was the klenow fragment of E. coli DNA polymerase -1 whch could not withstand the high temperature of the denaturation step. Presently, sequence in just a few PCR cycle in a very short duration of time. So it exploits the natural function of DNA polymerase to copy the genetic material r performing" molecular photocoping "

PCR consists of three basic steps

1) Denaturation : on rising the temperature to about 95º C for about one minute , the DNA gets denatured and the two stands separate.

ii) R enaturation or Annealing : as the temperature of the mixture is slowly cooled to about 55ºC the primers base pair with the complementary regions flanking DNA strands. This process is called renaturation or annealing. High concentration of primer ensures annealing between each DNA strand and the primer rather than the two strands of DNA

iii) synthesis or extension : The initiation of DNA synthesis occurs at 3'- OH end of each primer . The primers are extended by joining the bases (dNTPs) complementary to DNA stands. THE synthetic process inPCR is similar to the DNA replication of the leading strand . However,the temperature has to be kept optimal as required by the enzyme DNA polymerase. For Taq DNA polymerase temperature is around 75ºC.The reaction can be stopped by rising the temperature to about 95ºC. since both stands are copied during PCR , there is an exponential increase in the number of copies of the gene. These three steps are repeated 20-30 times in an automated thermocycler that can heat and cool the reaction mixture in tubes within a very short time . This results in exponential accumulation of specific DNA fragments ends of which are defined by 5' end of the primers . The doubling of DNA stands corresponding to be target sequences

allows us to estimate the amplification associated with each cycle using the formula. Amplification P% 2", where n P%no. of cycles

5. Method

PCR begins with dsDNA containing the sequence to be amplified and a pair of oligonucleotied primers which flank that DNA . The primers usually are 20 of more nucleotides long and are made synthetically , so a limitation of PCR is that information must be available about the sequence of interest. In brief PCR is done (Fig-1) as follows :

a) Denaturae the ds DNA to single stands by heating at 94-95ºC (Fig- 8.21, part-1)
b) Cool the mixture , and allow to anneal the primers (A and B in the figure) at 37- 65ºC, depending on how well the base sequences of the primers complement the base sequence of the DNA. The two primers are designed so that they anneal to the opposite stands of the template DNA flanking the sequence to be amplified . As a result , the 3' ends of the primers face each other
c) Extend the primers with DNA polymerase at 70-75º C (Fig-8.21, part-2). For this , a thermo stable DNA polymerase, such as Taq DNA polymerase is used.
d) Repeat the heating cycle to denature the DNA to single stands and cool the solution to anneal the primers again (Fig-8.21, part-3) . (Further amplification of original strands is omitted in the remainder of the figure)
e) Repeat the extension of the primer with Taq DNA polymerase (Fig8.21, part -4) . in such of the two double standed molecules produced in the figure . one stand is of unit length; that is, it is the length of DNA between the 5' end of the primer A and the 5' end of primer B – the length of the target DNA . The other strand in both molecules is longer than unit length.
f) Repeat the denaturation of DNA and the annealing of new primers (Fig-8.21, part-5) (For amplification, the further amplification of those strands which are no longer than unit length is omitted in the rest of the figure).
g) Repeat the extension of the primer with Taq DNA polymerase (Fig-8.21, part-6). This produces unit length. dsDNA Note that it took three cycles to produce the two molecules of unit-length DNA

Repeated denaturation, annealing, and extension cycles result in ageometric increase in the amount of unit-length

DNA. So with PCR , the amount of new DNA generated increase geometrically. Srarting with 1 molecules of DNA ,1 cycle of PCR produces 2 molecules , 2 cycle produces 4 molecules and 3 cycles produces 8 mole cules. A further 10 cycle produces 1024 copies 2| 10 of the target DNA and 20 cycles there will be

- The strand buffer works well for a wide range of templates and oligonucleotide primers, but it may not be optimal for any particular combination . Thus , the conditions given should be regared as a point of departure to explore modifications and potential improvements
- In particulary , the concentration of Mg2+ should be optimized whenever a new combination of target and primers is first used or when the concentration of dNTPs or primers is altered . The dNTPs are the major source of phosphate groups in the reaction , and any change in their concentration affects the concentration of the available Mg2+

c) choice of polymerase enzymes

- The enzymatic basic for PCR amplification is DNA polymerization reaction that extends the annealed primers in the standard 5'-3' direction.
- The original protocol used the klenow fragment of E. coli DNA polymerase – I to perform the primer extension reaction ; however this meant that fresh enzymes had to be added after each round of denaturation because this enzyme is easily heat-activated.A related problem with using an E. coli DNA polymerase is that the optimal activity level of the enzyme is 37°C ,which greatly limits the specifity of the reaction owing to degenerate primer annealing at this low temperature .
- Both of these problems can be solved by switiching to a DNA polymerase isolated from a thermophilic bacterium..

- The first commercially available thermostable DNA polymerase for PCR came from the thermophilic eubacterium, Thermus aquaticus known as Taq polymerase and a genetically – engineered from of the enzyme synthesized in E. coli. (ApliTaq tm)
- Taq DNA polymerase is a 94D thermostable DNA polymerase. Optimal optimal temperature for Taq DNA polymerase is 72ºC. it lacks 3'-5' exonuclease activity but has 5'-3' polymerase activity. For most amplification reactions 1.5 to 2 unit of enzyme is recommended, s higher enzyme concentration leads to non- specific amplification.
- Some thermostable DNA polymerase cn use RNA templates as a substrate , wich can be useful for PCR application that require a separate cDNA synthesis reaction using viral reverse transcriptase . An enzyme of this is the recombinant form of Tth (rTth) polymerase from Thermus thermophilus , which can catalyze high temperature reverse transcription of RNA in the presence of MnCl2.

Thermostable DNA polymerase commonly used in PCR

DNA polymerase	Source	Exonuclease activity
Pfu	Pyrococcus furiosus	3' – 5' (Proofreading)
Pfu (exo-)	Pyrococcus furiosus	No
Psp	Pyrococcus furiosus Sp. GB-D	3' – 5' (Proofreading)
Psp (exo-)	Pyrococcus furiosus Sp. GB-D	No
Pwo	Pyrococcus woesi	3' – 5' (Proofreading)
Taq(native or recombinant)	Thermus aquaticus	5'-3'
Taq(N-terminal deletion)	Thermus aquaticus	No
Tbr	Thermus brocianus	5'-3'
Tfl	Thermus flavus	-
Tli	Thermus litoralis	3' – 5' (Proofreading)
Tli (exo-)	Thermus litoralis	No
Tma	Thermus maritime	3' – 5' (Proofreading)
Tth	Thermus thermophilus	5'-3'

Characteristic features of some Thermostable DNA polymerase commonly used in PCR

Enzyme	Relative efficiency	Error rate	Processivity	Extension rate	5' – 3' exonuclease	3' – 5' exonuclease
Taq	88	2 x 10-4	55	75	NO	Yes
Tli	70	4 X 10-5	7	67	Yes	No
Pfu	60	7 X 10-7	N.D	N.D	Yes	No
rTth	n.d	N. D	30	60	No	Yes

Relative efficiency - Percent conversion of template to product per cycle
Error rate - Frequency of error per base pairs incorporated.
Processivity - Average number of nucleotides added before dissociation.
Extension rate - Average number of nucleotides added per second.
n.d - not determined.

d) dNTPs

- dNTPs are purchased or prepared at saturation concentrations (200 µ M for each Dntp) in 0, 1 mM EDTA. A stock solution of dNTPs (50 mM) should be adjusted to pH 7.0 with 1 N NaoH , to ensure that the pH of the final reaction dose not fall below 7.1.

e) Source DNAor target sequence

- Template DNA sequence can be added in a single or double stranded form.
- Linear target sequences are amplified better as compared to closed circular DNAs.

- Purity of template is flexible and even crude DNA extracts (e.g. pulp of a fossil tooth, a hair follicle) can be sued as long as the addition of template dose not inhibit the activity of polymerase.
- Higher amount of template DNA can lead to non-specific amplification.
- A single cell or crude lysates prepared by simply boiling cells in water or specimens with an average molecular length of only a few hundred base pairs are usually adequate for successful amplification.
- The concentration of of target sequences in the PCR reaction is generally in nanograms (5 – 100 ng). The concentration of of target sequences in the template DNA obviously varies according to the circumstances and is often not under the control reactions that contain decreasing amounts of known target sequences (1.0, 0.1, 0.01 0.001 µg etc.) to check that the amplification reaction is functioning at the required sensitivity.

f) Amplification reaction and specificity

- There are two important fundamental aspects of the PCR amplification ; one is enormous amplification achieved and the other is the specificity of the PCR.
- The PCR amplification procedure tolerates many variations from the ideal reaction conditions. In particular, a degree of mispairing will be tolerated, as long as the 3' –endmost two or three bases do not contain a mismatch.
- The target sequence is defined by the flanking primers and the specificity derives from the specific hybridization of the primers under the annealing conditions set for the thermal cycle. The fact is that the length of the target sequence is limited to less than few kilobases. This is especially likely when degenerate primers is employed. Howerer, an unintended point of hybridization will often be irrelevant because it is not likely that a second primer molecule will hybridize near enough for amplification to occur.

g) Cycling parameters

PCR is performed by incubating the samples at three different temperatures corresponding to the three steps (denaturation, annealing and extension) in a cycle of amplification (Fig-2). This cycling can be accomplished either manually with preset water baths or automatically with thermal cycler available from several manufactures.

Initial Denaturation step : complete denaturation of template DNA at the strat of the PCR reaction is of key importance. Incomplete denaturation resuls inefficient utilization of template in the first amplification cycle and in apoor yield of PCR product. It is generaly performed at 95ºC for 1 to 3 minutes , depending on the GC content of the template . if longer initial denaturation or temperature is necessary, then Taq DNA polymerase can be added after this step as hogher temperature may affect the enzyme stability. Initial denaturation step is performed only oince at the beginning of the reaction.

Denaturation : Subsequent denaturation steps are performed for a shorter time of 30 sec to 1 minute at 94ºC for , 30 cycles.This is sufficient, since the PCR product synthesized in the first amplification cycle is significantly shorter than the template DNA and completely denatures under these conditions. Certain additives like DMSO | Glycerol are used to facilate DNA denaturation depending on the GC content.

Annealing : the optimal annealing temperature is generally 5ºC lower than the melting temperature of the primer – template DNA duplex , performed for 30 sec to 1 minute. If non – specific products are obtained in addition to the expected product the annealing temperature is optimized by increasing it stepwise by 1"2ºC.

melting Temperature (Tm) – it is the temperature at which primer and DNA hybrid will dissociate . it is determined by using following formula -Tm={4(G+C) } + {2(A+T)}

Extension : Primer extension, resulting in the synthesis of new DNA strand is carried out at 72ºC , which is optimal temperature for Taq DNA

7. Setting of a standard amplification reaction or protocol

i) Procedure :

- Set up the general reaction in a 0.5 ml microfuge tube as describe below and as in table .Mix well and centrifuge it.
- 10 X PCR buffer . 600mM TRIS – HCL (pH9.5, room temperature), 150mM (NH4)2 SO4 and MgCl2 Overaly with mineral oil (100 µl)
- The above given standrand conditions work for a wide range of templates and oligonucleotide primers, but they maynot be optimal for any particular condition.
- Heat the reaction mixture for 5 min at 94°C, to denature the DNA completely While the reaction mixture is still at 94ºC, add 0.5µl of Taq DNA polymerase (5 units| µ) . Taq DNA polymerase is supplied in a storange buffer containing 50% glycerol. This solution is very viscuous and is difficult to pipette with accuracy. Athe brst method is to centrifuge the tube containing the enzyme at 12000g for 10 s at 4°C in a microfuge. And then to withdraw the required amount of enzyme
- *Sample Voloume :* Most amplification are performed at 20, 50 or 100µl in volume in 0.2 or o.5 microfuge tubes. Larger volume do not allow adequate thermal aquilibrium of the reaction mixture.

T A B L E *PCR reagents needed for a 100µl of reaction mixture*

Reagent	Volume	Final concentration
10X PCR buffer	10µl	1X
10 Mm dNTPs mix	2µl	Each dNTP0.2 –1.25mM
Primer 1	Variable	0.1–1.0µM
Primer 2	Variable	0.1 –1.0µM
Template DNA	Variable	0.1 – 1.µs| 100µl
Taq DNA polymerase	0.5µl	2.5 units	100µl
DMSO*	Variable	5%
Glycerol*	Variable	10%
PMPE*	Variable	1%
Sterile water	Variable	-
Final concentration	100µl	-

*Substitute with other enhancer agents as available.

The following reagent are added to the PCR tube in the following order :

Reagent	Volume
Sterile water	38 µl
10X assay buffer	5µl
10mM dNTPs mix	3µl
Template DNA (100ng | µ)	1µ
Forward Primer (100 ng |µl)	1µl
Reverse Primer (100 ng | µ)	1µl
Taq DNA polymerase (3 U | µ)	1µl
Total reaction Volume	50µl

Reaction mixture is layered with 100 or 50µl (depending on the volume of the reaction mix) of mineral oil to prevent evaporation of sample during repeated cycles of heating and cooling. Eral oil need not be addes if the Thermalcycler is equipped with a heat lid.

Typical conditions for denaturation annealing and polymerization are given in following table. The samples to -20ºC for storange. If the PCR is run overnight, then set the thermocycler to the end of the last cycle, so that the next day the early morning samples can be transferred

Cycling procedure

File	Cycle	Temperature	Time	No.of cycle
First cycle				1
	Denaturation	94ºC	5 min	
	Anneal	50ºC	2nin	
	Elongate	72ºC	3min	
Subsequent cycle				30 -35
	Denaturation	94ºC	1 min	
	Anneal	50 - 65ºC	2 min	
	Elongate	72ºC	3 min	
Last cycle				1
	Denaturation	94ºC	1 min	
	Anneal	50ºC	2 min	
	Elongate	72ºC	10 min	

Carefully with a sample of the amplified DNA from the bottom of the tube and analyzed it by gel eletrophoresis southern hybridization or DNA sequencing. If necessary, the can be removed from the sample by extraction with 150 µl of chloroform. The micelle can be transferred to a fresh tube with an automatic micropipettes. However, in Therrmocycler , the adding of oil is avoided by uniformly heating the tubes at the top also, so there will not be any condensation of water under the caps.

ii) precaution :

→ The timing of individual steps should begin only after the reaction mixtures have reached the required temperatures. Between 30 – 60s are required for the reaction mixture to reached the desired temperature after the temperature shift. It is important to adjust the length of the incubation steps to compensate for these reactions.

→ The annealing temp. (50ºC) chosen here is a compromise. The amplification is more efficient if the annealing is carried out at lower temperature (37°C), but the amount of mispairing is very high . At higher temperature (55C) , the specificity of the amplification reaction is increased, but its overall yield will be reduced.

→ the longer the distance between the primers . the longer the time required for the complete synthesis of the entire target sequence. This time given above in the table is optimized for a target sequence of about 500 bases long.

→ The number of amplification cycles depends on the concentration of target DNA in the reaction mixture. At least 25 cycles are required to amplify single – copy target sequences in mammalian genomic DNA, just enough to detect on agarose or polyacrylamide gels. Also , the amount of Taq polymerase usually become limiting after 25 -30 amplification cycles.

iii) Analysis on Agarose gel :

→ Following PCR amplification , 5µof gel loading buffer is added to each of the PCR tubes.

→ Then the mixture is tapped thoroughly for the 2 layers to separate

→ Following that , 15µof the reaction mixture is carefully pipetted out (avoiding mineral oil layer) and loaded onto 1.5 % agarose gel.

→ Agarose Gel electrophoresis is then carried out and stained with enthidium bromide to analyzed the PCR products

→ With Pcr , specific fragments can be amplified and RFLP | sequencing under taken without isolating the organism.

→ The product could also be analyzed by blotting | transfer to nylon membrane and hybrization with specific probes.

→ incorporation of bi0tin| dgoxigenin labeled d UTP during amplification and diction by colorimetric | luminescent techniques are other approaches for detection and quantitation of PCR products.

8. Types of PCR

i) Conventional DNA based PCR : These are the classical and conventional PCR assays. The primers target sequences on DNA and amplification follows the usaal steps of denaturation, annealing and elongation. Most of the PCR techniques developed for various organism belong to this category.

ii) nested PCR : Sequence similarities between the target SNA and related DNA are very frequently seen .as

a result if this, the primers may bind to both the DNAs and therefore even the undesired DNA also gets amplified in PCR. Use if nested primars increases the specificity of PCR and selectively amplifies target and undesired DNA .Nested PCR is illustrated in Fig. 8-3 In the first cycle if PCR, the products are both from target DNA and amplification proceeds.

A further modification of this method has been called drop in drop out PCR. Inwich the two sets of primers are added simultaneously. The primers are designed such that the outer set amplifies at a much higher melting temperature than the inner set and has a low annealing temperature. Cycling begins at high temperature is dropped, allowing the inner set to prime as well. After several rounds the annealing temperature is dropped, allowing the inner set to prime as well. After few rounds of PCR, when the shorter product accumulates, the denaturation is also dropped so that products of the outer primers can no longer melt to form lemplates, which causes the accumulation of products from the inner primers only.

iii) Inverse PCR : In the inverse PCR, amplification of DNA of the unknown sequences is carried out from the known sequence. Fig. 23.09. The target is cleaved with restriction enzyme which does not cut known sequence but cuts the unknown sequence on either side. The fragments so formed are inverted and get circularized by DNA ligase. The PCR is performed on the circular fragments of DNA. Two primers are used that face outwards from the known DNA sequence. It may be noted that the primers are are generated in the opposite ddirection to the normal, since the original sequence is inverted during circularization. PCR amplification gives a single linear product that includes unknown DNA from both left and right sides. The PCR product can now be cloned and / or sequenced.

iv)Anchored PCR : In the anchored PCR, a small sequence of nucleotides can be attached or tagged to the target DNA i.e. the DNA is anchored. This is particularly useful when the sequence surrounding the target DNA is not known. The anchor is frequently a poly G tail to which a poly C primer is used. The anchoring can also be done by the use of adaptors. As the adaptors possess a known sequence, the primer can be chosen.

v) Asymmetric PCR : PCR technique can also be used for the synthesis of single stranded DNA molecules, particularly useful for DNA sequencing. In the asymmetric PCR two primers in a ratio 100 : 1 are used. After 10-15 cycles of PCR, one primer is exhausted. The result is that in the next 10-15 cycles, only single stranded DNAs are generated.

vi) In-situ PCR amplification and detection : Techniques have been developed for the correlation of molecular results with cytological and histological features. In these techniques, theamplification can be done directly on the sections. Paraffin embedded or cytospin coated onn coated glass slides are digested with protease and amplification solution is added. Taq polymerase is then added at 60º C cycles are done. Product could be detected by in-situ hybridization or by direct incorporation of biotin / digoxigeninlabelled nucleaotieds.

vii) Reverse Trancription PCR : The PCR technique can also be employed for the amplification of RNA molecules in which reverse transcription occur by a thermostable Reverse Transcriptase (rTth) isolated from Thermus thermophilus. That is why it is called as RT-PCR. So, the RNA molecule (mRNA) must be first converted into Cdna. Alternatively, one of the viral reverse transcriptase enzymes (AMV RTase or MMLV RTase) can be used for the cDNA synthesis reaction, and then a second reaction is performed using one of the thermostable DNA polymerase. Different primers can be employed for the synthesis of first of Cdna. These include the use of random primers, oligo dT primer and a gene sequence specific primer (GSP). Thus , when cloning eukaryotic genes the cDNA version is used as it lavks the introns. Once the cDNA has been made, PCR can be used to amplify the cDNA and generate multiple copies. This combined procedure is referred to as RT – PCR (Fig….. 23-14, 23 – 15 , 3 – 16)

RT—PCR has other uses. A specific mRNA molecule is made when the gene for the protein isturned of and expressed. Therefore, extraction and purification of the mRNA gives several copies of every gene that is being expressed under particular growth condition. RT—PCR can then performed on the mixture of mRNA using PCR primers that match some particular gene of interest. If this gene was expressed under the specific

growth conditions, a PCR product will be produced, whereas, if this gene was switch off, none of the particular mRNA will be present and no band will be generated. Carrying out RT—PCR on an organism under different growth conditions reveals when the gene under scrutiny was switched on. This allows analysis of which environmental factors bring about expression of any choosen gene.(Fig……..)

Rapid Amplification of cDNA ends (RACE) – Using only reverse transcriptase, full length cDNA copies may be herd to get, especially from mRNA that is very low amounts or unusually long, revers transcriptase often fails to reach the end of a long RNA template due to hindarance by RNA seceondary structure. Thus the 5'' end is often incomplete. Consequently some means of recovering the complete cDNA in two halves; hence the name Rapid Amplification of cDNA ends (RACE). It is necessary to know part of the internal sequence of the mRNA/cDNA in order to design the internal primers; therefore, the technique is generally usued when an incomplete cDNA was isolated by other techniques as library screening. The RACE procedure is unique as anchor sequences are added to each end of the cDNA to facilitate the PCR.

The 3' reaction of RACE—PCR primes reverse transcriptase to synthesize a DNA copy from poly (A) tail of the mRNA by using an oligo (dt) primer that has a unique anchor sequence at the 5' end. Science the internal sequence is known , an internal primer is designed and known as gene sequence specific primer (GSP) . so that PCR will amplify from poly(A) tail to the middle of the gene (Fig…23. 17.

In the 5' reaction, the internal primer GSP is use to initiate DNA synthesis using reverse transcriptase. Next , an artificial poly(A) tail is added to the 3 'end of the DNA by internal transferse and Datp . The same oligo (dT)/ anchor primer is used ti initiate the3' reaction is then used again during the PCR amplification cycle for the 5' reaction . The anchor sequence primer and internal primers are generally designed to include conventional restriction sites to allow further cloning sequencing . (Fig…)

viii) Real- time quantitative PCR : There are many amplifications of the PCR where it would be advantageous to be able to quantify the amount of staring material . Theoretically there is a quantitative relationship between the amount of starting material (target sequence) and the of PCR product at any given cycle . In practice , replicate reactions yield different amounts of products , making quantitation unreliable. Higuchi et L. (1992< 1993) pioneered the use of ethidium bromide to quantify PCR products as they accumulate, Amplification produces increasing amounts of doublestranded DNA, with binds ethidium bromide, resulting in an increase in fluorescence. By plotting the increase in fluorescence versus cycle number it is possible to analyse the PCR kinetics in real time. This is much more satisfactory than analyzing product accumulation after a fixed number of cycles.

The principal drawback to the use of ethidium bromide is that both specific and non-specific products generate a signal. This can be overcome by the use of probe-based methods for assaying product accumulation (Livak et al. 1995). The probes used are oligonucleotides with a reporter fluorescent dye attached at the 5' end and a quencher dye at the 3' end. While the probe is intact, the proximity of the quencher reduces the fluorescence emitted by the reporter dye. If the target sequence is present, the probe anneals downstream from one of the primer sites. As the primer is extended, the probe is cleaved by the 5' nuclease activity of the Taq polymerase (Fig. . This cleavage of the probe separates the reporter dye from the quencher dye, thereby increasing the reporter-dye signal. Cleavage removes the probe from the target strand, allowing primer extension to continue to the end of the template strand. Additional reporter-dye molecules are cleaved from their respective probes with each cycle, effecting an. increase in fluorescence intensity proportional to the amount of amplicon produced. Instrumentation has been development which combines thermal cycling with measurement of fluorescence, thereby enabling the progresss of the PCR to be monitored in real time. This revolutionizes the way one approaches PCR-based quantitation fo DNA. Reactions are characterized by the point in time during cycling when amplification of a product is first detected, rather than by the amount of PCR product accumulated after a fixed number of cycles. The higher the starting copy number of the target, the sooner a significant increase in fluorescence is noted. Quantitation of the amount

of target in unknown samples is achieved by preparing a standard curve, using different starting copy numbers of the target sequence.

The real-time PCR assay has many advantages over conventional RT-PCR methods, including rapidity, quantitative measurement, lower contamination rate, higher sensitivity, higher specificity, and easy standardization. Thus nucleic acid- based assay or real-time quantitative assay might eventually replace

Virus isolation and conventional RT – PCR as the new gold standard for the rapid diagnosis of virus infection in the actual- phase samples. Real-time PCR has enhanced wider acceptance of the PCR due to its improved rapidity , sensitivity , reproducibility and the reduced risk of carry over contamination. Real – time PCR assay used for quantitative RT-PCR combine the best attributes of both relative and competitive (end-point) RT-PCR in that they are accurate, precise, capable of high throughput, and relatively easy to perform. Real –time PCR automates the laborious process of amplification by quantitating reaction products for each sample in every cycle. The result is an amazingly broad fold dynamic range, with no user intervention or replicates required. Data analysis, including standard curve generation and copy number calculation, is performed automatically. As more labs and core facilities acquire the instrumentation required for real-time analysis, this technique may become the dominant RT-PCR- based quantitation technique.

Advantages of Real Time PCR

→ Rapidity due to reduced cycle times and removal of post PCR detection procedures., → Very sensitive, → Reproducible., → Reduced risk of carry – over contamination., → High sample throughput (200 samples day).,→ Easy to perform ., → The detection of amplicons could be visualized as the amplification progressed .,→ Allow for quantitation of result, → Software driven operation.

Real – time Reporters

→ SYBR r Green
→ TaqMan r and
→ Molecular Beacons

Ll real – time PCR systems rely upon the detection and fluorescent reporter , the signal of which increase in direct proportion to the amount if PCR product in a reaction a) SYBRr Green

In the simplest and most economical format , that repoter is the double stand DNA – specific dye SYBRr Green (molecular probes). SYBRr Green binds double standed DNA, and upon excitation emits light. Thus as a PCR product accumulates , fluorescence. The disadvantages is that is that SYBRr Green will bind to any double standed DNA in the reaction , including primer – dimmer and other non- specific reaction products , which result in an overestimation of the target concentration. For single PCR product reaction with well-designed primers . SYBR Green can work extermly well. With spurious non- specific background only showing up in very late cycles. (Fig- 23-22)

b) TaqMan probes : are oligonucleotides that contain a fluorescent dye, typically on the 5' base and a quenching dye, typically located on the 3' base. When irradiated, the excited fluorescent dye transfer energy to the nearby quenching dye molecule rather fluorescing, resulting in a non-fluorescent substrate. TaqMan probes are designed to hybridize to an internal region of a PCR product. The TaqMan probe consist of two fluorophores linked by a DNA sequence that will hybridize to the middle of the target DNA Fluorophores resonance energy transfer (FRET) transfers the energy from the short wave length fluorophores on one end to the long wavelength fluorophores on the other end. This quenches the short wave emission (Fig. 23:23). During PCR, when the polymerase replicates a template on which a TaqMan probe is bound, the 5' exonuclease activity of the polymerase cleaves the probe. This sepearates the fluorescent and quenching

dyes and FRET no longer occurs. Fluorescence increases in each cycle, proportional to the rate of probe cleavage.

c) Molecular Beacons : It is used in conjuction with PCR primers to give a highly specific amplification plus detection system. Scorpion primers consist of a molecular becon (Fig. 23 : 25) joined toa single stranded DNA primer by an inert linker molecule. It also contain fluorescent and quenching dyes, but FRET only occurs when the quenching dye is directly adjacent to the fluorescent dye. Molecular beacons are designed to adopt a hairpin structure while free in solution, bringing the fluorescent dye and quencher in close proximity

When a molecular beacon hybridizes to a target, the fluorescent dye and quencher are separated, FRET does not occur, and the fluorescent dye emits light upon irradiation. Unlike TaqMan probes, moleculer beacons are designed to remain intact during the amplification reaction, and must rebind to target in every cycle for sugnal measurement

Real-time Reporters for Multiplex PCR : TaqMan probe and molecular beacons allow multiple DNA species to be measured in the same sample (multiplex PCR), since fluorescent dyes with different emission spectra may be attached to the different probes. Multiplex PCR allows internal controls to be co-amplified and permits allele discrimination it single-tube, homogeneous assay, These hybridization probes afford a level of discrimination impossible to obtain with SYBR Green, since they will only hybridize to true targets in a PCR andnot to primer- dimmers or other spurious products.

Investing in the Real- Time Technique: Real- time PCR requires an instrumentation platform that consists of a thermal cycler, computer, optics for fluorescence excitation and emission collection, and data acquisition and analysis software. These machines, available from several manufacturers, differ in sample capacity (some are 96-well standard format, other process fewer samples or require specialized glass capillary tubes). Method of excitation (some use laser, others broad spectrum light sources with tunable filter), and overall sensitivity. There are also platform – specific differences in how the software processes data. Real-time PCR machines are not cheap, but are well within purchasing reach of core facilities or labs that have the need for high throughput quantitative analysis.

Viral Quantitation : The majority of diagnostic PCR assay reported to data have been used in a qualitative or yes/no format. The development of real-time PCR has brought true quantitation of target nucleic acids out of the pure research laboratory and into the diagnostic laboratory. Determining the amount of template by PCR can be performed in two ways:

→ as relative quantitation and
→ as absolute quantitation

Relative quantitation : describes changes in the amount of a target sequence compared with its level in a related matrix.

Absolute quantitation : states the exact number of nucleic acid targets present in the sample in relation to a specific unit.

Generally, relative quantitation provides sufficient information and is simpler to develop. However, when monitoring the progress of an infection, absolute quantitation is useful in order to express the results in units that rae common to both scientists and clinicians and across different platforms. Absolute quantitation may also be necessary when there is a lack of sequential specimens to demonstrste changes in virus levels, no suitably standardized reference reagent is available or when the viral load is used to differentiate active versus persistent infection.

A very accurate approach to absolute quantitation by PCR is the use of competitive co-amplification of an internal control nucleic acid of known concentration and a wild type target nucleic acid of unknown concentration, with the former designed or chosen to amplify with an equal efficiency to the latter. However, while conventional competitive PCR is relatively inexpensive, real-time PCR is far more convenient, reliable and better suited to quick decision making in a clinical situation. This is because conventional. Quantitative,

competitive PCR (qcPCR) requires significant development and optimization to ensure reproducible performance and a predetermined dynamic range for both the amplification and detection components.

Limitation of Real Time PCR

⇒ Inability to monitor amplicons size without opening the system., ⇒ Incompatibility of some platforms with some fluorogenic chemistries., ⇒ The relatively restricted multiplex capabilities of current applications., ⇒ The start-up esprese of real time PCR is prohibitive when used in low-throughput laboratory

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Declaration

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AXIALLY SYMMETRIC FORCES AND CRYSTAL DYNAMICS OF TRANSITION METALS, Pd, Th AND Ni

S.R.B. THAPA*

Abstract

Crystal dynamics of transition metals has been studied by applying a phenomenological model. In this model the potential energy is considered due to (i) ion-ion and (ii) ion- electron interactions. Contribution due to ion-ion interaction is evaluated using axially symmetric model while contribution due to ion-electron interaction is evaluated using screened coulomb potential. The theoretical model is used to compute phonon frequencies. The computed phonon frequencies are used to interpret the lattice specific heat capacities and Debye characteristic temperatures of face centered cubic crystals Pd, Th and Ni giving satisfactory agreement with experimental results.

Key Words: Axially symmetric model, Debye Characteristic Temperature, Lattice Specific heat, Phonon frequencies, Screened coulomb potential.

Introduction

Lattice dynamics of metals have been studied theoretically by large number of workers using pseudopotential and phenomenological models. Bertolo and Shukla (1975,1977) studied the phonon frequencies and lattice specific heats of transition metals using modified version of Bhatia model of Lehmann et al(1962). Thakur and Singh (1986) applied three body phenomenological valence force field model to study phonon frequencies, lattice specific heats and Debye characteristic temperatures of transition metals. Applying Cheveau model (1968), S.Pal(1975, 1976) studied the lattice dynamics of Palladium. Rosengren et al (1975), J.Kumar(1977) and Vrate et al(1977) used different form of model potentials to study lattice dymanics of Thorium. Using pair wise forces for short range and Kreb's approach (1965) for long range coulomb forces Gupta et al(1975) calculated dispersion relations of nickel. Thapa(1998) studied lattice dynamics of Pd, Th and Ni using the concept of many body interactions of Sarkar and Sengupta (1969). First principle theories and pseudopotential approach involve rigorous and tedious calculations while phenomenological models are comparatively simple. In this paper we apply a phenomenological model which is already used by Thapa et al (2000) to explain lattice dynamics of p-block metals Al and Pb. The present model includes axially symmetric forces for ion-ion interaction

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and screened coulomb potential for ion-electron interaction. Ion-ion interaction includes bond stretching (central) and bond bending (non- central) forces up to second neighbour. Model for ion-ion interaction is developed by Lehman et al(1962) and that for ion-electron interaction is developed by Thakur and Singh (1986).

Theoretical Model

The theoretical model used is already reported by Thapa et al (2000). The secular determinant which determines the angular frequency of modes of vibration in the crystal is given by

$$|D(q)-m\omega^2 I| = 0 \quad \text{——————————————————————————(1)}$$

Where m is ionic mass and I is unit matrix.Following relations for elastic constants and phonon frequencies are reported by Thapa et al (2000).

$$C_{11}=1/2a\ [2\alpha_1+2\beta_1+4\alpha_2+k.2a] \quad \text{——————————————————(2)}$$
$$C_{12}=1/2a\ [\alpha_1-5\beta_1-4\beta_2+k.2a] \quad \text{——————————————————(3)}$$
$$C_{44}=1/2a\ [\alpha_1+3\beta_1+4\beta_2] \quad \text{——————————————————(4)}$$
$$\omega_L^2(X) = 1/m\ [8\alpha_1+12\beta_1+D_{11}^{\text{i.e.}}(x)] \quad \text{——————————(5)}$$
$$\omega_T^2(X) = 1/m\ [4\alpha_1+16\beta_1+D_{33}^{\text{i.e.}}(x)] \quad \text{——————————(6)}$$

Subscripts L and T represent longitudinal and transverse waves respectively, k is Bulk modulus of electron gas, 'a' is semi lattice constant. $D_{11}^{\text{i.e.}}$ and $D_{33}^{\text{i.e.}}$ are elements of dynamical matrix corresponding to ion-electron interaction which are same as that reported by Thakur and Singh(1986).

The value of Bulk modulus k is restricted by the relation $C_{12} - C_{44} = 4k$ ————(7)

β_1 = bond bending force constant corresponding to first nearest neighbour.
β_2 = bond bending force constant corresponding to second nearest neighbour.
α_1 = bond stretching force constant corresponding to first nearest neighbour.
α_2 = bond stretching force constant corresponding to second nearest neighbour.

Evaluation of Model Parameters

Input data for evaluating model parameters α_1, α_2, β_1 and β_2 are given below in table 1, 2 and 3. Evaluated values of model parameters are given in Table 4.

T A B L E 1 *(Elastic constants of Pd, Th and Ni in unit of 10^{10} Nm $^{-2}$)*

Transition metals	Elastic constants(10^{10}Nm^{-2}) C_{11}	C_{12}	C_{44}	Reference
Palladium	22.700	17.590	7.170	Rayne(1954,1961)
Thorium	7.530	4.890	4.780	Auard(1969)
Nickel	24.600	15.00	12.200	Klerk (1959)

T A B L E 2 *(zone boundary phonon frequencies of Pd, Th & Ni)*

Transition metals	Zone boundary phonon frequencies(10^{12}Hz) $(\upsilon_L)_x$	$(\upsilon_T)_x$	Reference
Palladium	6.70	4.5	Miller and Brockhouse (1971)
Thorium	3.474	2.259	Reese, et al(1973)
Nickel	8.55	6.27	Birgeneau, et al(1964)

T A B L E 3 *(Atomic mass, Semi-lattice constant, Screening multiplication constant, Inter-electronic spacing, Fermi surface wave vector)*

Noble metals	Atomic mass (m)10^{-27} Kg	Semi Lattice constant (a)10^{-1}nm	Screening multiplication constant	Inter-electronic spacing (r_O) 10^{-1}nm	Femisurface wave vector k_F 10nm	Reference
Palladium	176.624	1.945	0.6369	2.137	0.898	Harrison(1980)
Thorium	385.183	2.542	0.8322	1.252	1.532	
Nickel	97.458	1.762	0.1290	1.633	1.175	

T A B L E 4 *(Evaluated values of Model parameters and electron Bulk modulus of Pd, Th & Ni)*

Transition metals	Force Constants (Nm^{-1})			
	α_1	α_2	β_1	β_2
Palladium	39.8424	0.1899	-1.1277	-2.1128
Thorium	23.8429	-1.8720	-1.1037	0.9663
Nickel	24.4218	7.1667	3.3565	2.1254

Results and Discussion

Using the values of force constants phonon dispersion relations of transition metal Pd, Th and Ni along symmetry directions [ξ00],[ξξ0] and [ξ ξ ξ] are computed.

The values of C_v at different temperature are obtained by formula from Thakur and singh(1986)

$$C_v = (3R/3000)\ \Sigma_{\upsilon} E(h\upsilon/kT)g(\upsilon)$$

$g(\upsilon)$ is frequency distribution function defined by $g(\upsilon)d\upsilon = 9N\upsilon^2 d\upsilon/\upsilon_D^3$, υ_D is Debye threshold frequency, $\upsilon_D = k\theta_D/h$.$E(h\upsilon/kT)$ is the Einstein function defined by

$E_x = (x^2e^x)/(e^x - 1)^2$ where $x = h\upsilon/kT$, υ is frequency, k is Boltzmann constant, h is Planck's constant, T is temperature and N is number of atoms in the crystal. θ_D is Debye temperature.

Calculation of C_v at different temperatures is done by dividing first Brillouin zone of the crystal into one thousand miniature cells which reduce to 48 non equivalent points under symmetry operations. Secular equation (1) is solved at these points by dividing the frequency spectrum in intervals of $\triangle\upsilon$=0.1T Hz. Debye temperature θ_D is calculated by standard table of [C_v - θ_D/T] from Saha and Srivastava (1965) by using computed values of C_v at different temperatures. Calculated results of phonon frequencies, specific heats and Debye temperatures of Pd, Th and Ni are compared with experimental results.

Palladium: The calculated results of phonon frequencies for palladium along three symmetry directions on the basis of developed model are plotted in fig(1) along with experimental results of Miller and Brockhouse(1971) giving satisfactory agreement.

The calculated lattic specific heats of Palladium plotted against temperature are shown in fig.(2) with experimental results of Clusius and Schachinger(1947) giving satisfactory agreement. Debye characteristic temperatures obtained from lattice specific heat are plotted as a function of temperature in fig. (3) with experimental points of Clusius and Schachinger (1947) for comparison. Agreement is satisfactory.

Thorium: The calculated results of phonon frequencies for Thorium along three symmetry directions on the basis of adopted model are plotted in fig(4) along with experimental results of Reese et al (1973) giving satisfactory agreement.

The calculated lattice specific heat of Thorium plotted against temperature is shown in fig.(5) with experimental results of Reese et al(1973) giving satisfactory agreement. Debye characteristic temperature obtained from lattice specific heat is plotted as a function of temperature in fig. (6) with experimental points of Reese et al (1973) for comparison. Agreement is satisfactory.

Nickel : The calculated results of phonon frequencies for Nickel along three symmetry directions on the basis

of developed model are plotted in fig. (7) along with experimental results of Birgeneau et al(1964) giving satisfactory agreement

The calculated lattice specific heats of Nickel plotted against temperature are shown in fig. (8) with experimental results of Busey and Giaque (1952) giving satisfactory agreement. Debye characteristic temperatures obtained from lattic specific heat are plotted as a function of temperature in fig. (9) with experimental points of Busey and Giaque (1952) for comparison. Agreement is satisfactory.

Conclusions

The theoretical model developed to study the lattice dynamics of face centered cubic metals Al and Pb [Thapa et al(2000)] explains satisfactorily phonon dispersion results, Lattice specific heats and Debye characteristic temperatures of face centered cubic metals Pd, Th and Ni. Hence axially symmetric model for ion-ion interaction and screened coulomb potential for ion-electron interaction explains satisfactorily the lattice dynamics of transition metals Palladium, Thorium and Nickel and p-block metals Al and Pb.

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Fig.1. Phonon dispersion curves for palladium along symmetry directions Experimental points (0) are due to Miller and Brockhouse (1971).

Fig.2. (C_{v}-T) curves for palladium. Experimental points (0) are due to Clusius and Schachinger(1947).

Fig.3. (θ_{D}-T) curves for palladium. Experimental points (0) are due to Clusius and Schachinger(1947).

Fig.4. Phonon dispersion curves for thorium along symmetry directions. Experimental points (0) are due to Reese et al (1973).

Fig.5. (C_{v}-T) curves for thorium. Experimental points (0) are due to Reese et al(1973).

Fig.6. (θ_{D}-T) curves for thorium. Experimental points (0) are due to Reese et al(1973).

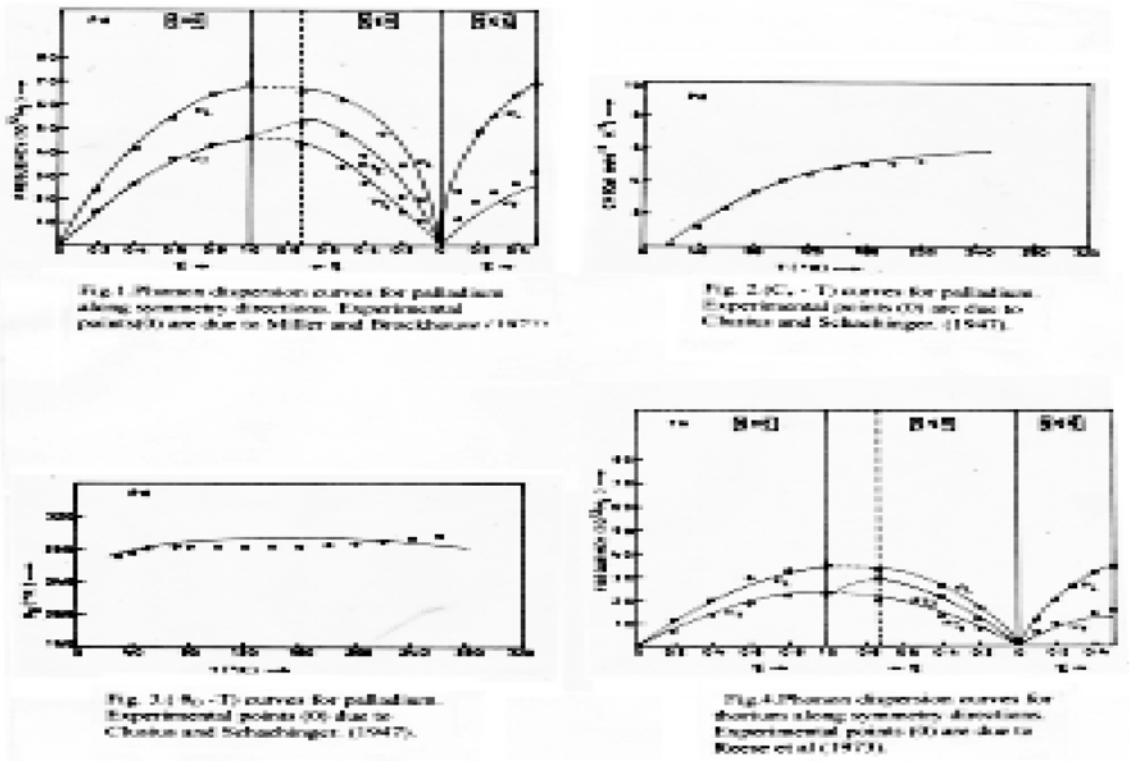
Fig.7. Phonon dispersion curves for nickel along symmetry directions. Experimental points (0) are due to Birgeneau et al (1964).

Fig.8. (C_{v}-T)curves for nickel. Experimental points (0) are due to Busey and Giaque(1952).

Fig.9. (θ_{D}-T) curves for nickel. Experimental points (0) are due to Busey and Giaque (1952) .(1971)

DECLARATION

The Declaration of the author for publication of Research Paper in The Indian Journal of Research Anvikshiki ISSN 0973-9777 Bi-monthly International Journal of all Research: I, *Sita Ram Bahadur Thapa, Birendra Multiple Campus, Bharatpur (Chitwan) Nepal*. the author of the research paper / article entitled AXIALLY SYMMETRIC FORCES AND CRYSTAL DYNAMICS OF TRANSITION METALS, Pd, Th AND Ni declare that , I take the responsibility of the content and material of my paper as I myself have written it and also have read the manuscript of my paper carefully. Also, I hereby give my consent to publish my paper in The Indian Journal of Research, Anvikshiki ISSN 0973-9777 Bi-monthly International Journal of all Research , This article / research paper is my original work and no part of it or it's similar version is published or has been sent for publication anywhere else. I authorise the Editorial Board of The Indian Journal of Research Anvikshiki ISSN 0973-9777 Bi-monthly International Journal of all Research to modify and edit the manuscript. I also give my consent to the Editor of The Indian Journal of Research Anvikshiki ISSN 0973-9777 Bi-monthly International Journal of all Research to own the copyright of my research paper / article.



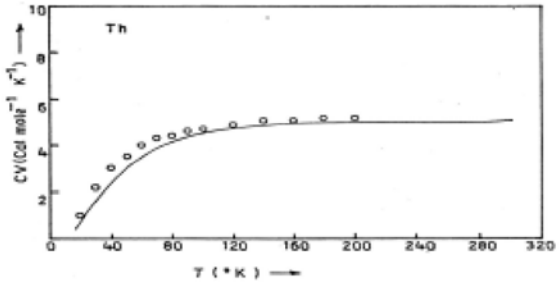


Fig. 5.(C_v - T) curves for thorium. Experimental points (0) are due to Reese et al (1973).

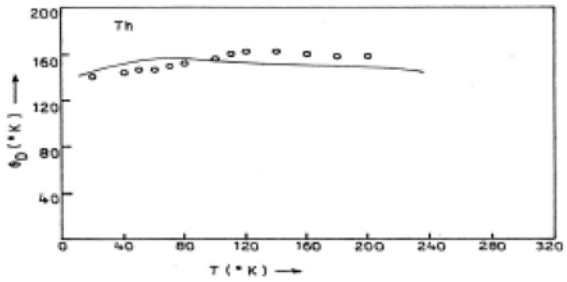


Fig.6.(θ_D -T) curves for thorium. Experimental points (0) due to Reese et al (1973).

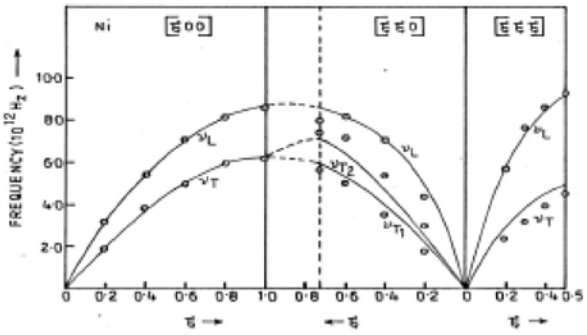


Fig.7.Phonon dispersion curves for nickel along symmetry directions. Experimental points (0) are due to Birgeneau et al (1964).

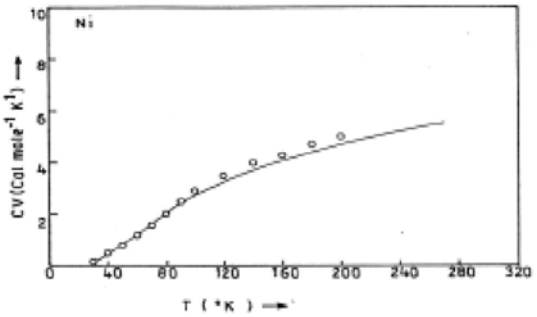


Fig. 8.(C_v - T) curves for nickel. Experimental points (0) are due to Busey and Giaque (1952).

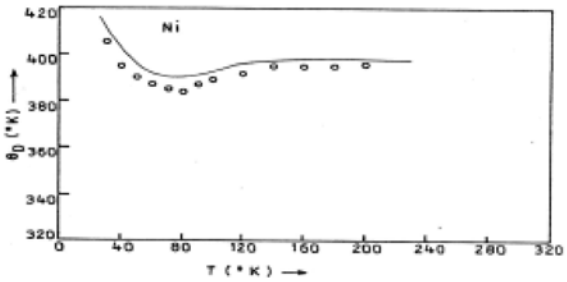


Fig.9.(θ_D -T) curves for nickel. Experimental points (0) due to Busey and Giaque (1952).

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ANALYTICAL STUDY OF ATMOSPHERE CLIMATE AND WEATHER

UTTIM LAL SHAU*

Introduction

The atmosphere of the Earth serves as a key factor in sustaining the planetary ecosystem. The thin layer of gases that envelops the Earth is held in place by the planet's gravity. Dry air consists of 78% nitrogen, 21% oxygen, 1% argon and other inert gases, such as carbon dioxide. The remaining gases are often referred to as trace gases,[15] among which are the greenhouse gases such as water vapor, carbon dioxide, methane, nitrous oxide, and ozone. Filtered air includes trace amounts of many otherchemical compounds. Air also contains a variable amount of water vapor andsuspensions of water droplets and ice crystals seen as clouds. Many natural substances may be present in tiny amounts in an unfiltered air sample, including dust,pollen and spores, sea spray, volcanic ash, and meteoroids. Various industrialpollutants also may be present, such as chlorine (elementary or in compounds), fluorinecompounds, elemental mercury, and sulphur compounds such as sulphur dioxide[SO_2].

Atmospheric layers

Principal layers

Earth's atmosphere can be divided into five main layers. These layers are mainly determined by whether temperature increases or decreases with altitude. From highest to lowest, these layers are:

- Exosphere: The outermost layer of Earth's atmosphere extends from the exobase upward, mainly composed of hydrogen and helium.
- Thermosphere: The top of the thermosphere is the bottom of the exosphere, called the exobase. Its height varies with solar activity and ranges from about 350–800 km (220–500 mi; 1,100,000–2,600,000 ft). The International Space Station orbits in this layer, between 320 and 380 km (200 and 240 mi).
- Mesosphere: The mesosphere extends from the stratopause to 80–85 km (50–53 mi; 260,000–280,000 ft). It is the layer where most meteors burn up upon entering the atmosphere.
- Stratosphere: The stratosphere extends from the tropopause to about 51 km (32 mi; 170,000 ft). The stratopause, which is the boundary between the stratosphere and mesosphere, typically is at 50 to 55 km (31 to 34 mi; 160,000 to 180,000 ft).
- Troposphere: The troposphere begins at the surface and extends to between 7 km (23,000 ft) at the poles and 17 km

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(56,000 ft) at the equator, with some variation due to weather. The troposphere is mostly heated by transfer of energy from the surface, so on average the lowest part of the troposphere is warmest and temperature decreases with altitude. The tropopause is the boundary between the troposphere and stratosphere.

Other layers

Within the five principal layers determined by temperature are several layers determined by other properties :

- The ozone layer is contained within the stratosphere. It is mainly located in the lower portion of the stratosphere from about 15–35 km (9.3–22 mi; 49,000–110,000 ft), though the thickness varies seasonally and geographically. About 90% of the ozone in our atmosphere is contained in the stratosphere.
- The ionosphere, the part of the atmosphere that is ionized by solar radiation, stretches from 50 to 1,000 km (31 to 620 mi; 160,000 to 3,300,000 ft) and typically overlaps both the exosphere and the thermosphere. It forms the inner edge of the magnetosphere.
- The homosphere and heterosphere: The homosphere includes the troposphere, stratosphere, and mesosphere. The upper part of the heterosphere is composed almost completely of hydrogen, the lightest element.
- The planetary boundary layer is the part of the troposphere that is nearest the Earth's surface and is directly affected by it, mainly throughturbulent diffusion.

The potential dangers of global warming are being increasingly studied by a wide global consortium of scientists. These scientists are increasingly concerned about the potential long-term effects of global warming on our natural environment and on the planet. Of particular concern is how climate changeand global warming caused by anthropogenic, or human-made releases ofgreenhouse gases, most notably carbon dioxide, can act interactively, and have adverse effects upon the planet, its natural environment and humans' existence. Efforts have been increasingly focused on the mitigation of greenhouse gases that are causing climatic changes, on developing adaptative strategies to global warming, to assist humans, animal and plant species, ecosystems, regions and nations in adjusting to the effects of global warming. Some examples of recent collaboration to address climate change and global warming include:

Another view of the Aletsch Glacier in theSwiss Alps and because of global warming it has been decreasing

- The United Nations Framework Convention Treaty and convention on Climate Change, to stabilize greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system.[16]
- The Kyoto Protocol, which is the protocol to the international Framework Convention on Climate Change treaty, again with the objective of reducing greenhouse gases in an effort to prevent anthropogenic climate change.[17]
- The Western Climate Initiative, to identify, evaluate, and implement collective and cooperative ways to reduce greenhouse gases in the region, focusing on a market-based cap-and-trade system.[18]

A significantly profound challenge is to identify the natural environmental dynamics in contrast to environmental changes not within natural variances. A common solution is to adapt a static view neglecting natural variances to exist. Methodologically, this view could be defended when looking at processes which change slowly and short time series, while the problem arrives when fast processes turns essential in the object of the study.

Weather

Weather is a set of all the phenomena occurring in a given atmospheric area at a giventime.[20] Most weather phenomena occur in the troposphere,[21][22] just below thestratosphere. Weather refers, generally, to day-to-day temperature and precipitation activity, whereas climate is the term for the average atmospheric conditions over longer periods of time.[23] When used without qualification, "weather" is understood to be the weather of Earth.

Weather occurs due to density (temperature and moisture) differences between one place and another. These differences can occur due to the sun angle at any particular spot, which varies by latitude from the tropics. The strong temperature contrast between polar and tropical air gives rise to the jet stream. Weather

systems in the mid-latitudes, such asextratropical cyclones, are caused by instabilities of the jet stream flow. Because the Earth'saxis is tilted relative to its orbital plane, sunlight is incident at different angles at different times of the year. On the Earth's surface, temperatures usually range ±40 °C (100 °F to –40 °F) annually. Over thousands of years, changes in the Earth's orbit have affected the amount and distribution of solar energy received by the Earth and influence long-term climate

Surface temperature differences in turn cause pressure differences. Higher altitudes are cooler than lower altitudes due to differences in compressional heating. Weather forecasting is the application of science and technology to predict the state of the atmosphere for a future time and a given location. The atmosphere is a chaotic system, and small changes to one part of the system can grow to have large effects on the system as a whole. Human attempts to control the weather have occurred throughout human history, and there is evidence that human activity such as agriculture and industry has inadvertently modified weather patterns.

There are many plant species on the planet.

An example of the many animal species on the Earth.

Evidence suggests that life on Earth has existed for about 3.7 billion years.[24] All known life forms share fundamental molecular mechanisms, and based on these observations, theories on the origin of life attempt to find a mechanism explaining the formation of a primordial single cell organism from which all life originates. There are many different hypotheses regarding the path that might have been taken from simple organic molecules via pre-cellular life to protocells and metabolism.

Although there is no universal agreement on the definition of life, scientists generally accept that the biological manifestation of life is characterized by organization,metabolism, growth, adaptation, response to stimuli and reproduction.[25] Life may also be said to be simply the characteristic state of organisms. In biology, the science of living organisms, "life" is the condition which distinguishes active organisms from inorganic matter, including the capacity for growth, functional activity and the continual change preceding death.[26][27]

A diverse array of living organisms (life forms) can be found in the biosphere on Earth, and properties common to these organisms—plants,animals, fungi, protists, archaea, and bacteria—Reduction and clean up of pollution, with future goals of zero pollution;

- Cleanly converting non-recyclable materials into energy through direct combustion or after conversion into secondary fuels;
- Reducing societal consumption of non-renewable fuels;
- Development of alternative, green, low-carbon or renewable energy sources;
- Conservation and sustainable use of scarce resources such as water, land, and air;
- Protection of representative or unique or pristine ecosystems;

- Preservation of threatened and endangered species extinction;
- The establishment of nature and biosphere reserves under various types of protection; and, most generally, the protection of biodiversityand ecosystems upon which all human and other life on earth depends.

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Declaration

The Declaration of the author for publication of Research Paper in The Indian Journal of Research Anvikshiki ISSN 0973-9777 Bi-monthly International Journal of all Research: I, *Uttim Lal Shau, Dept. of Botany, M.G.College Darbhanga (Bihar) India.* the author of the research paper / article entitled ANALYTICAL STUDY OF ATMOSPHERE CLIMATE AND WEATHER declare that , I take the responsibility of the content and material of my paper as I myself have written it and also have read the manuscript of my paper carefully. Also, I hereby give my consent to publish my paper in The Indian Journal of Research, Anvikshiki ISSN 0973-9777 Bi-monthly International Journal of all Research , This article / research paper is my original work and no part of it or it's similar version is published or has been sent for publication anywhere else. I authorise the Editorial Board of The Indian Journal of Research Anvikshiki ISSN 0973-9777 Bi-monthly International Journal of all Research to modify and edit the manuscript. I also give my consent to the Editor of The Indian Journal of Research Anvikshiki ISSN 0973-9777 Bi-monthly International Journal of all Research to own the copyright of my research paper / article.

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MODELING IN PLANT BREEDING

ANAND KAUSHAL*

Abstract

Conventional plant breeding largely depends on phenotypic selection and breeder's experience, therefore the breeding efficiency is low and the predictions are inaccurate. Along with the fast development in molecular biology and biotechnology, a large amount of biological data is available for genetic studies of important breeding traits in plants, which in turn allows the conduction of genotypic selection in the breeding process. However, gene information has not been effectively used in crop improvement because of the lack of appropriate tools. The simulation approach can utilize the vast and diverse genetic information, predict the cross performance, and compare different selection methods.

Key words: breeding simulation, genetic model, breeding strategy, design breeding.

Introduction

Phenotype of a biological individual is attributed to genotypic and environmental effects. The major breeding objective is to develop ness genotypes that are genetically superior to those currently available, for a specific target population of environments (Fehr 1987; Falconer and Mackay 1996; Lynch and Walsh 1998). To achieve this objective, breeders face many complex choices in the design of efficient crossing and selection strategies aimed at combining the desired alleles into a single target genotype. Though breeders spend great efforts in choosing parents to make the targeted crosses, approximately 50-80% of the crosses are discarded in generations F_1 to F_8, following the selection for agronomic traits (e.g., plant height, lodging tolerance, tillering. appropriate heading date, and balanced yield components), disease resistance (e.g., stern rust, leaf rust, and stripe rust), and end-use quality (e.g., dough strength and extensibility, protein quantity and quality). Then, after two cycles of yield trials (i.e., preliminary yield trial in F_8 and replicated yield trial in F_9), only 10% of the initial crosses remain, among which 1-3% of the crosses originally made are released as cultivars from CIMMYT's international nurseries (Wang et al. 2003, 2005): Significant resources can therefore be saved if the potential performance of a cross, using a defined selection strategy, can be accurately predicted.

On the other hand, a great amount of studies on QTL mapping have been conducted for various traits in plants and animals in recent years (Zeng 1994; Tanksley and Nelson 1996; Frary et al. 2000; Barton and

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Keightley 2002; Li et al. 2003). As the number of published genes and QTLs for various traits continues to increase, the challenge for plant breeders is to determine how to best utilize this multitude of information for the improvement of crop performance. Quantitative genetics provides much of the framework for the design and analysis of selection methods used within breeding programs (Falconer and Mackay 1996; Lynch and Walsh 1998; Goldman 2000). However, there are usually associated assumptions, some of which can be easily tested or satisfied by experimentation; others can seldom, if ever, he met. Computer simulation provides us with a tool to investigate the implications of relaxing some of the assumptions and the effect this has on the conduct of a breeding program (Kempthone 1988). Breeding simulation allows the definition of complicated genetic models consisting of multiple alleles, pleiotropy, epistasis, and genes by environment interaction, and provides a useful tool to breeders, who can efficiently use the wide spectrum of genetic data and information available. This approach will be very helpful when the breeders want to compare breeding efficiencies from different selection strategies, to predict the cross performance with known gene information, and to investigate the efficient use of identified QTLs in conventional breeding, and so on. In this article, the principles of simulation modeling in plant breeding are introduced initially, and then several applications using the simulation tool of QuLine are summarized.

Principles of Simulation Modeling in Plant Breeding

The genetics and breeding simulation module of QuLine

QU-GENE is a simulation platform for quantitative analysis of genetic models, which consists of a two- stage architecture (Podlich and Cooper 1998). The first stage is the engine, and its role is to: (1) define the genotype by environment (GE) system (i.e., all the genetic and environmental information of the simulation experiment), and (2) generate the starting population of individuals (base germplasm) (Fig. 1). The second stage encompasses the application modules, whose role is to investigate, analyze, or manipulate the starting population of individuals within the GF system defined by the engine. The application module usually represents the operation of a breeding program. A QU-GENE strategic application module, QuLinc, has therefore been developed to simulate the breeding procedure deriving inbred lines (Fig. 1). Built on QU-GENE, QuLine (previously called QuLim) is a genetics and breeding simulation tool, which can integrate various genes with multiple alleles operating within epistatic networks and differentially interacting with the environment, and predict the outcome from a specific cross following the application of a real selection scheme (Wang et al. 2003; Wang et al. 2004). It therefore has the potential to provide a bridge between the vast amount of biological data and the breeder's queries on optimizing selection gain and efficiency. QuLine has been used to compare two selection strategies (Wang et al, 2003). to study the effects on selection of dominance and epistasis (Wang et al. 2004), to predict cross performance using known gene information (Wang et al. 2005), and to optimize marker–assisted selection to efficient pyramid multiple genes (Kuchel et al. 2005; Wang et al. 2007).

Genetic models used in simulation

The simulation principles are illustrated by using CIMMYT's wheat breeding program as an example. Two breeding strategies arc commonly used in CIMMYT's wheat breeding programs. The MODPED (modified pedigree) method begins with pedigree selection of individual plants in the F_2, followed by three bulk selections from F_3 to F_5, and pedigree selection in the F_6: hence the name modified pedigree/bulk. In the SELBLK (selected bulk) method, spikes of selected F_2 plants Within one cross are harvested in bulk and threshed together, resulting in one F_3 seed lot per cross. This selected bulk selection is also used from F_3, to F_5, Whereas, pedigree selection is used only in the F_6. A major advantage of SELBLK. compared to MODPED is that fewer seed lots need to be harvested, threshed, and visually selected for seed appearance, leading to

significant saving of time, labor, and costs associated with nursery preparation, planting, and plot labeling ensue (van Ginkel et al. 2002). The flowchart of SELBLK is shown in Fig.2.

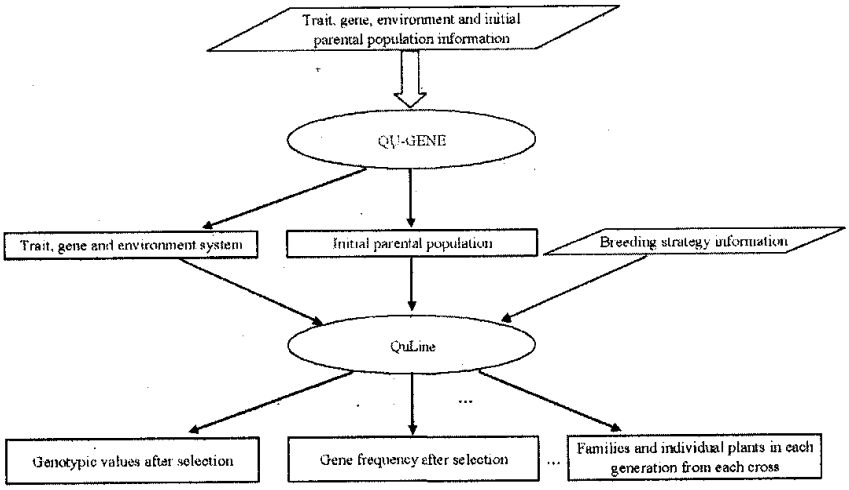

Fig. 1 *Flowchart of the breeding simulation tool QnLine. The two ellipses represent the two computer programs. i.e. QU-GENE and QuLine: the parallelograms represent inputs for QU-GENE: and QuLine: and the rectangles represent outputs from QU-Gl'NE and QuLine*

Apart from the pleiotropic effects of genes affecting other traits, it is postulated that there are 20 genes yield per, se(italic in necessary?) even though their very existence has been debated. Four gene effect models were considered for yield, those are, pure additive [AD0. Aa = (AA + aa)/2, where A and a represent the two alleles at each locus affecting the yield], partial dominance [AD1, Aa[1] (AA+aa)/2, but is between AA and aa]. a

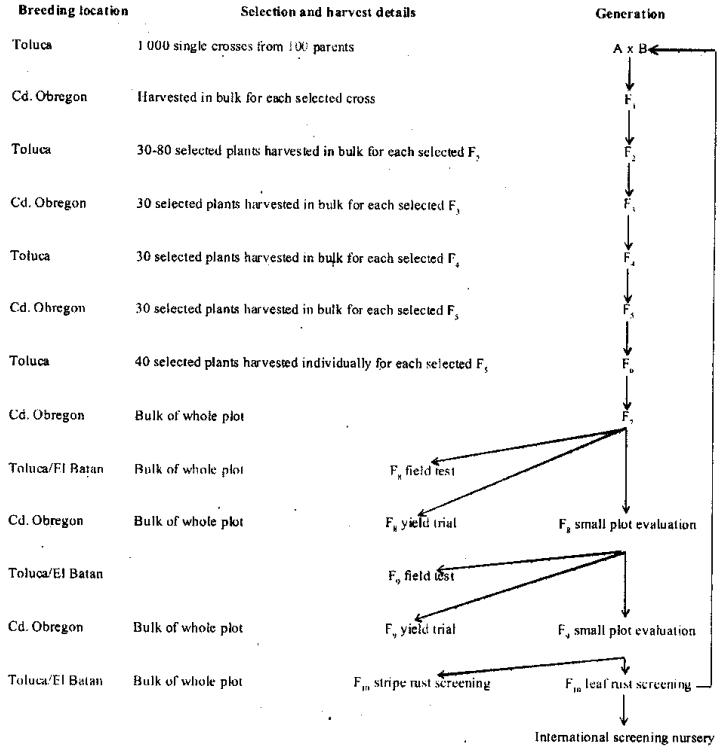

Fig. 2 *Germplasm flow in CIMMYT's Wheat Breeding Program, The breeding slrategy described was called selected hulk selection method.*

combination of partial, complete, and overdominance (AD2, the genetic values of AA, Ac and aa are independent), and digenic interaction (ADE) (Wang et al. 2004).

T A B L E 1 *Number of segregating genes and their genetic effects in the Cd. Obregon environment type[1])*

Gene classification	Number of genes	Traits affected	Individual gene effects		
			AA	Aa	aa
Yield	20	Yield (t / ha)	Four genetic models for yield : AD0 (pure additive)AD1 (partial dominance), AD2 (overdominance), ADE (digenic epistasis)		
Lodging	3	Lodging (%)			
Stem rust	5	Yield (t / ha^{-1})	0.00	5.00	10.00
			0.00	-0.40	-0.80
		Stem rust (%)	0.00	0.50	1.00
			0.00	-0.25	-0.50
Leaf rust	5	Yield (t / ha^{-1})	0.00	-0.75	-1.50
			0.00	5.00	10.00
		Kernal	0.00	-0.25	-0.50
Stripe rust	5	weight (g)	0.00	-0.75	-1.50
Height	3	Leaf rust	0.00	0.00	0.00
		(%)	40.00	30.00	20.00
Maturity	5	Yield (t / ha^{-1})	5.00	2.50	0.00
			20.00	16.00	12.00
Tillering	3	Kernal	-1.00	-0.50	0.00
		weight (g)	5.00	3.00	1.00
		Stripe rust	2.00	1.00	0.00
		Height (cm)	1.00	0.50	0.00
		Lodging (%)	-1.00	-0.50	0.00
Grains per ear	5	Maturity	-1.50	-0.75	0.00
		(day)	14.00	10.00	6.00
		Kernal	2.00	1.00	0.00
Kernal weight	5	weight (g)	-1.00	-0.50	0.00
		Tillering	12.00	8.50	5.00
		(no.)	1.00	0.50	0.00
		Lodging	2.00	1.00	0.00
		Maturity (day)			
		Grains per ear			
		Kernal weight (g)			
		Grains per ear			
		Lodging (%)			
		Kernal weight (g)			
		Kernal weight (g)			
		Yield (t / ha^{-1})			
		Lodging (%)			

1) There is no stripe rust in the Cd. obregon environment type. So the effects of the 5 genes for stripe rust were set at 0. However, these genes have effects in the other two environment types.

Some small-scale field experiments were conducted comparing the efficiencies of MODPED and SELBLK (Singh et al. 1998). however, the efficiency of SELBLK compared with that of MODPED remains untested on a larger scale. The genetic models developed accounted for epistasis, pleiotropy, and genotype by environment (GE) interaction (Table 1). For both breeding strategies, the simulation experiment comprised of the same 1000 crosses developed from 200 parents. A total of 258 advanced lines remained following 10 generations of selection. The two strategies were each applied 500 times on 12 GE systems.

The average adjusted genetic gain on yield across all genetic models was 5.83 for MODPED and 6.02 for SELBLK, a difference of 3.3% (Fig.3-A). This difference is not large and therefore unlikely to be detected using field experiments (Singh et al. 1998). However, it can be detected through simulation, which indicates that the high level of replication (50 models by 10 runs in this experiment) is feasible with simulation and can better account for the stochastic properties from a run of a breeding strategy, and from the sources of experimental errors. The average adjusted gains for the two yield gene numbers 20 and 40 were 6.83 and 5.02, respectively, suggesting that genetic gain decreases with increasing yield gene number.

The number of crosses remaining after one breeding cycle was significantly different among models and strategies, but not among runs. The number of crosses remaining from SELBLK was always higher than that from MODPED, which means that delaying pedigree selection favors diversity.

As the number of families and selection methods after F6 were basically the same for both MODPED and SELBLK, only the resources allocated from F_1 to F_8 were compared. The total number of individual plants from F_1 to F_8 was calculated to be 5,155,090 for MODPED and 3,358,255 for SELBLK (Fig.3-C).

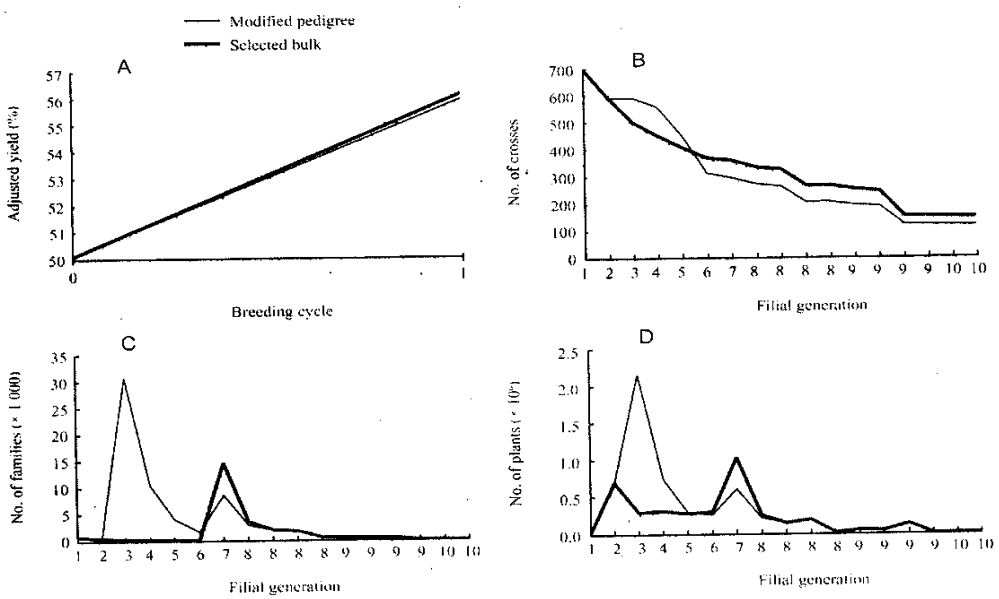

Fig. 3 *Comparision of modified pedigree and selected bulk from the simulation experiment. A. adjusted genetic gain after one breeding cycle across all experimental sets; B number of crosses after each generation's selection across all experimental sets. C. number at families in each generation in one breeding cycle: D. number of individual plants in each generation in one breeding cycle.*

Assuming that planting intensity is similar, SELBLK will use approximately two thirds of the land allocated to MODPED. Furthermore, SELBLK produced smaller number of families compared to MODPED. From F_1 to F_8 there were 63,188 families for MODPED, but only 24,260 for SELBLK. approximately 40% of the number for MODPED (Fig.3-D). Therefore when SELBLK is used, fewer seed lots need to be handled at both harvest and sowing, resulting in a significant saving in time, labor, and cost.

Conclusion

In the future it will he possible to build more realistic genetic models if advances in genomics improve the understanding of the genotype to phenotype relationship and genotype by environment interactions (Bernardo 2002; Cooper et al. 2005). Conclusions on the relative merits of breeding strategies based on simple gene-to- phenotype models may have to be re-evaluated in the context of an exponentially growing knowledge base. This information will aid in determining gene number and gene effects on phenotype. In addition, conventional plant breeding provides a wealth of information about trait heritability and trait correlation. As there is accumulation in the knowledge of the genetics for most breeding traits, simulation modeling will become more and more important, as computer simulation can help to investigate many what- if crossing and selection scenarios, and allows many scenarios to be tested in silico in a short period of time, which in turn helps breeders make important decisions before conducting highly resource demanding field experiments.

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Declaration

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MECHANISM OF BIOLOGICAL NITROGEN FIXATION

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The mechanism of nitrogen fixation has intrigued biochemist for many years. The main problem in this process is that nitrogen is chemically extremely inert and can be reduced enzymatically under relatively mild condition. The traditional methods used for studying metabolically active pathways have proved surprisingly unfruitful and revealed that the formation of free intermediates in the reduction process. Recently however considerable progress has been made on the biochemistry of nitrogen fixation and the understanding of biological nitrogen fixation has advance with impressive rapidity during the last two decade.

Winogradsky in 1894 proposed that nitrogen fixation by Clostridium pasteurianum was the reduction N_2 to NH3 by nascent hydrogen formed in the butyric acid fermentation. Although this mechanism seemed reasonable for an anaerobe. But was not acceptable for other organism. Bulen(1936) and Vitranen(1938) proposed that nitrogen is first reduce to hydroxylamine which then combines with oxaloacetic acid to produce aspartic acid. Using $^{15}N_2$, Burris(1942) furnished first clear cut evidence that NH_3 is the first stable intermediate compound that terminate the inorganic phase of N_2 fixation, which was latter accepted by Vitranen(1947).

The simplest conclution from the experience of these earlier works appeared to be that N_2 convert to NH_3 via an unknown pathway. The NH_3 is converted to glutamic acid by reductive animation and other amino acids are formed by transamination reaction to meet the need for the synthesis of proteins. The unique reaction in the biological nitrogen fixation therefore, one enzyme driven reaction which reduce molecular N_2 to NH_3. The overall reaction consists of addition of six electrons and must have intermediate steps to reduce N_2 to NH_3.

$$N \equiv N \xrightarrow{2e^-} NH{=}NH \xrightarrow{2e^-} H2N{-}NH2 \xrightarrow{2e^-} 2NH3$$

Nitrogen Diamide
Hydrazine Ammonia

Recently a proposal of 8 electron requirement suggested to explain H_2 evolution during nitrogen fixation. At least 16 ATP molecules, 4 ATPs per pairs of electrons are required

$$N_2 + 8H^- + 8e^- + 16ATP \qquad 2NH_3 + H_2 + 16ADP + 16\ Pi$$

Workers in anumber of laboratories have isolated from different nitrogen fixing bacteria, purified enzymes capable of reducing N_2. This enzyme known as nitrogenase.

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Energy Required For N_2

Pyruvic acid through a specific reaction called phosphoroclastic dissimulation provides reducing power and ATP .IN this reaction pyruvic acid is degraded to acetyl phosphate, $CO2_K H_2$

Acetyl phosphate yield ATP

Acetyl PO2 +ADP ——————————→Acetate+ATP

THE Required amount of ATP molecules are:

- 12ATP for reduction of dinitrogenous to ammonia.
- 4ATP for evolution of competitive inhibitor hydrogen
- 2ATP to remove ammonia a repressor of enzyme synthesis, oxygen will denature enzymes. Carbon also needed from photosynthesis/calvin cycle.

Electron donors

Pyruvic acid and NADPH are the electron donors in most of the cases. Hydrogen gas can also serve as the electron donors. Other sources are photolysed water assimilated carbon and reduced sulphur compounds .It is also evident that electron donating system could be ps-I,the glycolysis and krebs cycle and pentose phosphate pathway .

Nitrogenase

Nitrogenase is the main enzyme responsible for the biological conversation of molecular N_2 to NH_3. It consists of two protein in a ratio of 2:1, azoferredoxin and molybdoferredoxin. Both protein contain acid – labile sulfide, in addition molybdoferredoxin contain two molybdenum atoms per molecule. It is also known as fraction – I (Protein I or Component I) and fraction – II (Protein II or Component II). Besides names like MoFe protein and Fe protein are used also to describe the two component of nitrogenase.

Properties of the components of the enzyme Nitrogenase

Property	Azoferredoxin (Dinitrogenase reductase)	Molybdoferredoxin (Dinitrogenase)
Molecular weight	55000	220000
Number of subunit	2	4
Molecular weight of subunit	Both with 27500	Two – 59500, Two – 52000
Molybedenum atom	0	2
Iron atom	4	18
Acid – labile sulfide	11	16
Mg^{2+}, Ca^{2+}	Nil	Present
O_2	O_2 sensitive	O_2 insensitive

Formation of active nitrogenase enzyme requires one molecule of F1and two of F2. A binding factor is not essential but is present invivo enzyme. The participants of the reation one dinitrogen, an electron donar, ATP and Mg^{++}. The original source of the electron varies in different nitrogen fixing bacteria. In aerobic bacteria such as *Azotobacte*r sp. The electron originates in the TCA cycle. In anaerobic microbes such as *Clostridium*, they include (come) formate, hydrogen molecule and pyruvate. However, irrespective of the source of the reducing power, the electrons are transferred to a carrer of the flavoprotein or ferredoxin type which unreduced form participates in nitrogenase catalyzed reaction.

The reduction of N_2 to NH_3 occurs in three steps, each of which requires electron pairs. 6 electron transfers take place and this requires a total 12 ATPs per N_2 reduce. The overall process actually requires at least 8 electron and 16ATPs because nitrogenase also reduce H_2O to H_2. The H_2 reacts with diamine (HN=NH) to form N_2 to H_2. The cycle operates to some extent even under favorable conditions and make nitrogrn fixation even more expensive. Symbiotic N_2 fixing bacteria can consume almost 20% of the ATP produce by the host plant. The requirement of ATP is very puzzling, from the thermodynamic consideration, ATP should not be required since the overall reaction for reduction of molecular N_2 is an exergonic process. Moreover the ATP requirement is strongly high and about 16 ATP are requires per molecule of dinitrogen reduced.

Characteristic of nitrogenase complex

1. Consists of two enzymes: dinitrogen reductase and dinitrogenase.
2. Enzymes are denatured by oxygen.
3. Dinitrogen reductase – contains the trasitional metal iron, dinitrogenase contains the transition metal atom – iron and molybdenum.
4. It needs Mg^+ ions to activate the ATP.
5. Requires 12 ATP to reduce N_2 to $2NH_4$.
6. Hydrogen is a competitive inhibitor of Dinitrogenase.
7. NH_4^+ represses the synthesis of the enzymes.
8. Reduces other triple bonded compounds in addition to N_2, like acetelene (which is used for assay test).
9. It converts ATP to ADP when functioning.
10. It is inhibited by ADP.
11. It reduces Hydrogen to gaseous N_2 even when N_2 is reduced.

O_2 Sensitivity

One of the striking properties of nitrogenase in their O_2 sensitivity both MoFe and Fe proteins of nitrogenase are irreversibly damaged by O_2 and special anoxygenic techniques have been devised for their purification. MoFe protein relatively less sensitive to O_2 than Fe protein. For all N_2 fixing organism O_2 is potentially inhibitory to growth and different protective mechanisms are applicable to different systems.

In Rhizobium – leghaemoglobin enhance the transport of O_2 and prevent partial pressure of O_2 form reaching concentration damaging to nitrogenase.

In Cyanobacteria :

(i) N_2 fixation occurred in heterocyst and adjacent vegetative cells provide metabolite for generation of $NADPH_2$. ATP is synthesize in the heterocyst by photophosphorylation of ps-I, however ps-II is absent.
(ii) Thick wall and ps-II absent for anaerobic condition are condusive for N_2 fixation
(iii) However, this type of protective mechanism is not found in all blue green algae. Some of them example Plectonema do not form heterocyst these species and the unicellular N_2 fixers of Gloeocapsa sp fix N_2 only at low partial presence of O_2.

In Azotobacter – How the enzyme is able to function in highly aerobic bacteria like azotobacter as intrigued microbial physiologist for some times. Aerobic bacteria possess two protective mechanisms for insensitivity of O_2 for fixing N_2.

(i) Conformational change: According to which there is a reversible change in the shape of the enzyme molecule in the presence of O_2 that renders it insensitive to O_2. the enzyme can undergo a conformational change by the association with protective protein in presence of Mg^{++} become insensitive to O_2.

(ii) Respiratory protection: The enzyme can be protected and maintained in a catalytically active form by the operation of an oxygen scavenging process such as high respiratory activity. *Azotobacter* sp possess a very active branched respiratory system. One branched of the electron transport chain in coupled of three

phosphorylation site. Thus with increasing O_2 concentration the rate of respiration can be increased in these organisms by a partial uncoupling. Thus excess of O_2 is utilized for the oxidation of various substrates in the cell.

This is a waste of $NADH_2$ but it does protect the nitrogenase against O_2 damage.

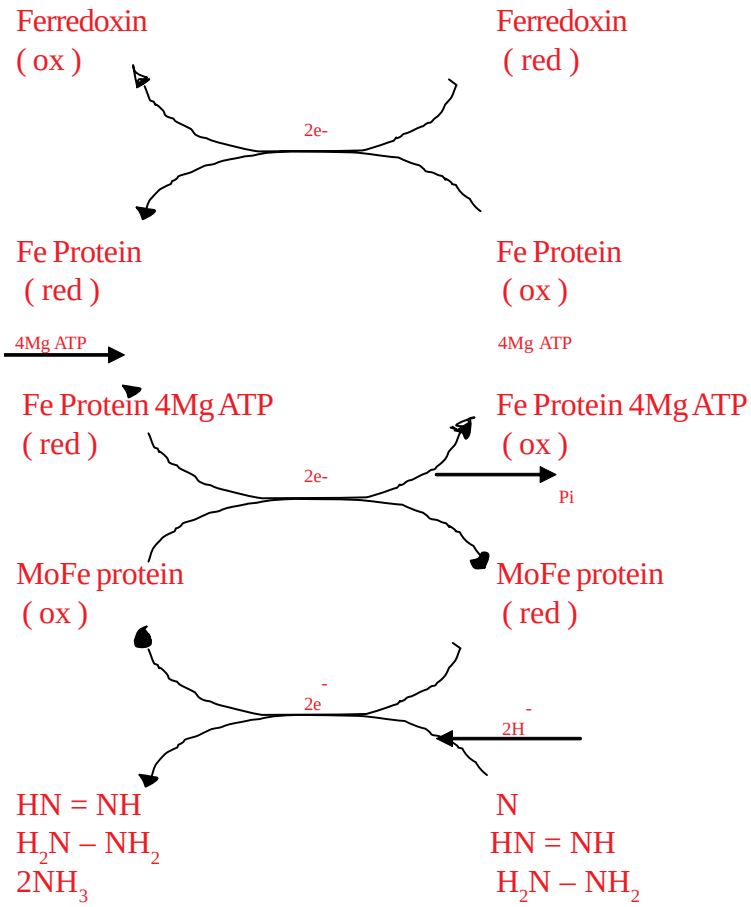
iii) The unique nitrogenase of Streptomyces thermoautotrophicus: A structurally and functionally novel molybdenum nitrogenase is present in the streptomycete, *Streptomyces thermoautotrophicus.* This organism is a thermophilic, filamentous member of the Actinobacteria.

Streptomyces thermoautotrophicus is a hydrogen bacterium that uses CO as an electron donor in energy metabolism & is also an autotroph. *Streptomyces thermoautotrophicus* fixes nitrogen & its nitrogenase contains Mo. But unlike classic Mo nitrogenase, S. *thermoautotrophicus* nitrogenase is completely insensitive to O_2 . The di nitrogenase component of the S. *thermoautotrophicus* nitrogenase, called Str 1, contains three different polypeptides that show some structural similarity to di nitrogenase polypeptides from other N_2 fixers. In contrast, the dinitrogenase reductase component, called Str 2, shows no similarity to other dinitrogenase reductases. Str2 is, however, highly similar to manganese-containing enzymes called superoxide dismutase, & this is its role in this unusual nitrogenase.

There is a pattern to electron flow in the S. *thermoautotrophicus* nitrogenase system that mimics that of classical nitrogenase. Str2 supplies electron to Str1 in the S. thermoautotrophicus nitrogenase. The source of the electrons each superoxide (O_2^-) & the O_2^- is formed from the reduction of O_2 by a CO dehydrogenase. Thus, in analogy to the pyruvate → flavodoxin → dinitrogenase reductase → dinitrogenase reaction sequence in classical N_2 fixation, the S.*thermoautotrophicusis* CO→ O_2→ Str2→ Str1.And remarkably ,instead of O_2 inhibiting nitrogenase,oxygen is actually required in the reaction mechanism of the S.*thermoautotrophicus* nitrogenase ,

Other unique properties of the S.thermoautotrophicus nitrogenase , include the fact that the enzyme consumes less than half of the ATP of classical nitrogenase and does not reduce other triply bonded compounds ,such as acetylene .collectively ,these properties ,especially thatof O_2 insensitivity ,lend hope to plant biotechnologists trying to engineer N_2 Fixation into crop plants such as corn (maize) that do not harbor known N_2 Fixing symbionts. In plants (oxygenic phototrophs), of course, only an O_2 insebsitive nitrogenase could fix N_2.

Mechanism of Nitrogenase action



The flow of two electron form ferredoxin to N2 is outlined. This process is repeated three times in order to reduce N2 to 2NH3 and the substrate product pairs for each steps are shown at the bottom of the figure

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DECLARATION

The Declaration of the author for publication of Research Paper in The Indian Journal of Research Anvikshiki ISSN 0973-9777 Bi-monthly International Journal of all Research: I, *Ghanashyam Mahato, Assistant Teacher, M.Sc. in Botany, J. K. College (Bandwan) Purulia (West Bengal) India*. the author of the research paper / article entitled MECHANISM OF BIOLOGICAL NITROGEN FIXATION declare that , I take the responsibility of the content and material of my paper as I myself have written it and also have read the manuscript of my paper carefully. Also, I hereby give my consent to publish my paper in The Indian Journal of Research, Anvikshiki ISSN 0973-9777 Bi-monthly International Journal of all Research , This article / research paper is my original work and no part of it or it's similar version is published or has been sent for publication anywhere else. I authorise the Editorial Board of The Indian Journal of Research Anvikshiki ISSN 0973-9777 Bi-monthly International Journal of all Research to modify and edit the manuscript. I also give my consent to the Editor of The Indian Journal of Research Anvikshiki ISSN 0973-9777 Bi-monthly International Journal of all Research to own the copyright of my research paper / article.

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EFFECT OF RADIO FREQUENCY ELECTROMAGNETIC FIELDS EMITTED BY MOBILE PHONE AND CELLULAR PHONE BASE STATION ON HUMAN HEALTH

H.D. KHANNA* AND RAJENDRA KUMAR JOSHI**

Overview

The speculative fears of mobile phones being a danger to health in the long run, seem to be coming true. A latest study talks about the harmful effects of not just using mobile phones but also the radiation from mobile phone towers. Radiation from mobile phones and towers poses serious health risks, including loss of memory, lack of concentration, disturbance in the digestive system and sleep disturbances.

Study on the hazards posed by mobile phones also reported that the damages may not be lethal for humans, but they are worse for birds and insects as well. The studies have attributed the radiation effects to the disappearance of butterflies, bees, insects and sparrows.

There are reports also which recommends that mobile towers should not be installed near high density residential areas, schools, playgrounds and hospitals. "The localized SAR value as per the Indian guidelines standard is 2 watt per kg, averaged over a six minute period and using a 10 gram average mass. With higher SAR values of mobile handsets the public could potentially receive much higher radiofrequency exposure. The Federal Communication Commission of US recommended that SAR levels to be lowered down to 1.6 watt/kg.

The health ministry, department of Biotechnology, DoT, has recommended that mobile phones not adhering to standard levels of specific absorption rate (SAR) - a measure of the amount of radiofrequency energy absorbed by the body while using a phone - should be barred. The reports of ICMR says that compared to Europeans, Indian cell phone users are more at risk for adverse effect of radiation due the country's hot tropical climate, low body mass index, and low fat content. In another report, citizens are scared of the radiation from mobile tower as some housewives have suffered from various forms of cancer. The study of the biological effects of mobile phone towers, points "All these women do not have any family history of cancer. Plus, all of them are within a certain radius of those mobile towers. All this is not a coincidence." So how do we minimise the damage in view of such grave consequences. The report adds - "While talking on mobile, keep calls short or send a text message (SMS). This advice should be especially relevant keeping in mind the children, adolescents and pregnant women" said the report. The advice should be printed in the user manual by handset manufacturers.

Introduction

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Radiation is a process in which energetic particles or energy or waves travel through a medium or space. There are two distinct types of radiations:

I. Ionizing radiation
II. Non -ionizing radiation

I. Ionizing Radiation: It is capable of producing ions on interaction with matter (passes through or collides with some material) – in other words enough energy (more than 1216 kJ/mol of energy) to remove an electron from an atom or molecules (groups of atoms). The loss of an electron with its negative charge causes the atom (or molecule) to become positively charged. The loss (or gain) of an electron is called ionization and a charged atom (or molecule) is called an ion.

II. Non Ionizing Radiation: Non Ionizing Radiation is the term used to describe the part of the electromagnetic spectrum two main regions, namely optical radiation (ultraviolet, visible and infrared) and electromagnetic field 'EMF', power frequencies, micro waves and also radio frequencies.

X-rays, radioactive material produce alpha, beta, and gamma radiation, cosmic rays from the sun and space.

Optical radiation

Optical radiation is another term for light, covering ultraviolet (UV) radiation, visible light, and infrared radiation. The greatest risks to health are probably posed by:

⇒ UV radiation from the sun. Exposure of the eyes to UV radiation can damage the cornea and produce pain and symptoms similar to that of sand in the eye. The effects on the skin range from redness, burning and accelerated ageing through to various types of skin cancer.

⇒ The misuse of powerful lasers. High-power lasers can cause serious damage to the eye (including blindness) as well as producing skin burns.

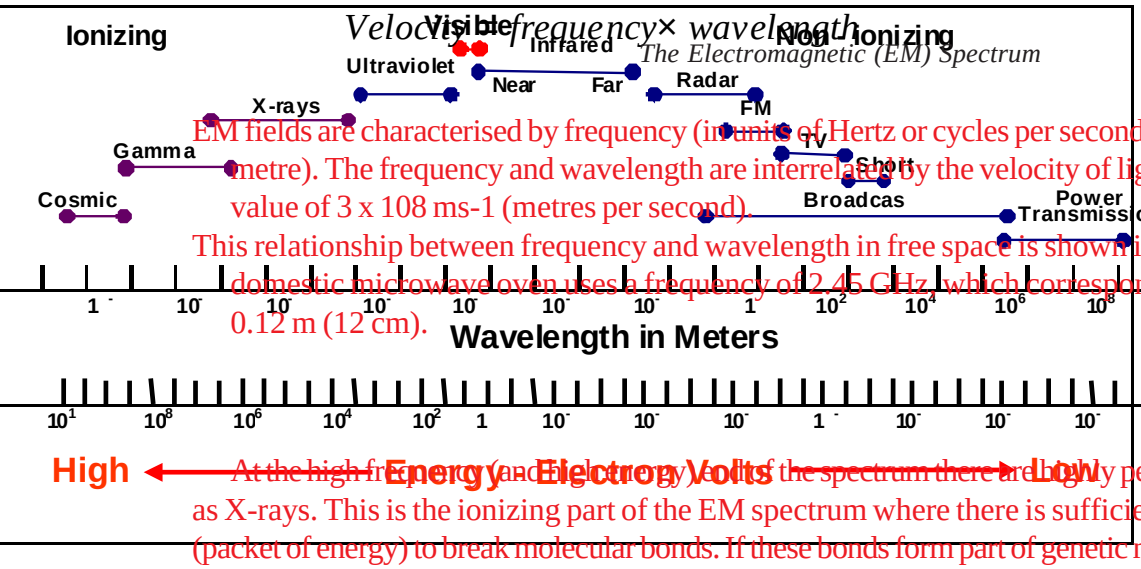
Electro -magnetic fields : Electromagnetic fields (EMFs) arise whenever electrical energy is used. So for example, EMFs arise in our home from electrical appliances in the kitchen, from work processes such as radiofrequency heating and drying and in the world at large from radio, TV and Telecoms broadcasting masts and security detection devices.

What are their effects? : It has been known for a long time that exposure of people to high levels of EMFs can give rise to acute effects. The effects that can occur depend on the frequency of the radiation. At low frequencies the effects will be on the central nervous system of the body whilst at high frequencies, heating effects can occur leading to a rise in body temperature. In reality, these effects are extremely rare and will not occur in most day-to-day work situations

What is Electromagnetic radiation? : Electromagnetic (EM) radiation is a pure energy. It results from the motion of charge objects. It travels at a speed of light through vacuum. It is completely described by its frequency, intensity and direction of travel.

The Electromagnetic Fields : Electromagnetic Fields (EMF) occur in nature and thus have always been present on earth. Further with the growth of mobile communications, population is being exposed to the low-level Electromagnetic Fields produced by the base station antennas normally mounted on cellular mobile towers and by handheld mobile telephone sets/radio terminals

Electromagnetic energy or EME is a natural form of energy. EME occurs in many different forms as shown in the electromagnetic (EM) spectrum. EME is composed of oscillating electric and magnetic fields. EME at different frequencies within the spectrum behaves differently in its interactions with matter. The largest natural source of EME is the sun and this generates energy from many parts of the spectrum, including radio signals.



EM fields are characterised by frequency (in units of Hertz or cycles per second) and wavelength (in units of metre). The frequency and wavelength are interrelated by the velocity of light in free space, which has a value of 3 x 108 ms-1 (metres per second).

This relationship between frequency and wavelength in free space is shown in equation. For example the domestic microwave oven uses a frequency of 2.45 GHz which corresponds to a wavelength of about 0.12 m (12 cm).

At the high frequency (and energy) end of the spectrum there are highly penetrating forms of EME such as X-rays. This is the ionizing part of the EM spectrum where there is sufficient energy in a single photon (packet of energy) to break molecular bonds. If these bonds form part of genetic material, ionizing energy may be able to cause direct genetic damage, thus initiating cancer.

Cellular network

A cellular network is a radio network distributed over land areas called cells, each served by at least one fixed-location transceiver known as a cell site or base station. When joined together these cells provide radio

Cellular Radio Tower

coverage over a wide geographic area. This enables a large number of portable transceivers (e.g., mobile phones, pagers, etc.) to communicate with each other and with fixed transceivers and telephones anywhere in the network, via base stations, even if some of the transceivers are moving through more than one cell during transmission.

Cellular networks offer a number of advantages over alternative solutions:

⇒ increased capacity
⇒ reduced power use
⇒ larger coverage area
⇒ reduced interference from other signals

An example of a simple non-telephone cellular system is an old taxi driver's radio system where the taxi company has several transmitters based around a city that can communicate directly with each taxi.

Mobile Phone

The wide spread use of mobile phones have increased over the past decade in all over the World. It's no longer viewed as a luxury service, but recognized as an important infrastructure service that should be available, to all at affordable prices. They are now an essential part of business, commerce and society. Many studies have established the direct multiplier effect of increase in tele density on economic growth. It is well known from various international studies that there exists a causative relationship between increase in telecommunication penetration and GDP growth.

Use of mobile phones has increased rapidly in India also for last few years. Mobile phones emit radiations in the microwave frequency range and therefore the exposure to radiation has also increased by means of mobile phones or mobile phone base stations.

A mobile phone (cell phone) is a low-power, single-channel; two-way radio and on the other hand its base stations are low-power multi-channel two-way radios. They produce radio-frequency (RF) energy (that's how they communicate), and they expose people near them to RF energy. This RF energy can also be called microwaves, radio waves, RF radiation (RFR) or RF emissions. Around the world a variety of frequencies are used for mobile phones and mobile phone base station. The interaction of that electromagnetic energy with biological material like cells, laboratory animals or humans; depends on the frequency of the source, most common frequencies for mobile phones are 800-900 MHz.

The RF energy absorbed by humans may be somewhat more or less than the RF energy from other types of mobile phones or mobile phones base stations. However, because both the phones and the base stations are low power (short range), the RF energy exposure levels from them are generally very low. Although radiation exposures are very low, but once the energy is absorbed by the biological matter, due to persistent use or

frequent exposure to source can cause severe and long lasting damage to human health. It might take years for the damage to produce noticeable symptoms.

There is very limited data on the possible effects of electromagnetic fields emitted by mobile phones and cell phone base stations on human health. In independent scientific studies there are only few studies which show the risks (like brain activity, brain tumor, increase in B.P., male fertility etc.) associated with exposure to the radiation from cell phones and base station but industry sponsored studies have failed to show a clear link between cell phone uses and health risk.

Conclusion

All mobile phones function through communication links made by a fixed installation called base station, which transmits all the signals. While establishing this communication link, electromagnetic radiations emitted from base station antennas could pose a serious threat to the health of people living in close proximity, particularly children below 16 years, pregnant women and those using medical aids. These radiations can also cause diseases like cancer, nervous disorders, insomnia and hypertension. Because these electromagnetic fields can be harmful, there is a need for national and international collaboration for making a exposure standard and control programme to enforce them.

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Declaration

The Declaration of the author for publication of Research Paper in The Indian Journal of Research Anvikshiki ISSN 0973-9777 Bi-monthly International Journal of all Research: We, *H.D. Khanna and Rajendra Kumar Joshi, (Corresponding Author) Professor & Head, Department of Biophysics, I.M.S., B.H.U.,Varanasi (U.P.) India.& Assistant Professor in Biophysics, Department of Physiology, SMIMER, Umarwada, Surat (Gujarat) India.* the authors of the research paper / article entitled EFFECT OF RADIO FREQUENCY ELECTROMAGNETIC FIELDS EMITTED BY MOBILE PHONE AND CELLULAR PHONE BASE STATION ON HUMAN HEALTH declare that , We take the responsibility of the content and material of our paper as We have written it and also have read the manuscript of our paper carefully. Also, We hereby give our consent to publish our paper in The Indian Journal of Research, Anvikshiki ISSN 0973-9777 Bi-monthly International Journal of all Research , This article / research paper is our original work and no part of it or it's similar version is published or has been sent for publication anywhere else. We authorise the Editorial Board of The Indian Journal of Research Anvikshiki ISSN 0973-9777 Bi-monthly International Journal of all Research to modify and edit the manuscript. We also give our consent to the Editor of The Indian Journal of Research Anvikshiki ISSN 0973-9777 Bi-monthly International Journal of all Research to own the copyright of our research paper / article.

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INNOVATIVE AND INTEGRATIVE SUPPLY CHAIN MANAGEMENT : A SYSTEM DYNAMICS APPROACH

RAJESH SINGH* AND S.K.SHARMA**

Abstract

Supply Chain management is an approach to working with supplier not only purchasing but also a comprehensive approach to develop maximum value from the supply chain. Leading companies determine the right supply chain strategy and often develop a logistics management organization to ensure effective warehousing and distribution. Thus Supply Chain Management provides great opportunities for firms to develop a competitive advantage often using e-commerce.

In this paper, Production distribution model of Forrester has been used to demonstrate the traditional way of managing of supply chain vis-à-vis use of new information links for networking with supply chain network among supplier, distributor, and manufacturer.

It is demonstrated if information link among the three sectors are linked ,the retailer is aware of information of inventory and order backlog from distributor , and the distributor also receives information from the manufacturer will substantially reduce inventory at all levels. The middle level supplier (distributor) can maintain stock of inventory for varieties of customer, who use the same product, can also offer substantially cost saving for the purchaser as well as for the distributor.

The paper shows the use of information via an e-commerce reduces the Bull-whip effect in Supply Chain. It reduces the associated cost of inventory, transportation, shipping and increases customer service and profitability.

1. Introduction

In changing economic scenario, supply chain management has emerged as an excellent tool for reducing costs and improving performance, thereby decreasing the Bull-whip effect. Unlike the traditional business practices where supply chain partners exploit one another to maximize their own objectives, supply chain management advocates the philosophy of collaboration along the whole chain. The supply chain consists of a number of independent business organizations and achieving collaboration between them so as to work together towards a common goal is a challenges.[1]

On the other hand, the difficulties in predicting customer needs and wants in a given period constitute the main source of demand uncertainty that a good forecast may cope with this uncertainty. In fact, the ultimate success lies in the ability to manage the demand uncertainty with the existent supply capabilities' impact of the

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e-commerce on the supply chain process that plans, implements, and controls the efficient, effective flow and storage of goods, services, and related information from the point-of-origin to the point-of-consumption in order to meet customers' requirements''. The impact that e-commerce has on the integration of key business processes from end user through original suppliers that provides products, services and information that add value for customers and other stakeholders".[2]

The output of this paper includes the vision, design principles, and rules for action needed to enable effective supply chain integration with the help of e-commerce.

2. Literature Review

System dynamics is a methodology for studying and managing complex feedback systems, such as one finds in business and other social systems. In fact it has been used to address practically every sort of feedback system. [3]

What system dynamics attempts to do is understand the basic structure of a system, and thus understand the behaviour it can produce. Many of these systems and problems which are analyzed can be built as models on a computer. System dynamics takes advantage of the fact that a computer model can be of much greater complexity and carry out more simultaneous calculations than can the mental model of the human mind. [4]

Production Distribution Model

Production Distribution Model is described in terms of interacting flow systems, namely the flows of information, materials, orders, money, manpower, and capital equipment. Based on the development and use of a System Dynamics simulation model, Forrester[1961] describes, analyses, and explains issues evolving around supply chain management. It is important to point out that many current research issues in supply chain management have already been pointed out, or even scrutinised by Forrester in [1961], including demand amplification, inventory swings, the effect of advertising policies on production variations, de-centralised control, or the impact of the use of information technology on the management process. Integrated Supply Chain Management is a process-oriented, integrated approach to procuring, producing, and delivering products and services to customers. Integrated Supply Chain Management covers the management of material, information, and funds flows.

The bullwhip effect or whiplash effect refers to the phenomenon where orders to the supplier tend to have larger variance than sales to the buyer (i.e., demand distortion), and the distortion propagates upstream in an amplified form (i.e. variance amplification). [6]

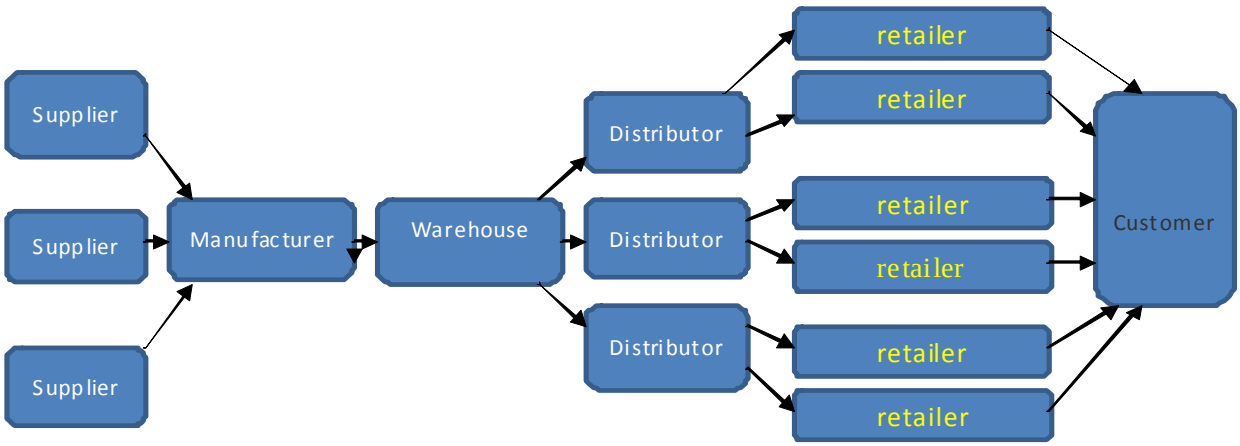


Figure 1 *Production Distribution Model*

In a traditional vision of the supply chain (SC), demand flows up the chain (from each trading partner to its upstream trading partner) and products flow in the opposite direction. Time delays, distorted demand signals, and poor visibility of exceptional conditions result in critical information gaps and serious challenges for SC managers, including misinformation and ultimately, mistrust.

2.1 Causes of Bullwhip Effect

At the same time, customer demand is passed to the wholesalers, distributors or manufacturers in the form of retailers' order, which is actually the demand for higher-level chain partners.

Demand forecasts in practice, however, are rarely accurate and they become even worse at higher levels of the supply chain.

The bullwhip effect, also known as Forrester or whiplash effect is one of the key areas of research in SCM applications. It represents the phenomenon where orders to supplier tend to have larger variance than sales to the buyer, and customer demand is distortedLee et al., 1997b H. Lee, V. Padmanabhan and S. Whang, Information distortion in a supply chain: The bullwhip effect, Management Science *43* (1997), pp. 546–558. Full Text via CrossRef View Record in Scopus Cited By in Scopus (894). This demand distortion also propagates to upstream stages in an amplified form. [6]

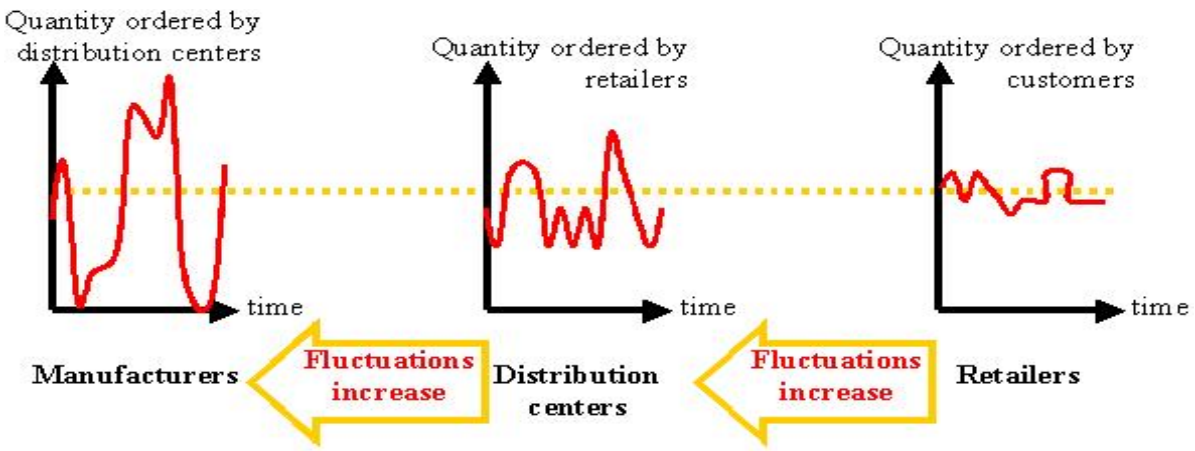


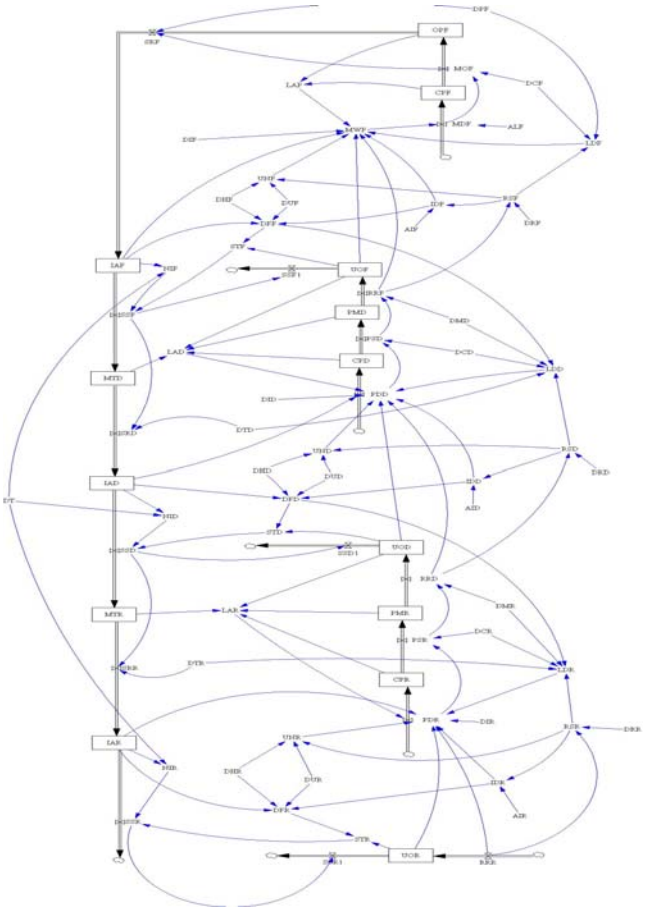
Figure 2

Within the context of E-SCM applications, this study essentially analyzes the impact of demand forecasting on the bullwhip effect. Based on a simulation model, a two-stage E-supply chain is examined using exponential smoothing forecasting on the bullwhip effect under linear demand assumption with seasonal swings. While in earlier research, analytically examined the similar problem for autoregressive demand structures and linear demand, they did not take into account the demand seasonality. This study therefore fills this gap by developing a simulation model for E-SCM applications, which experiments the different scenarios of selecting suitable parameters for exponential smoothing forecasting, lead time and demand seasonality.

The bullwhip effect was first noticed and studied by Forrester (1961) in a series of simulation analysis. He named this problem as "demand amplification". He further concluded that the problem of the bullwhip effect stemmed from the system itself with its policies, organization structure and delays in material and information flow, not stemmed from the external forces.

2.2 Value of Information Sharing

Realizing the pitfalls of not sharing information with supply chain partners firms are increasing moving towards a collaborative supply chain where supply chain partners share information freely and on a real-time basis.



Studies related to estimating the benefit of sharing information is often referred in the literature as value of information (VOI). Literature on the value of information sharing in supply chain is very rich. So Young Sohn and Michael Lim [2008] explore the effect of forecasting and information sharing in supply chain for multi-generation products. Bourland et al. [1996] study how sharing inventory data improves the supplier's ordering decisions with stationary stochastic demand.

Forrester has tested the model by exciting customer requisition at retail by 10% step increase over its initial steady state value of 100 units/ week Figure-B shows the results which forrester has obtained.The VENSIM software was used to simulate the model [Bora and Mohapatra, 1982].The three-tier structure of the model and the policy structure at each sector interact to give rise to a wide fluctuation in inventory and production rate in manufacturing sector.

Explaining the underlying reasons for such fluctuation, Forrester (1960,page137) states "This progressive increase in the peak ordering rate as the disturbance moves upward in the system is a result of the two sources of amplification in the policies controlling the ordering decisions-the unavoidable necessity in the supply line to and from the next higher stage, and the practice of increasing the 'desired' inventory as the level of average sales increase'.

Forrester has shown that neither reduction in clerical delays nor elimination of distributor sector is capable of bringing about an appreciable reduction in the fluctuations.

'Industrial Dynamics', Forrester[1961] has shown that even when factory production decisions are taken by attaching very high confidence to retail sales compared to immediately available requisition received from distributors the reduction in fluctuation are very marginal. Forrester [1961] has also shown how the system instability gets accentuated when all the sectors base their replenishment ordering decisions on a sales forecasting procedure using trend extrapolation.

However, Forrester has shown that DIR, DID, and DIF, which indicate rapidity of inventory adjustment at the respective sectors, are the most sensitive parameters in determining system behaviour.

The Authors have considered taking more information sources. For example in retail sector the purchase decision in retail in Equation (3.1) and is modified as given below:

- R PDR.KL = [RSR.K+(1/DIR)((IDR.K - IAR.K)+(LDR.K - LAR.K)+(UOR.K -UNR.K))] *(PRMUOD.K) *(PRMID.K) ....(3.4)
- A PRMUOD.K = TABHL (TPRMUOD, RUOUND.K,0,2, 0.5)
- T TPRMUOD = 1.0/1.0/1.0/0.85/0.5
- A RUOUND.K = UOD.K/UND.K
- A PRMID.K = TABHL (TRRMID, RIADD.K, 0, 2, 0.5)
- T TPRMID = 0.5/0.75/1.0/1.0/1.0
- A RIADD.K = IAD.K/IDD.K

Where,

- PRMUOD Purchase decision rate multiplier at retail , from unfilled order backlog at distributor(Dimensionless)
- PRMID Purchase decision rate multiplier at retail from inventory at distributor(Dimensionless)
- TABHL DYNAMO functional notation for table for high low extension
- TPRMUOD Table for unfilled orders at factory
- RUOUND Ratio of unfilled orders to unfilled order normal at distributor(dimensionless)
- TPRMID Table for Inventory Actual at distributor
- RIADD Ratio of Inventory actual at Distributor to the inventory Desired at distributor(dimensionless)

The purchase decision at distributor is similarly expressed:

- R PDD.KL = [RSD.K+(1/DID)((IDD.K - IAD.K)+(LDD.K - LAD.K)+(UOD.K -UND.K))] *(PDMUOF.K) *(PDMIF.K) …….(3.5)
- A PDMUOF.K = TABHL (TPDMUOF, RUOUNF.K, 0, 2, 0.5)
- T TPDMUOF.K = 1.0/1.0/1.0/0.85/0.5
- A RUONF.K = UOF.K/UNF.K
- A PDMIF.K = TABHL (TPDMIF, RIADF.K, 0, 2, 0.5)
- T TPDMIF = 0.5/0.85/1.0/1.0/1.0
- A RIADF.K = IAF.K/IDF.K

Where,

- PDMUOF Purchase decision rate multiplier at distributor from unfilled order backlog at factory (Dimensionless)
- PDMIF Purchase decision rate multiplier at distributor from inventory actual at factory sector (Dimensionless)
- TPDMUOF Table values for unfilled order backlog at factory
- RUOUNF Ratio of unfilled order backlog to unfilled order desired at factory (Dimensionless)
- TPDMIF Table for inventory actual at factory
- RIADF Ratio of Inventory actual to inventory desired at factory (Dimensionless)

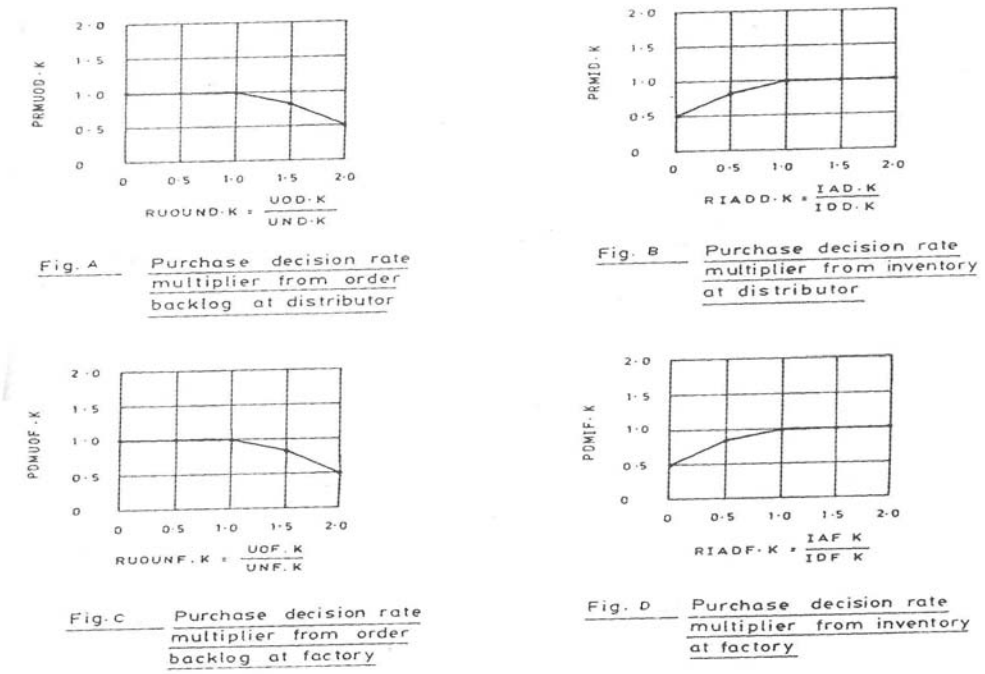


Figure 4 *Purchase decision rates v/s various factors*

The equation for manufacturing decision rate at factory, MDF, is modelled by retaining the original equation(3.3) and modifying the time constants of this equation, we have:

- R MDF.KL = RRF.K +(IDF.K - IAF.K)/DIAF+(LDF.K - LAF.K)/DLAF+ (UOF.K -UNF.K)/DUOF ……..(3.6)

- DIAF Delay in adjusting inventory actual at factory (weeks)
- DLAF Delay in adjusting pipeline content actual at factory (weeks)
- DUOF Delay in adjusting unfilled order backlog at factory (weeks)

The values of the above mentioned parameter are taken as :

- DIAF = 1.75(weeks)
- DLAF = 1.0(weeks)
- DUOF = 2.0(weeks)

The model is then simulated with the newly designed policies defined in equation(3.4) through equation (3.6) by giving the requisition received at retail RRR a step increase of 10% over its initial steady state value of 1000 units/week occurring at the fourth week. Figure-4 shows the behaviour of the model with these revised policies. The simulation run of all the above mentioned policy sets are obtained by using VINSIM and are drawn on the same scale for comparison.

Figure 4 shows a greatly attenuated system response. Table-1 gives a comparative statement of the progression of order rate disturbance created by the change in retail sales.

It is evident from table-1 that requisition received at different sectors are growing progressively, but have far less pronounced peaks as compared to those obtained Forrester. Manufacturing orders at factory are only 27% as compared to 45% reported by Forrester.

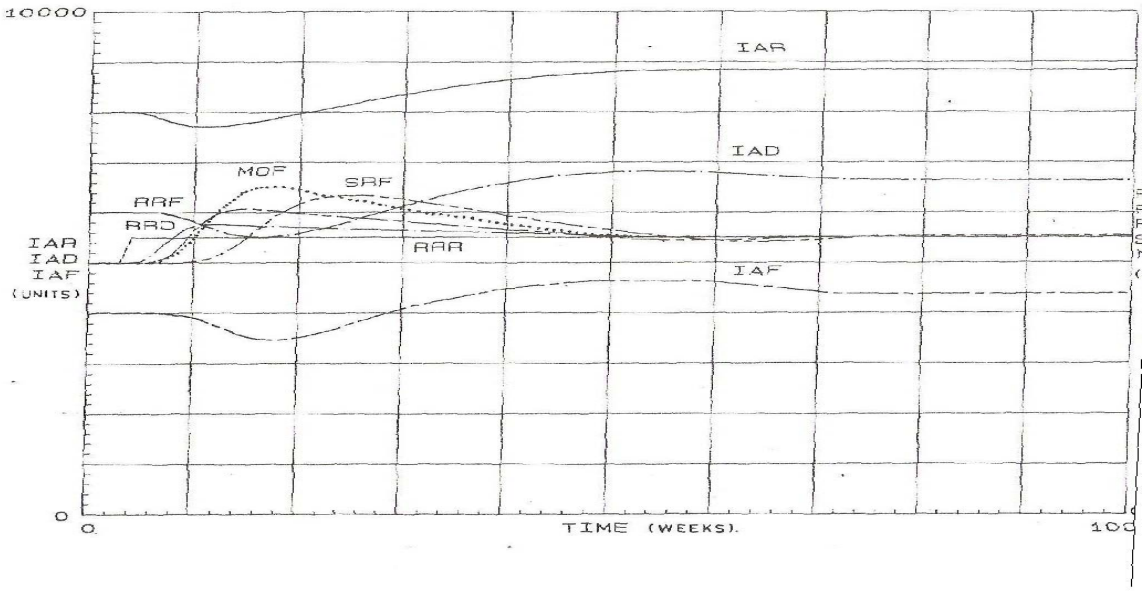


Figure 5 *Response of production-distribution model with proposed policy set 1 to a 10% step increase in retail sales*

T A B L E 1 *Time of Peak Orders and Production Rates ,After 10% Sales Increase*

Variables	Proposed Policy Set Peak Value of change (%)	Intial Policy Set (Forrester) Peak Value of change(%)
Retail Sales	10	10
Distributor Order from Retail(RRD)	15	18
Factory orders from Distributor(RRF)	21.5	34
Manufacturing orders to Factory(MOF)	29.5	51
Factory output (SRF)	27	45

The increase in requisitions received at distributor and factory sectors causes the order backlog at distributor and factory sector (UOD and UOF) to increase. As UOD and UOF increase, the amplification in requisitions received , RRD and RRF , is reduced because of the presence of two new multipliers, PRMUOD and PDMUOF. For example, an increase in UOD causes the multiplier PRMUOD to act as a discouragement factor, and restricts placing of more orders from retail to distributor till the time when the backlog is more than its desired value. The same is true for orders from the distributor to the factory sector, since placing of orders from the distributor sector takes into account the position of unfilled order backlog at the factory sector.

As the orders reach their peak, the actual inventory levels at all the sectors start falling progressively. Approximately for 60 weeks actual inventory at distributor and factory are less than their desired inventories. Therefore, the amplification on requisition received at distributor and factory are greatly nullified by the discouragement factors PRMID and PDMIF for lower than desired inventories at higher stages.

However, as the actual inventory comes closer to the value of desired inventory or even exceeds it, the effect of discouragement factor is progressively diminished. Therefore, a very small fluctuation of factory production rate SRF persists. The peak and trough are 27% and 0% about the initial steady state value.

As with the ordering policy and production rates, the inventory fluctuations are also greatly attenuated. The inventory at factory sector has a peak of 11% at 44th week above the initial value and without any undershoots gradually settles down to its desired value of 4000 units. [9]

4. Conclusion

The dynamic behaviour of the complex production-distribution model with new information link just above their sector has shown substantial reduction in bull-whip effect or magnification effect at manufacturing sector. Since the chain between producer and consumer is normally long there is a time lag between demand and supply.

To reduce the magnification information of inventory and order backlog to the sectors just below it are very important sources of information. Therefore, to avoid magnification effect or bullwhip effect the manufacturer, distributor and retailer must network and thereby react quickly to any changes well before it is filtered up the chain

This study may further be extended in a way to assess the impact of bullwhip effect on the performance measures of the E-supply chain (e.g., total cost of the members, total chain cost, service level of chain members and service level of the chain). Given the fact that the bullwhip effect has a deteriorating impact on the performance measures of the whole chain, the magnitude of a direct relationship between the bullwhip effect and the performance measures of E-Commerce on the supply chain and its members might be an interesting area for future research. While in practice there are many different forms of on-line customer demands as well as many forecasting techniques to predict these demands. Similar analyses may be extended to an E-supply chain including more on-retailers, distributors and wholesalers as well as manufacturers with tight capacity limitations in order to observe the impact of e-commerce on the bullwhip effect in E-SCM applications.

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DECLARATION

The Declaration of the author for publication of Research Paper in The Indian Journal of Research Anvikshiki ISSN 0973-9777 Bi-monthly International Journal of all Research: We, *Rajesh Singh and S.K.Sharma, Corresponding author and Research Scholar, Department of Mechanical Engineering, IT-BHU, Varanasi (U.P.) India & Professor and Ex-Head, Department of Mechanical Engineering, IT-BHU, Varanasi (U.P.) India.* the authors of the research paper / article entitled INNOVATIVE AND INTEGRATIVE SUPPLY CHAIN MANAGEMENT : A SYSTEM DYNAMICS APPROACH declare that , We take the responsibility of the content and material of our paper as We have written it and also have read the manuscript of our paper carefully. Also, We hereby give our consent to publish our paper in The Indian Journal of Research, Anvikshiki ISSN 0973-9777 Bi-monthly International Journal of all Research , This article / research paper is our original work and no part of it or it's similar version is published or has been sent for publication anywhere else. We authorise the Editorial Board of The Indian Journal of Research Anvikshiki ISSN 0973-9777 Bi-monthly International Journal of all Research to modify and edit the manuscript. We also give our consent to the Editor of The Indian Journal of Research Anvikshiki ISSN 0973-9777 Bi-monthly International Journal of all Research to own the copyright of our research paper / article.

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FUNCTIONAL ANALYSIS OF NEUROPHYSIOLOGICAL DATA

DAYA SHANKAR PRATAP*

Abstract

A method for functional analysis of neurophysiological data by decomposing neurophysiological data and EEG signal to form a plurality of signal features. The signal features may then optionally be analyzed to determined one or more patterns.

Introduction

Neurophysiological data includes any type of signals obtained from the brain. Such signals may be measured through such tools as EEG (electroencephalogram), which is produced using electroencephalography. Electroencephalography is the neurophysiologic measurement of the electrical activity of the brain (actually voltage differences between different parts of the brain), performed by recording from electrodes placed on the scalp or sometimes in or on brain tissue. As used herein, the term "neurophysiological data" also refers to brain imaging tools, including but not limited to CAT (computer-aided tomography) scans (otherwise known as CT or computed tomography) scans, PET (positron emission tomography) scans, magnetic resonance imaging (MRI) and functional magnetic resonance imaging (fMRI), ultrasound and single photon emission computed tomography (SPECT).

Discussion

In the following detailed description, numerous specific details are set forth in order to provide a thorough understanding of the present invention. It will be understood by those of ordinary skill in the art that the present invention may be practiced without these specific details. In other instances, well-known methods, procedures, components and structures may not have been described in detail so as not to obscure the present invention.

The method of the present invention features decomposing neurophysiological data to form a plurality of signal features. As described herein as a non-limiting, illustrative example only, the method of the present invention is described with regard to EEG data.

EEG data is preferably collected in response to a stimulus or stimuli, such that signals are obtained from the subject before and after the application of the stimulus or stimuli. The stimulus or stimuli may optionally comprise any type of task and/or action, including conceptual tasks and/or actions (the latter may optionally be used with

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any subject but are preferred when the subject is suffering from some type of physical and/or cognitive deficit that may prevent actual execution of a task and/or action, as for example may be seen in response to various brain injuries such as stroke). The EEG data is then decomposed to form a plurality of signal features, which relate to the brain activity or activities generating the signal(s).

Decomposition of EEG data preferably includes waveform analysis. Conventional waveform analysis is performed by examining the pattern of peaks; however, this method is flawed, because the true generator (i.e., brain and/or external neural location which produced the wave) is not known. According to preferred embodiments, the method of the present invention uses wavelet analysis and bandpass/bandwidth filtering to locate underlying aspects of the wave, such that the wave is decomposed to a plurality of overlapping sets of signal peaks which together make up the waveform. The filters themselves may optionally be overlapping. Even if the bandpass cutoff is not defined correctly, the preferred examination of data from a plurality of subjects results in identification only of repetitive peaks that make up the waveform. Such analysis may optionally be performed after the subject has been subjected to a stimulus or stimuli; if no such stimulus/stimuli are provided, then optionally a predetermined template may be provided and applied to the signals as described herein.

Furthermore, it is also possible to use the Talairach Distance to estimate the location of the subset of electrodes that would be expected to provide the most useful information regarding a particular pattern, determined as described above. The coordinates of the N regions in the target network activity pattern are marked by Ti(x,y,z), i=1, . . . , N, and the coordinates of the M regions in the observed network activity pattern are marked by Oj(x,y,z), j=1, . . . , M. [0142]For each Oj(x,y,z), j=1, . . . , M, the distance is computed to the nearest Ti(x,y,z), i=1, . . . , N, and mark it by Dj. [0143]The Talairach Distance is then computed by Eq.1: TD = j = 1 M Dj M ##EQU00001##

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A STUDY OF ATTITUDE OF SENIOR SECONDARY STUDENTS OF AMBALA TOWARDS PHYSICS BASED ON MAGNETISM

RADHA RAMAN SURI*

Abstract

Aristotle attributes the first of what could be called a scientific discussion on magnetism to Thales, who lived from about 625 BCE to about 545 BCE. Around the same time in ancient India, the Indian surgeon, Sushruta, was the first to make use of the magnet for surgical purposes. In 1600, William Gilbert concluded that the Earth was itself magnetic and that this was the reason compasses pointed north (previously, some believed that it was the pole star (Polaris) or a large magnetic island on the north pole that attracted the compass). In 1905, Einstein used these laws in motivating his theory of special relativity, requiring that the laws held true in all inertial reference frames. Electromagnetism has continued to develop into the 21st century, being incorporated into the more fundamental theories of gauge theory, quantum electrodynamics, electroweak theory, and finally the standard model. In real sense, Magnetism is a property of materials that respond at an atomic or subatomic level to an applied magnetic field. Ferromagnetism is the strongest and most familiar type of magnetism. It is responsible for the behavior of permanent magnets, which produce their own persistent magnetic fields, as well as the materials that are attracted to them. However, all materials are influenced to a greater or lesser degree by the presence of a magnetic field. Some are attracted to a magnetic field (paramagnetic); others are repulsed by a magnetic field (diamagnetism); others have a much more complex relationship with an applied magnetic field. Substances that are negligibly affected by magnetic fields are known as non-magnetic substances. They include copper, aluminum, gases, and plastic. It shows that it has valuable position in Physics. This research presents the attitude of senior secondary students of Ambala towards value of Magnetism in Physics.

Introduction

Aristotle attributes the first of what could be called a scientific discussion on magnetism to Thales, who lived from about 625 BCE to about 545 BCE. Around the same time in ancient India, the Indian surgeon, Sushruta, was the first to make use of the magnet for surgical purposes. In ancient China, the earliest literary reference to magnetism lies in a 4th century BCE book called Book of the Devil Valley Master "The lodestone makes iron come or it attracts it." The earliest mention of the attraction of a needle appears in a work composed between AD 20 and 100 (Louen-heng) "A lodestone attracts a needle." The ancient Chinese scientist Shen Kuo (1031–1095) was the first person to write of the magnetic needle compass and that it improved the accuracy of navigation by employing the astronomical concept of true north (Dream Pool Essays, AD 1088), and by the 12th century the Chinese were known to use the lodestone compass for navigation. They sculpted a directional spoon from lodestone in such a way that the handle of the spoon always pointed south. Alexander Neckham, by 1187, was the first in Europe to describe the compass and its use for navigation. In 1269, Peter Peregrinus

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de Maricourt wrote the Epistola de magnete, the first extant treatise describing the properties of magnets. In 1282, the properties of magnets and the dry compass were discussed by Al-Ashraf, a Yemeni physicist, astronomer, and geographer. In 1600, William Gilbert published his De Magnete, Magneticisque Corporibus, et de Magno Magnete Tellure (On the Magnet and Magnetic Bodies, and on the Great Magnet the Earth). In this work he describes many of his experiments with his model earth called the terrella. From his experiments, he concluded that the Earth was itself magnetic and that this was the reason compasses pointed north (previously, some believed that it was the pole star (Polaris) or a large magnetic island on the North Pole that attracted the compass). An understanding of the relationship between electricity and magnetism began in 1819 with work by Hans Christian Oersted, a professor at the University of Copenhagen, who discovered more or less by accident that an electric current could influence a compass needle. This landmark experiment is known as Oersted's Experiment. Several other experiments followed, with André-Marie Ampere, who in 1820 discovered that the magnetic field circulating in a closed-path was related to the current flowing through the perimeter of the path; Carl Friedrich Gauss; Jean-Baptiste Biot and Félix Savart, both of which in 1820 came up with the Biot-Savart Law giving an equation for the magnetic field from a current-carrying wire; Michael Faraday, who in 1831 found that a time-varying magnetic flux through a loop of wire induced a voltage, and others finding further links between magnetism and electricity. James Clerk Maxwell synthesized and expanded these insights into Maxwell's equations, unifying electricity, magnetism, and optics into the field of electromagnetism. In 1905, Einstein used these laws in motivating his theory of special relativity, requiring that the laws held true in all inertial reference frames. Electromagnetism has continued to develop into the 21st century, being incorporated into the more fundamental theories of gauge theory, quantum electrodynamics, electroweak theory, and finally the standard model.

Value of Magnetism in Physics

Magnetism is a property of materials that respond at an atomic or subatomic level to an applied magnetic field. Ferromagnetism is the strongest and most familiar type of magnetism. It is responsible for the behavior of permanent magnets, which produce their own persistent magnetic fields, as well as the materials that are attracted to them. However, all materials are influenced to a greater or lesser degree by the presence of a magnetic field. Some are attracted to a magnetic field (paramagnetic); others are repulsed by a magnetic field (diamagnetism); others have a much more complex relationship with an applied magnetic field. Substances that are negligibly affected by magnetic fields are known as non-magnetic substances. They include copper, aluminum, gases, and plastic. The magnetic state (or phase) of a material depends on temperature (and other variables such as pressure and applied magnetic field) so that a material may exhibit more than one form of magnetism depending on its temperature, etc.

Sources of magnetism

There exists a close connection between angular momentum and magnetism, expressed on a macroscopic scale in the Einstein-de Haas effect "rotation by magnetization" and its inverse, the Barnett effect or "magnetization by rotation".

At the atomic and sub-atomic scales, this connection is expressed by the ratio of magnetic moment to angular momentum, the gyro magnetic ratio.

Magnetism, at its root, arises from two sources:

- Electric currents or more generally, moving electric charges create magnetic fields (see Maxwell's Equations).
- Many particles have nonzero "intrinsic" (or "spin") magnetic moments. Just as each particle, by its nature, has a certain mass and charge, each has a certain magnetic moment, possibly zero.

In magnetic materials, sources of magnetization are the electrons' orbital angular motion around the nucleus,

and the electrons' intrinsic magnetic moment, see electron magnetic dipole moment. The other sources of magnetism are the nuclear magnetic moments of the nuclei in the material which are typically thousands of times smaller than the electrons' magnetic moments, so they are negligible in the context of the magnetization of materials. Nuclear magnetic moments are important in other contexts, particularly in nuclear magnetic resonance (NMR) and magnetic resonance imaging (MRI). Ordinarily, the enormous number of electrons in a material is arranged such that their magnetic moments (both orbital and intrinsic) cancel out. This is due, to some extent, to electrons combining into pairs with opposite intrinsic magnetic moments as a result of the Pauli exclusion principle (see electron configuration), or combining into filled sub shells with zero net orbital motion. In both cases, the electron arrangement is so as to exactly cancel the magnetic moments from each electron. Moreover, even when the electron configuration is such that there are unpaired electrons and/or non-filled sub shells, it is often the case that the various electrons in the solid will contribute magnetic moments that point in different, random directions, so that the material will not be magnetic. However, sometimes — either spontaneously, or owing to an applied external magnetic field — each of the electron magnetic moments will be, on average, lined up. Then the material can produce a net total magnetic field, which can potentially be quite strong.

The magnetic behavior of a material depends on its structure, particularly its electron configuration, for the reasons mentioned above, and also on the temperature. At high temperatures, random thermal motion makes it more difficult for the electrons to maintain alignment.

Need of the Study

We as human beings have immense greed for power with a little push; we become creators and destroyers, trying to decide who will live or who will die on this earth. The question is this, how can we evaluate our daily activities. Science has changed the outlook of life style. It has made various new inventions which help us to make our life better as before. In science, physics has great importance. No one can deny it. All the discoveries and structures made in accuracy due to this subject. Experiments are done in this way and found the real aspects through it. In general way, Magnetism is a property of materials that respond at an atomic or subatomic level to an applied magnetic field. It has valuable place in this subject. Without it, this subject can not locate its real position. We have to change the mindset of the students. It has been proved many times that the role of magnetism in physics is valuable, it needs practical experiments which are done with real objects but students neglect to use practical aspects so the researcher has conducted this study to know about the real attitude of senior secondary students towards value of Magnetism in Physics.

Statement of the Topic

The statement of the study is as under, " A Study of Attitude of Senior Secondary Students of Ambala towards Physics based on Magnetism."

Aims and Objectives of the Study

The study started with the following aims and objectives:

1. To find out whether attitude of Male and female Senior Secondary Students of Public School of Ambala towards Physics based on Magnetism is same or not.
2. To find out whether attitude of Male and female Senior Secondary Students of Government Aided School of Ambala towards Physics based on Magnetism is same or not.
3. To find out whether attitude of Male and female Senior Secondary Students of Government School of Ambala towards Physics based on Magnetism is same or not.

Hypotheses of the Study

The following hypotheses were formulated for the present investigation:

1. There is no significance difference between attitude of Boys and Girls students of Senior Secondary Public Schools of Ambala.
2. There is no significance difference between attitude of Boys and Girls students of Senior Secondary Government Aided Schools of Ambala.
3. There is no significance difference between attitude of Boys and Girls students of Senior Secondary Government Schools of Ambala.

Sample : The sample of the study consisted of 150 students of senior secondary schools of Ambala. The sample was selected randomly and divided into two groups' males and females.

Design of the Study: The present study will be based on survey method which was conducted on the Students of different senior secondary schools of Ambala

Sample of Senior Secondary Students of Ambala					
Public School		Government Aided School		Government School	
50		50		50	
Boys	Girls	Boys	Girls	Boys	Girls
25	25	25	25	25	25

Tools used : For the collection of data the investigator has used self made questionnaire of 20 questions on the basis of different practical aspects. It will help the researcher to know about the value of Magnetism in Physics.

Statistical Techniques

For the analysis of data, following statistical techniques were used :

- Mean
- S.D
- S.E
- 't' value

Methodology: The data was collected following the normative survey method of investigation for study to know the awareness levels of Senior Secondary Students of Ambala towards value of Magnetism in Physics.

Finding of the Study

Sr.No.	Catogory	No.	M/F	Mean	S.D	S.E	t-value	Significancelevel
1	Public	25	Male	87	3.22	0.9	1.11	NotSignificant
	School	25	Female	86	3.16			
2	Govt.	25	Male	83.6	4.32	1.0	3	Significant
	Aided	25	Female	80.6	2.5			
	School							
3	Govt.	25	Male	75	6.63	2.14	1.68	Not Significant
	School	25	Female	71.4	3.07			

From the values of the above table the following findings can be attained at

1. The calculated t-value 1.11 reveals that there is no significant difference between the two means (Males, Mean 87, Females-86) with S.D- 3.22 & 3.16 respectively on the basis of attitude level of Public sr. secondary school students of Ambala towards Magnetism.

2. The calculated t-value 3 reveals that there is significant difference between the two means (Males, Mean 83.6, Females-80.6) with S.D- 4.32 & 2.5 respectively on the basis of attitude level of Government Aided Sr. secondary school students of Ambala towards Magnetism.
3. The calculated t-value 1.68 reveals that there is no significant difference between the two means (Males, Mean 75, Females-71.4) with S.D- 6.63 & 3.07 respectively on the basis of attitude level of Governmnet Senior Secondary School Students of Ambala towards Magnetism.

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Declaration

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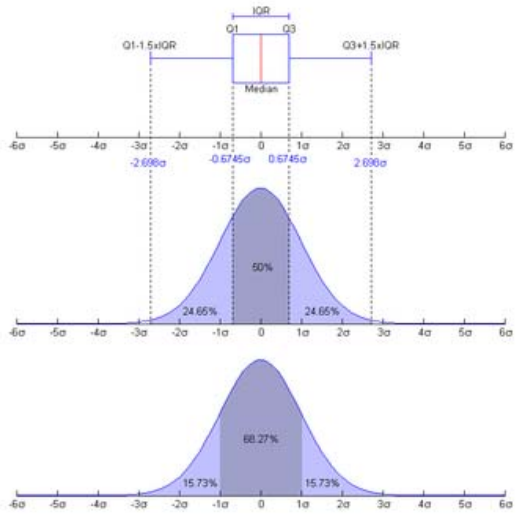
STUDY OF DENSITY IN PROBABLITY CONDITIONS

DAYA SHANKAR PRATAP*

Introduction

In this paper, the density of a continuous random variable is a function that describes the relative likelihood for this random variable to occur at a given point. The probability for the random variable to fall within a particular region is given by the integral of this variable's density over the region. The probability density function is nonnegative everywhere, and its integral over the entire space is equal to one. The terms "probability distribution function"[1] and "probability function"[2] have also sometimes been used to denote the probability density function. However, this use is not standard among probabilists and statisticians. In other sources, "probability distribution function" may be used when the probability distribution is defined as a function over general sets of values, or it may refer to the cumulative distribution function, or it may be a probability mass function rather than the density. Further confusion of terminology exists because density function has also been used for what is here called the "probability mass function".[3]



Probability density function

A probability density function is most commonly associated with absolutely continuous univariate distributions. A random variable X has density f, where f is a non-negative Lebesgue-integrable function, if:

$$\mathrm{P}[a \leq X \leq b] = \int_a^b f(x)\,\mathrm{d}x.$$

Hence, if F is the cumulative distribution function of X, then:

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$$F(x) = \int_{-\infty}^{x} f(u)\,\mathrm{d}u,$$

and (if f is continuous at x)

$$f(x) = \frac{\mathrm{d}}{\mathrm{d}x} F(x).$$

Intuitively, one can think of f(x) dx as being the probability of X falling within the infinitesimal interval [x, x + dx].

This definition may be extended to any probability distribution using the measure-theoretic definition of probability. A random variable X with values in a measure space $(\mathcal{X}, \mathcal{A})$ (usually R^n with the Borel sets as measurable subsets) has as probability distribution the measureX_*P on $(\mathcal{X}, \mathcal{A})$: the *density* of X with respect to a reference measure ì on $(\mathcal{X}, \mathcal{A})$ is the Radon–Nikodym derivative:

$$f = \frac{\mathrm{d}X_*P}{\mathrm{d}\mu}.$$

That is, f is any measurable function with the property that:

$$\Pr[X \in A] = \int_{X^{-1}A} \mathrm{d}P = \int_A f\,\mathrm{d}\mu$$

for any measurable set $A \in \mathcal{A}$

Discussion

In the continuous univariate case above, the reference measure is the Lebesgue measure. The probability mass function of a discrete random variable is the density with respect to the counting measure over the sample space .

It is possible to represent certain discrete random variables as well as random variables involving both a continuous and a discrete part with a generalized probability density function, by using the Dirac delta function. For example, let us consider a binary discrete random variabletaking “1 or 1 for values, with probability ½ each.

The density of probability associated with this variable is:

$$f(t) = \frac{1}{2}(\delta(t+1) + \delta(t-1)).$$

More generally, if a discrete variable can take n different values among real numbers, then the associated probability density function is:

$$f(t) = \sum_{i=1}^{n} p_i\,\delta(t - x_i),$$

where x_1, …, x_n are the discrete values accessible to the variable and p_1, …, p_n are the probabilities associated with these values.

This substantially unifies the treatment of discrete and continuous probability distributions. For instance, the above expression allows for determining statistical characteristics of such a discrete variable (such as its mean, its variance and its kurtosis), starting from the formulas given for a continuous distribution.

Example

This elementary example illustrates the above definition of multidimensional probability density functions in the simple case of a function of a set of two variables. Let us call $\vec{R}$ 2-dimensional random vector of coordinates (X, Y): the probability to obtain $\vec{R}$ in the quarter plane of positive x and y is $\Pr(X > 0, Y > 0) = \int_0^\infty \int_0^\infty f_{X,Y}(x,y)\,dx\,dy.$

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Declaration

The Declaration of the author for publication of Research Paper in The Indian Journal of Research Anvikshiki ISSN 0973-9777 Bi-monthly International Journal of all Research: I, *Daya Shankar Pratap, Department of mathematics, D.B.S.D.D. College, Rampur, Kadana [Garkha] Saran (Bihar) India.* the author of the research paper / article entitled STUDY OF DENSITY IN PROBABLITY CONDITIONS declare that , I take the responsibility of the content and material of my paper as I myself have written it and also have read the manuscript of my paper carefully. Also, I hereby give my consent to publish my paper in The Indian Journal of Research, Anvikshiki ISSN 0973-9777 Bi-monthly International Journal of all Research , This article / research paper is my original work and no part of it or it's similar version is published or has been sent for publication anywhere else. I authorise the Editorial Board of The Indian Journal of Research Anvikshiki ISSN 0973-9777 Bi-monthly International Journal of all Research to modify and edit the manuscript. I also give my consent to the Editor of The Indian Journal of Research Anvikshiki ISSN 0973-9777 Bi-monthly International Journal of all Research to own the copyright of my research paper / article.

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SYNTHESIS OF TWO POTENTIALLY HEPTADENTATE ($N4O_3$) SCHIFF-BASE LIGANDS DERIVED FROM CONDENSATION OF TRIS (3-AMINOPROPYL)-AMINE AND SALICYLALDEHYDE OR 4-HYDROXYSALICYLALDEHYDE. NICKEL(II) AND COPPER(II) COMPLEXES OF THE FORMER LIGAND.

ANJANI KR. CHOUDHARY*

Abstract

Two potentially heptadentate ($N4O_3$) tripodal Schiff-base ligands: tris(3-(salicyl ideneimino)propyl)amine (H_3L1) and tris(3-(4'-hydroxysalicylideneimino)propyl)amine (H_3L2) have been prepared and characterized by various spectroscopic methods (IR, FAB-MS, NMR). They are derived from the condensation reactions of tris(3-aminopropyl)amine (tpt), with 3 equivalents of either salicylaldehyde or the ring- substituted salicylaldehyde, 4-hydroxysalicylaldehyde. The nickel (II) and copper(II) complexes of H_3L1 were obtained from the its reactions Ni(II) and Cu(II) salts in absolute methanol. These complexes were studied by IR and FAB-Mass spectrometry.

Key-words : Schiff-base, tripodal ligands, potentially heptadentate complexes

Introduction

Potentially heptadentate ($N4O_3$) Schiff-base ligands, derived from condensation reactions of tris (2-aminoethyl) amine (tren) with various ring substituted salicylaldehydes, have been prepared, and their coordination chemistry with a number of metal ions has been extensively investigated [1-5]. The amine phenol ligands, which have been prepared from the reduction of the corresponding Schiff-base ligands, have been also reported [6]. We and other workers have prepared complexes of fully condensed potentially heptadentate (N_7) Schiff-base ligands derived from the condensation of tripodal tetraamines with either 2-acetylpyridine or 2-pyridinecarhoxaldehyde [7-10]. However, herein we report the synthesis of the two potentially heptadentate ($N4O_3$) Schiff-base ligands, H_3L1 and H_3L2 (Figure 1) together with the synthesis of nickel (II) and copper (II) complexes of H_3L1.

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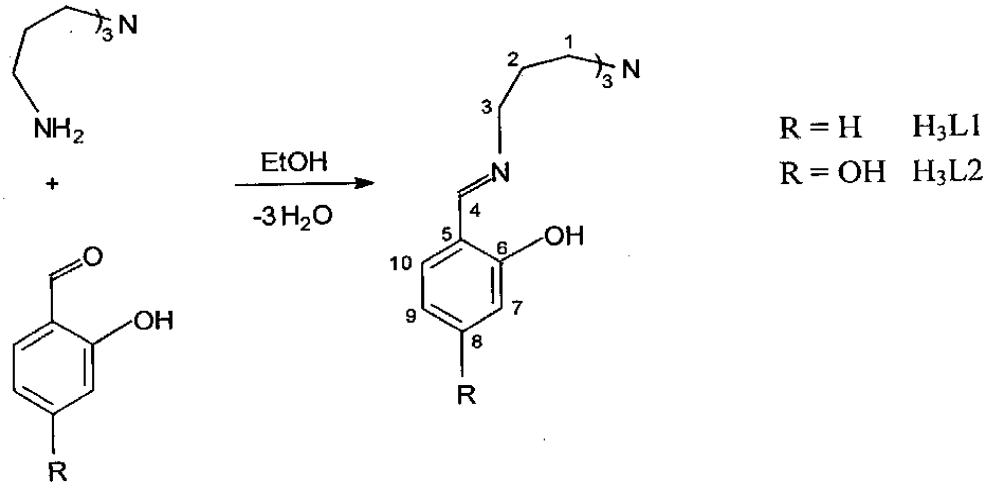

Figure 1 *The procedure of ligand synthesis, along with NMR numbering*

Results and discussion

Ligands

Two potentially heptadentate Schiff-base ligands were easily prepared by reaction of tris (3-amino-propyl) amine with 3 equivalent of salicylaldehyde or its 4-substituted derivative, as shown in Figure 1. They are both sensitive to moisture and must be kept under vacuum. Complete condensation of all primary amino groups is confirmed by the lack of N–H stretching bands in the IR 3150-3450 cm^{-1} region and the presence of strong C=N stretching bands for both H_3L1 and H_3L2 ligands. This conclusion is also supported by the ^{1}H-NMR data which shows not only the absence of N-H hydrogen resonances but also the presence of CH=N Hydrogen resonances at about 8 ppm.^{1}H- and ^{13}C-NMR spectra, mass spectral and infrared data for both ligands are completely consistent with the formulations indicated in Figure 1.

Complexes

Both complexes were investigated by elemental analysis, IR and FAB mass spectrometry. The lack of N-H stretching bands in the IR 3150-3450 cm^{-1} region and the presence of very strong C=N (Schiff base) stretching bands at about 1630 cm^{-1} for both compounds show that the expected complexes were synthesized. The mass spectral data for complexes 1 and 2 are consistent with deprotonation of two of the three hydroxyl groups of the ligand, giving neutral complexes (Figure 2). The latter conclusion is also supported by the insolubility of these complexes in water. In both complexes the bridgehead nitrogen atom may be coordinated to the metal ions, as we have observed for the corresponding complexes derived from 2-acetylpyridine [7,10].

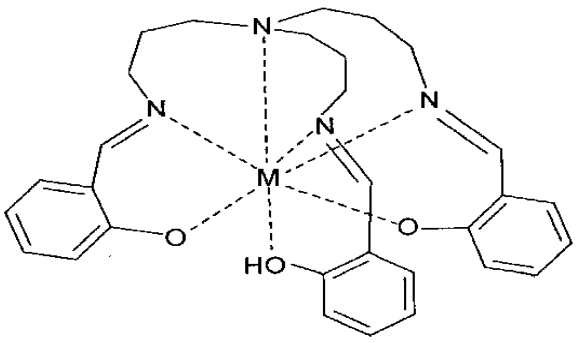

Figure 2. *The proposed chemicals structure for the complexes 1 and 2.*

Experimental

General

Salicylaldehyde and 4-hydroxysalicylaldehyde were obtained from Aldrich and were used without further purification. The tripodal tetraamine ligand tpt was synthesized according to the literature method [11]. IR and NMR spectra were measured on Shimadzu IR-435 and Bruker DPX 300 spectrometers respectively.

Ligand synthesis

Tris(3-(salicylideneimino)propyl)amine (H_3L1): To a solution of salicylaldehyde (1.46 g, 12 mmol) in diethyl ether (l2 mL) was added tpt (0.75g, 4 mmol) in absolute ethanol (l2 mL). After the addition of additional diethyl ether (20 mL) and cooling in an ice bath for 30 min, the yellow precipitate formed was filtered off, washed with diethylether and dried in vacuo. Yield, 1.7g (85%); mp 100-102 °C; Found: C 64.0%; H 7.6%; N 10.1%. $C_{30}H_{36}N_4O_3.3H_2O$ requires: C 65.0%; H 7.6%; N 10.1%; ^{1}H-NMR ($CDCl_3$, ppm, 300 MHz, Ar = Aromatic ring): δ 2.17 (m, 6H, 2-H), 3.06 (t, 6H, 1-H), 3.66 (t, 6H, 3-H), 6.85 (m, 6H, Ar H), 7.24 (m, 6H, Ar H), 8.33 (s, 3H, 4-H), 12.80 (bs, 3H, OH); ^{13}C-NMR ($CDCl_3$, ppm, 300 MHz): δ 25.92 (C-2), 51.82 (C-1), 56.33 (C-3), 119.64 (C-5), 117.67, 119.30, 132.94, 133.67 (C-7 to C-10), 162.36 (C-6), 167.96 (C-4); IR (Nujol mull) cm^{-1}: 3000-2300 (b, v_{O-H}), 1633.6, 1614.2 (sh), 1580, 1496.6 (s, $V_{C=N}$ and $v_{c=c}$); FAB MS (positive FAB in nitrobenzyl alcohol): m/z 501 (MH_+, $[C_{30}H_{37}N_4O_3]^+$, 80%).

Tris(3-((4'-hydroxysalicylidene)imino)propyl)amine (H_3L2): This compound was prepared analogously using 4-hydroxysalicylaldeyhde. Yield, 1.75g (80%); mp >170 °C (decom.); ^{1}H-NMR (DMSO, ppm, 300MHz, Ar = Aromatic ring) δ: 1.05 (t, CH_3-CH_2OH), 1.69 (m, 6H, 2-H), 2.43 (t, 6H, 1-H), 3.4 (q, CH_3-CH_2OH), 3.5 (t, 6H, 3-H), 6.13 (m, 3H, Ar H), 6.21 (m, 3H, Ar H), 7.13 (m, 3H, Ar H), 8.30 (s, 3H, 4-H), 12.80 (bs, 6H, OH); ^{13}C-NMR (DMSO, ppm, 300 MHz) δ: 28.41 (C-2), 51.08 (C-1), 54.97 (C-3), 111.43 (C-5), 103.02, 106.98, 133.62 (C-7, C-9, C-10), 162.11, 165.76 (C-6, C-8), 164.95 (C-4); IR (Nujol mull) cm^{-1}: 3500-2500 (broad weak band, v_{O-H}), 1636.8, 1607 sh (vs, $v_{C=N}$); FAB MS (positive FAB in nitrobenzyl alcohol): m/z 549 (MH^+, $[C_{30}H_{37}N_4O_6]^+$, 20%).

Complex Synthesis

Both complexes were readily prepared by addition of H_3L1 (0.5 mmol in 50 mL methanol) to a solution of the appropriate metal nitrate (0.5 mmol in the same solvent). After the addition of NaOH (3 mmol in 10 mL methanol-water), the reaction mixture was heated for 30 min. Evaporation of the solvent yielded the product as a green powder.

Ni(HL1).2H_2O (1). Yield (0.18gr, 65%); Found: C 60.5%; H 5.6%; N 9.1%. $C_{30}H_{38}N_4O_5Ni$ requires: C 60.7%; H 6.4%; N 9.4%; FAB MS (positive FAB in nitrobenzyl alcohol): m/z 557 (MH^+, $[C_{30}H_{35}N_4O_3Ni]^+$, 62%). IR (Nujol mull) cm^{-1}: 3345 (w, v_{O-H}), 1629.5 s, 1610, 1590, 1533 ($v_{C=N}$ and $v_{C=C}$).

Cu(HL1) (2). Yield (0.l7gr, 60%); FAB MS (positive FAB in nitrobenzyl alcohol): m/z 562 (MH^+, $[C_{30}H_{35}N_4O_3Cu]^+$, 55%). IR (Nujol mull) cm^{-1}: 3300 (w, v_{O-H}), 1619, 1599, 1536.5 ($v_{C=N}$ and $v_{C=C}$).

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Declaration

The Declaration of the author for publication of Research Paper in The Indian Journal of Research Anvikshiki ISSN 0973-9777 Bi-monthly International Journal of all Research: I, *Anjani Kr. Choudhary, Research Scholar, L.N.M.U. Darbhanga (Bihar) India*. the author of the research paper / article entitled SYNTHESIS OF TWO POTENTIALLY HEPTADENTATE ($N4O_3$) SCHIFF-BASE LIGANDS DERIVED FROM CONDENSATION OF TRIS (3-AMINOPROPYL)-AMINE AND SALICYLALDEHYDE OR 4-HYDROXYSALICYLALDEHYDE. NICKEL(II) AND COPPER(II) COMPLEXES OF THE FORMER LIGAND. declare that , I take the responsibility of the content and material of my paper as I myself have written it and also have read the manuscript of my paper carefully. Also, I hereby give my consent to publish my paper in The Indian Journal of Research, Anvikshiki ISSN 0973-9777 Bi-monthly International Journal of all Research , This article / research paper is my original work and no part of it or it's similar version is published or has been sent for publication anywhere else. I authorise the Editorial Board of The Indian Journal of Research Anvikshiki ISSN 0973-9777 Bi-monthly International Journal of all Research to modify and edit the manuscript. I also give my consent to the Editor of The Indian Journal of Research Anvikshiki ISSN 0973-9777 Bi-monthly International Journal of all Research to own the copyright of my research paper / article.

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PROBABLITY THEORY AND ITS APPLICATION

DAYA SHANKAR PRATAP*

Abstract

As a mathematical foundation for statistics, probability theory is essential to many human activities that involve quantitative analysis of large sets of data. Methods of probability theory also apply to descriptions of complex systems given only partial knowledge of their state, as instatistical mechanics. A great discovery of twentieth century physics was the probabilistic nature of physical phenomena at atomic scales, described in quantum mechanics

Introduction

The mathematical theory of probability has its roots in attempts to analyze games of chance by Gerolamo Cardano in the sixteenth century, and by Pierre de Fermat and Blaise Pascal in the seventeenth century (for example the "problem of points"). Christiaan Huygens published a book on the subject in 1657.[2]

Initially, probability theory mainly considered discrete events, and its methods were mainly combinatorial. Eventually, analyticalconsiderations compelled the incorporation of continuous variables into the theory.

This culminated in modern probability theory, on foundations laid by Andrey Nikolaevich Kolmogorov. Kolmogorov combined the notion ofsample space, introduced by Richard von Mises, and measure theory and presented his axiom system for probability theory in 1933. Fairly quickly this became the mostly undisputed axiomatic basis for modern probability theory but alternatives exist, in particular the adoption of finite rather than countable additivity by Bruno de Finetti.[3]

Most introductions to probability theory treat discrete probability distributions and continuous probability distributions separately. The more mathematically advanced measure theory based treatment of probability covers both the discrete, the continuous, any mix of these two and more.

Discussion

Consider an experiment that can produce a number of outcomes. The collection of all results is called the *sample space* of the experiment. The *power set* of the sample space is formed by considering all different collections of possible results. For example, rolling a die produces one of six possible results. One collection of possible results corresponds to getting an odd number. Thus, the subset {1,3,5} is an element of the power set of the sample space of die rolls. These collections are called *events*. In this case, {1,3,5} is the event that the die falls on some odd number. If the results that actually occur fall in a given event, that event is said to have occurred. Probability is a way of assigning every "event" a value between zero and one, with the requirement that the

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event made up of all possible results (in our example, the event {1,2,3,4,5,6}) be assigned a value of one. To qualify as a probability distribution, the assignment of values must satisfy the requirement that if you look at a collection of mutually exclusive events (events that contain no common results, e.g., the events {1,6}, {3}, and {2,4} are all mutually exclusive), the probability that at least one of the events will occur is given by the sum of the probabilities of all the individual events.[4]

The probability that any one of the events {1,6}, {3}, or {2,4} will occur is 5/6. This is the same as saying that the probability of event {1,2,3,4,6} is 5/6. This event encompasses the possibility of any number except five being rolled. The mutually exclusive event {5} has a probability of 1/6, and the event {1,2,3,4,5,6} has a probability of 1 - absolute certainty. For convenience's sake, we ignore the possibility that the die, once rolled, will be obliterated before it can hit the table.

Discrete probability distribution : Discrete probability theory deals with events that occur in countable sample spaces.

Examples

Throwing dice, experiments with decks of cards, and random walk.

Classical definition: Initially the probability of an event to occur was defined as number of cases favorable for the event, over the number of total outcomes possible in an equiprobable sample space: see Classical definition of probability.

For example, if the event is "occurrence of an even number when a die is rolled", the probability is given by $\frac{3}{6} = \frac{1}{2}$, since 3 faces out of the 6 have even numbers and each face has the same probability of appearing.

Modern definition: The modern definition starts with a finite or countable set called the sample space, which relates to the set of all*possible outcomes* in classical sense, denoted by Ω. It is then assumed that for each element $x \in \Omega$, an intrinsic "probability" value $f(x)$ is attached, which satisfies the following properties:

1. $f(x) \in [0, 1] \text{ for all } x \in \Omega\,;$
2. $\sum_{x \in \Omega} f(x) = 1\,.$

That is, the probability function *f*(*x*) lies between zero and one for every value of *x* in the sample space *Ω*, and the sum of *f*(*x*) over all values *x*in the sample space *Ω* is equal to 1. An event is defined as any subset E of the sample space Ω. The probability of the event is defined as $P(E) = \sum_{x \in E} f(x)\,.$

So, the probability of the entire sample space is 1, and the probability of the null event is 0.

The function $f(x)$ mapping a point in the sample space to the "probability" value is called a probability mass function abbreviated as pmf. The modern definition does not try to answer how probability mass functions are obtained; instead it builds a theory that assumes their existence.

Continuous probability distribution

Continuous probability theory deals with events that occur in a continuous sample space.

Classical definition: The classical definition breaks down when confronted with the continuous case. See Bertrand's paradox.

Modern definition: If the outcome space of a random variable *X* is the set of real numbers ($\mathbb{R}$) or a subset thereof, then a function called thecumulative distribution function (or cdf) F exists, defined by $F(x) = P(X \leq x)\,.$ That is, *F*(*x*) returns the probability that *X* will be less than or equal to *x*.

The cdf necessarily satisfies the following properties.

1. F is a monotonically non-decreasing, right-continuous function;
2. $\lim_{x \to -\infty} F(x) = 0$;
3. $\lim_{x \to \infty} F(x) = 1$.

If is absolutely continuous, i.e., its derivative exists and integrating the derivative gives us the cdf back again, then the random variable *X*is said to have a probability density function or pdf or simply density $f(x) = \frac{dF(x)}{dx}$.

For a set $E \subseteq \mathbb{R}$ the probability of the random variable *X* being in E is $P(X \in E) = \int_{x \in E} dF(x)$.

In case the probability density function exists, this can be written as $P(X \in E) = \int_{x \in E} f(x)\,dx$.

Whereas the *pdf* exists only for continuous random variables, the *cdf* exists for all random variables (including discrete random variables) that take values in $\mathbb{R}$.

These concepts can be generalized for multidimensional cases on $\mathbb{R}^n$and other continuous sample spaces.

The *raison d'être* of the measure-theoretic treatment of probability is that it unifies the discrete and the continuous cases, and makes the difference a question of which measure is used. Furthermore, it covers distributions that are neither discrete nor continuous nor mixtures of the two.

An example of such distributions could be a mix of discrete and continuous distributions—for example, a random variable that is 0 with probability 1/2, and takes a random value from a normal distribution with probability 1/2. It can still be studied to some extent by considering it to have a pdf of $(\delta[x] + \varphi(x))/2$, where $\delta[x]$ is the Dirac delta function.

Other distributions may not even be a mix, for example, the Cantor distribution has no positive probability for any single point, neither does it have a density. The modern approach to probability theory solves these problems using measure theory to define the probability space:

Given any set Ω, (also called sample space) and a σ-algebra $\mathcal{F}$on it, a measure P defined on $\mathcal{F}$ is called a probability measure if $P(\Omega) = 1$.

If $\mathcal{F}$ is the Borel σ-algebra on the set of real numbers, then there is a unique probability measure on $\mathcal{F}$ for any cdf, and vice versa. The measure corresponding to a cdf is said to be induced by the cdf. This measure coincides with the pmf for discrete variables, and pdf for continuous variables, making the measure-theoretic approach free of fallacies.

The *probability* of a set in the σ-algebra $\mathcal{F}$ is defined as $P(E) = \int_{\omega \in E} \mu_F(d\omega)$

where the integration is with respect to the measure μ_F induced by F.

Along with providing better understanding and unification of discrete and continuous probabilities, measure-theoretic treatment also allows us to work on probabilities outside $\mathbb{R}^n$, as in the theory of stochastic processes. For example to study Brownian motion, probability is defined on a space of functions.

Hints

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DECLARATION

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COMPLEXATION OF NI(II), CU(II) WITH PYRIDOXAL ANALOG SCHIFF BASE

SOMNATH JHA*

Abstract

The new complexes of Ni(II) and Cu(II) with pyridoxal analog (tridentate ligands) have been synthesized and characterized by Elemental Analysis, IR, UV-vis. magnetic moments, conductivity and electrochemical measurements. The spectral techniques suggest that all complexes of Ni(II) and Cu(II) exhibits square planar geometry. The low electrical conductance of the complex supports their neutral nature. The monomeric nature of the complexes and dimeric nature of Cu(II) complexes were assessed from their magnetic susceptibility values and spectral studies. The Schiff bases and their complexes indicates that the metal complexes exhibited higher antibacterial activity than the free ligands.

Key words : Pyridoxal, Ni(II) complexes, Cu(II) complexes.

Introduction

Semi- thiosemi, semicarbazones, amidoguanidine as well as their metal complexes have been the subject of great interest of many researchers for a number of years.[1-9] The significance of these compounds specially those of thiosemicarbazone complexes apart from their diverse chemical and structural characteristics, stem from their potential, biological activity, their use as analytical reagents are already established.[2]

The complexing behaviour and biological activities of [10–14] Schiff bases derived from Pyridoxal (vit – B_6) and subsequent literature[15] owing these Schiff bases to be a successful remedy for the diabetes led us to study the complexing behaviour of Schiff base of Pyridoxal analog (3-hydroxy–5–hydroxymethyl-2-methoxypyridine-4-carboxaldehyde).

The purpose of the present work is to study the complexes of Ni(II) and Cu(II) with 3-hydroxy–5–hydroxymethyl-2-methoxypyridine-4-carboxaldehyde semicarbazone (MPLSC) and 3-hydroxy–5–hydroxymethyl-2-methoxypyridine-4-carboxaldehide thiosemicarbazone (MPLTSC), 3-hydroxy–5–hydroxymethyl-2-methoxypyridine-4-carboxaldehyde amidoguanidine (MPLAG).

Experimental

These complexes were prepared by conventional method of refluxing the appropriate ligand with metal ion as chloride in alcohol for one hours. The precipitate was filtered, washed with aqueous alcohol and finally dried.

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Results and Discussions

All the complexes of Ni(II), Cu(II) with MPLSC, MPLTSC and MPLAG has been prepared by non-template method i.e. by the reaction of ready-made ligand and metal salts, mainly in warm alcoholic (less often aqueous) solution under an air atmosphere

The complex compound are coloured substance. Insoluble in water but fairly soluble in DMF. Data regarding the mpts, appearance and elemental analysis given in Table-1 and data regarding the IR spectra of the complex compounds given in Table-2.

Practically all the ligands and complexes of MPLSC, MPLTSC and MPLAG has been characterized in details in their IR spectra. The common features of all these spectra is that in the high-energy range in between 3500-3100 m^{-1}. They possess several bands, are ascribed to the n(OH) vibration of hydroxyl methyl group and H_2O, along with n(NH_2) vibration. The n(N–H) band, which is the spectra of free MPLSC and MPLTSC is observed at about 3100 cm^{-1} [16,18,19] is mixing from the spectra of singly deprotonated ligands. This also holds for the n$(NH)^+$ band. From pyridine ring, which in the spectra of the free ligands and complexes involving monoanionic ligands is observed at about 2850 cm^{-1}, while it is also absent from the spectra of complexes with dianionic form of the ligand. The very strong n(C=O) band in MPLSC ligand at 1680 cm^{-1} [17] that is around the value characteristic for the majority of semicarbazines[23,24] is in the complexes shifted to lower energies by 15–20 cm^{-1} (Neutral form) or is lost in (anionic form). A number of bands in the range 1640–1400 cm^{-1} in the spectra of both ligands and complexes are ascribed to pyridoxal ring libration, as well as to the n(C=N) and d(NH_2) of the chain [16,18,19]. M. Belicchi Ferrari et al.[21] observed that in the complexes involving neutral and singly protonated form MPLSC and MPLTSC ligand such as [Cu(MPLSC-H)(H_2O)]Cl, [Cu(MPLTSC-H)(H_2O)]Cl, spectra changes in 1500–1400 cm^{-1}. The medium instantly n(C=S) band in the ligand MPLTSC and its substituted derivatives observed in the range of 990–840 cm^{-1} is shifted due to complexation by 20–100 cm^{-1} [16,20,22].

T A B L E 1 *Analytical and preparation details for the complex compounds*

	Complex compound	Mpts	Appearance	Analysis (%) calculated (found)			
				C	H	N	Cu
1	[Cu(MPLSC-H)(H_2O)]Cl.H_2O	220°C	Brown	28.76 (28.07)	3.99 (4.05)	14.91 (14.56)	17.31 (18.02)
2	[Cu(MPLTSC-H)(H_2O)]Cl.H_2O	220°C	Brown	27.58 (27.35)	3.83 (4.09)	14.03 (14.02)	16.60 (16.11)
3	[Cu(MPLAG-H)(H_2O)]Cl.H_2O	220°	Brown	28.83 (28.53)	4.27 (4.83)	18.70 (18.05)	17.35 (17.05)
4	[Cu(MPLSC-H)(H_2O)$_2$]$_2$$Cl_2$.$2H_2O$	230°C	Brown	28.27 (28.02)	3.14 (3.92)	14.65 (14.02)	16.02 (16.41)
5	[Cu(MPLTSC-H)(H_2O)$_2$]$_2$$Cl_2$.$2H_2O$	220°C	Brown	28.19 (28.02)	3.26 (4.00)	14.62 (14.31)	16.57 (16.32)
6	[Cu(MPLAG-H)(H_2O)$_2$]$_2$$Cl_2$.$2H_2O$	230°C	Brown	22.00 (19.98)	4.00 (5.02)	22.00 (19.98)	20.00 (19.86)
				C	H	N	Ni
7	[Ni(MPLSC-H)(H_2O)].$2H_2O$	245°C	Red	34.42 (34.02)	4.46 (4.96)	17.85 (17.32)	18.71 (18.52)
8	[Ni(MPLTSC-H)(H_2O)].$2H_2O$	240°C	Red	34.31 (34.05)	4.13 (4.92)	17.79 (17.08)	18.65 (18.05)
9	[Ni(MPLAG-H)(H_2O)].$2H_2O$	244°C	Red	32.46 (31.98)	3.90 (4.05)	16.83 (16.52)	17.64 (17.02)

Electronic Spectra

The Ni(II) complexes exhibits two bands at 18420 cm^{-1} and 21160 cm^{-1} corresponding to transitions $^1A_{1g} \rightarrow {}^1A_{1g}$ (ν_1) and $^1A_{1g} \rightarrow {}^1B_{1g}$ (ν_2) the respectively. Since the complex is diamagnetic in nature therefore a square plannar geometry (C_4v) has been suggested for this complex. The Cu(II) complex show absorptions at 19990 cm^{-1} – 20100 cm^{-1} indicating square plannar geometry. Cu(II) complexes show absorptions at 32154 and 37878 cm^{-1} the binuclear Cu(II) and dimeric structures.[25]

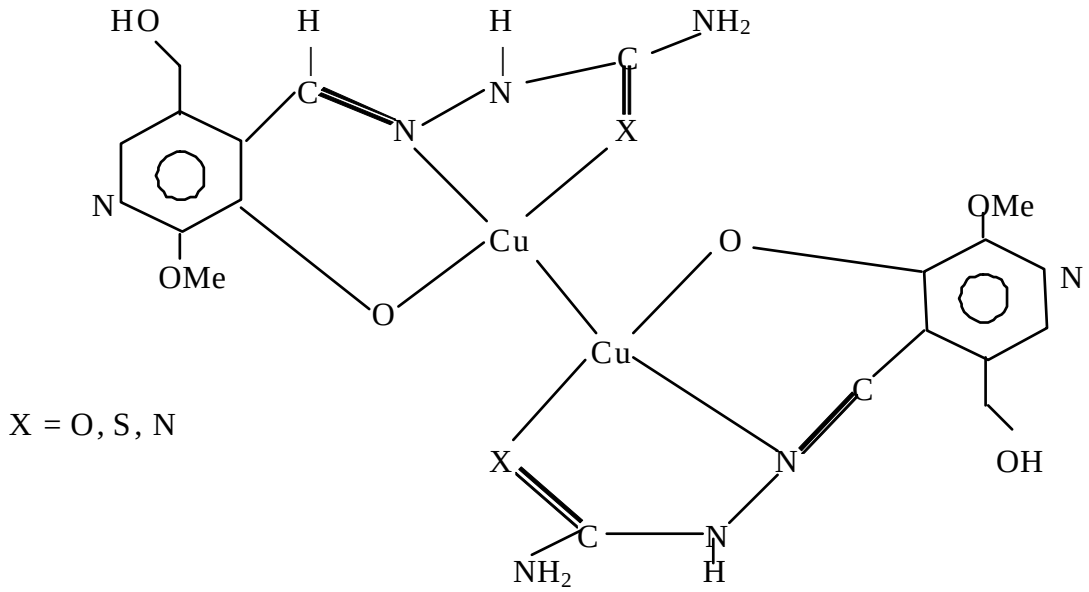
T A B L E 3 *Electronic spectra of complex compound in UV and viable range*

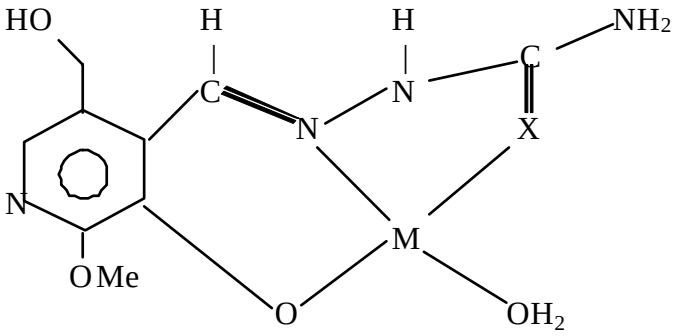
	Complex compounds	ν(max)	Assignments
1	[Cu(MPLSC-H)(H_2O)]Cl.H_2O	20,000	$^2B_{1g} \rightarrow {}^2A_{1g}$ $^2B_{2g} \rightarrow {}^2E_g$
2	[Cu(MPLTSC-H)(H_2O)]Cl.H_2O	20,100	$^2B_{1g} \rightarrow {}^2A_{1g}$ $^2B_{2g} \rightarrow {}^2E_g$
3	[Cu(MPLAG-H)(H_2O)]Cl.H_2O	19990	$^2B_{1g} \rightarrow {}^2A_{1g}$ $^2B_{2g} \rightarrow {}^2E_g$
4	[Cu(MPLSC-H)(H_2O)$_2$]$_2$$Cl_2$.$2H_2O$	13700	$^2E_g \rightarrow {}^2T_{2g}$
5	[Cu(MPLTSC-H)(H_2O)$_2$]$_2$$Cl_2$.$2H_2O$	13750	$^2E_{1g} \rightarrow {}^2T_{2g}$
6	[Cu(MPLAG-H)(H_2O)$_2$]$_2$$Cl_2$.$2H_2O$	15150	$^2E_{1g} \rightarrow {}^2T_{2g}$
7	[Ni(MPLSC-H)(H_2O)].$2H_2O$	18420	$^1A_{1g} \rightarrow {}^1A_{2g}$
		21160	$^1A_{1g} \rightarrow {}^1B_{1g}$
8	[Ni(MPLTSC-H)(H_2O)].$2H_2O$	18420	$^1A_{1g} \rightarrow {}^1A_{2g}$
		21160	$^1A_{1g} \rightarrow {}^1B_{1g}$
9	[Ni(MPLAG-H)(H_2O)].$2H_2O$	18420	$^1A_{1g} \rightarrow {}^1A_{2g}$
		21160	$^1A_{1g} \rightarrow {}^1B_{1g}$

Magnetic susceptibility : The μ_{eff} value of Cu(II) complexes are 1.83 - 1.85 BM and the μ_{eff} value of Ni(II) complexes are 2.98 – 3.01 BM.

Conclusion

On the basis of these results obtained by elemental analysis as well as uv-vis, I.R. spectra and magnetic susceptibility the following structures are suggested.





M = Cu(II) & Ni(II)
X = O, S, N

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TABLE 2 *Characteristic infrared absorption frequency (cm^{-1}) of the ligand and complexes.*

	ν(N-H) Ostretching	ν(C=N)	ν(C–O)	ν(C-N)	ν(N–H) bending	ν(O–H)	ν(C=S)	ν(C=O)	ν(M-N)	ν(M-O)
1 [Cu(MPLSC-H)(H_2O)]Cl.H_2O	3460	1585	1285	920-930					560	510
2 [Cu(MPLTSC-H)(H_2O)]Cl.H_2O	3460	1585	1285	920-930			990-840		560	510
3 [Cu(MPLAG-H)(H_2O)]Cl.H_2O	3460	1585	1280		1670	3140			520	490
4 [Cu(MPLSC-H)(H_2O)$_2$]$_2$$Cl_2$.$2H_2O$	3460	1585	1285	920-930					560	510
5 [Cu(MPLTSC-H)(H_2O)$_2$]$_2$$Cl_2$.$2H_2O$	3460	1440	1295			3260	990-840	1640	520	470
6 [Cu(MPLAG-H)(H_2O)$_2$]$_2$$Cl_2$.$2H_2O$	3400	1565	1280		1670	3140			520	490
7 [Ni(MPLSC-H)(H_2O)].$2H_2O$	3460	1580	1290	920-930		3140			490	520
8 [Ni(MPLTSC-H)(H_2O)].$2H_2O$	3460	1580	1285				990-840	1640	490	520
9 [Ni(MPLAG-H)(H_2O)].$2H_2O$	3380	1570	1280					1630	490	520

DECLARATION

The Declaration of the author for publication of Research Paper in The Indian Journal of Research Anvikshiki ISSN 0973-9777 Bi-monthly International Journal of all Research: I, *Somnath Jha, Research Scholar, M.L.S.M. College Darbhanga (Bihar) India.* the author of the research paper / article entitled COMPLEXATION OF Ni(II), Cu(II) WITH PYRIDOXAL ANALOG SCHIFF BASE declare that , I take the responsibility of the content and material of my paper as I myself have written it and also have read the manuscript of my paper carefully. Also, I hereby give my consent to publish my paper in The Indian Journal of Research, Anvikshiki ISSN 0973-9777 Bi-monthly International Journal of all Research , This article / research paper is my original work and no part of it or it's similar version is published or has been sent for publication anywhere else. I authorise the Editorial Board of The Indian Journal of Research Anvikshiki ISSN 0973-9777 Bi-monthly International Journal of all Research to modify and edit the manuscript. I also give my consent to the Editor of The Indian Journal of Research Anvikshiki ISSN 0973-9777 Bi-monthly International Journal of all Research to own the copyright of my research paper / article.

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SYNTHESIS ANTI CATALYTIC ACTIVITY OF TWO NEW CYCLIC TETRAAZA LIGANDS

ANJANI KR. CHOUDHARY*

Abstract

Two new chiral cyclic tetraaza ligands were synthesized and characterized. Their catalytic activity was tested in the asymmetric addition of diethylzinc to benzaldehyde. The expected secondary alcohol was obtained in moderate yields, but with very low enantioselectivity.

Keywords : Chiral tetraaza ligands, asymmetric catalysis. Catalytic activity

Introduction

The importance of nitrogen-containing ligands as catalysts for many asymmetric transformations has grown in the last years [1] because of their high stability, easy preparation and promising results [2]. In 1969 Uhlemann developed the synthesis of a new chiral Schiff base 1 from o-aminobenzaldehyde and 1, 2-cyclohexanediamine [3]. Compounds containing this optically active transcyclohexane-1, 2-diamine moiety have proven to be very useful in both asymmetric synthesis [4] and diastereomeric recognition of peptides [5].

We report in this paper the synthesis and characterization of two new tetraaza ligands containing 1, 2-cyclohexanediamine as the chiral unit and their ability to catalyse the addition of diethylzinc to benzaldehyde.

Results and Discussion

The ligand 2 was synthesized from compound 1 by reaction with oxalyl chloride in THF in the presence of Et_3N as catalyst, according to a procedure reported in the literature [6] (Scheme 1). After flash chromatography of the crude product, the cyclic compound 2 was obtained in a 68 % yield as colorless crystals.

The synthesis of ligand 4 using 1 as starting material was attempted by reaction with di-tert-butyl dicarbonate (Boc_2O) in CH_2Cl_2 using 4-dimethylaminopyridine (DMAP) as catalyst. Such reactions for similar substrates have been reported to give yields of 87-96 % [7]. According to the mechanism shown in Scheme 2, an intermediate urethane B is formed by reaction of the amine nitrogen with the Boc_2O. Intramolecular nueleophilic addition of the second arylamine to the urethane or an isocyanate, which may evolve from B by elimination of tert-butanol should yield urea 4.

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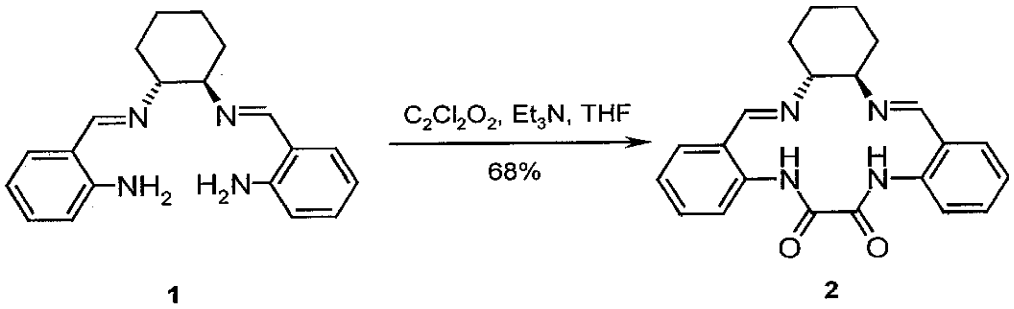
Scheme 1



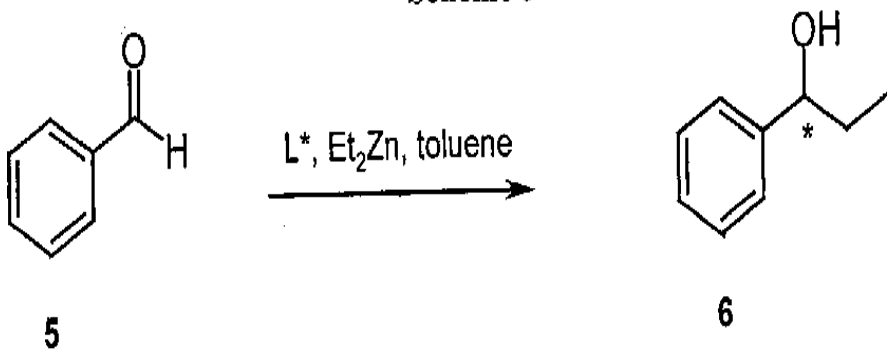
After performing the reaction and successive chromatographic separations, a colorless product was obtained. This product, however, displays in its ^{13}C-NMR spectrum two carbonyl group signals at $\delta = 151.3$ and $\delta = 151.7$, while only one was expected. ^{1}H-NMR spectra and mass spectrometry (molecular ion m/z = 391) indicated a different product with structure 3. A likely mechanism for its formation is the reaction of 1 with Boc_2O and loss of tert-butanol to A followed by intramolecular cyclization to yield 3. Only a few reports of stable carbamic anhydrides exist in the literature [8]. The proton and carbon NMR spectra of 3 indicate a non C_2 symmetric conformation of the molecule. The ^{1}H-^{13}C HMBC NMR data show that each N-H group can be correlated to one CO carbon.

It was thought that upon heating compound 3, it would release CO_2, thus leading to 4. This was tested by differential scanning calorimetry (DSC) [9], which showed a reaction of 3 at 259 °C, which indeed led to a loss of weight corresponding to CO_2 elimination, however, the high temperature at which this reaction occurs makes it of limited synthetic interest [10].

Catalysis

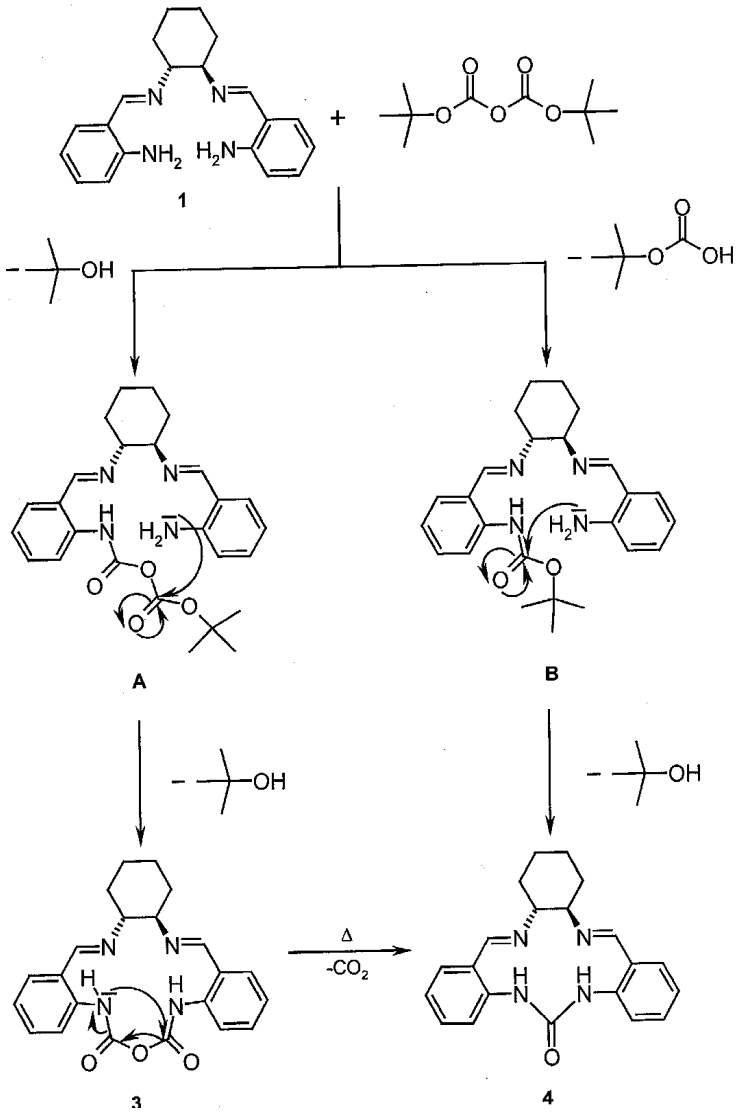
The cyclic diimine ligands 2 and 3 were examined as catalysts for the asymmetric addition of diethyizinc to benzaldehyde (Scheme 3).

Scheme 3



Moderate yields (51 and 88 %, respectively) of 1-phenylpropanol (6) were obtained, but no or very low enantioselectivities were observed [11]. The possible cause of these low selectivities could be the small size of the available cavity, which is not large enough to accommodate the Zn atom to form the intermediate zincate essential for the intramolecular alkyl transfer reaction.

Scheme 2



Experimental

General

Melting points were determined with a Buchi SMP 20 and are uncorrected. IR-spectra were recorded with a Bio-Rad FTS 3000 MX FT-IR. ^{1}H-NMR and ^{13}C-NMR were recorded with a Bruker ARX 400 or a Bruker AC 250 instruments at 250 and 62.9 MHz, respectively. The ^{1}H chemical shifts are reported in (ppm) relative to $CDCl_3$ (7.26 ppm), DMSO-d_6, (2.49 ppm) and TMS (0 ppm), while ^{13}C chemical shifts are reported in (ppm) relative to $CDCl_3$ (77 ppm), DMSO-d_6 (36.9 ppm) and TMS (0 ppm). MS-spectra were recorded on a Varian CH-5 (EI) and a Finnigan MAT SSQ 7000 (ESI). Solvents were distilled and dried according to standard laboratory methods [12].

Synthesis of the ligands

7, 10-Cyclooxalamide-N, N'-bis-(phenyl-2-ylmethylene)-cyclohexane-IR, 2R-diarnine (2): Schiff base 1 (400 mg, 1.25 mmol) and dry Et_3N (0.35 ml, 2.51 mmol) were dissolved in dry THF (20 mL) under nitrogen with stirring. A solution of oxalyl chloride (0.15 ml, 1.77 mmol) in dry THF (25 mL) was added with a syringe pump over a period of 2.5 h. The reaction mixture was then stirred for 19 h at room temperature. The mixture was concentrated to half of its volume and the colourless precipitate of the product was filtered off. Flash chromatography of the raw product in $CHCl_3$ afforded the cyclic compound 2 (318 mg, 0.85 mmol, 68 %), mp 223-225 °C (dec.); = -17° (c 1.0, $CHCl_3$); IR (KBr): v = 3440, 2963, 2925, 2854, 2359, 1683, 1635, 1577, 1506, 1440, 1290, 1261, 1159, 1093, 1025, 939, 859, 802, 753 cm^{-1}; ^{1}H-NMR ($CDCl_3$): δ =1.53-2.13 (m, 8H), 3.79 (s, 211), 7.00 (dd, 2H, J= 7.6 Hz), 7.18 (d, 211, J = 7.6 Hz), 7.40 (dd, 2H, J = 7.9, 7.6 Hz), 8.52 (s, 2H, HC=N), 8.87 (d, 2H, J= 7.9 Hz), 14.22 (s, 2H, PhNH); ^{13}C-NMR ($CDCl_3$): δ = 24.38, 33.1, 73.59, 119.95, 122.75, 123.52, 130.75, 132.85, 138,57, 159.74, 163.24; MS (PI-ElMS) m/z (%): 374.2 (8) [$M^{+\cdot}$], 228.2 (22) [$M^{+\cdot}$ — N=CH-Ph-NHCO], 147.1 (100) [N=CH-Ph-NHCO].

7, 10-Cyclodicarbonic-diamide-N, N'-bis-(phenyl-2-ylmethylene)-cyclohexane-IR, 2R-diamine (3): Ditert-butyl dicarbonate (Boc_2O, 657 mg, 3.01 mmol), 4-dimethylaminopyridine (DMAP, 41 mg, 0.34 mmol) and Schiff base 1 (500 mg, 1.56 mmol) were dissolved with stirring in dry CH_2Cl_2 (10 mL) under nitrogen. The reaction mixture was stirred for 30 minutes at room temperature and then at 40 °C for 6 h. Evaporation of the solvent and crystallization of the residue from EtOH (50 mL) afforded crude 3. After two purifications by column chromatography (eluting with AcOEt) a colorless product (230 mg, 0.59 mmol, 38%) was obtained, mp = 253-255°C (dec.); $[\alpha]_D^{25}$ = -20° (c 1.5, DMSO); IR(KBr): v = 3413, 3208, 3062, 2923, 2856, 1679, 1608, 1498, 1463, 1385, 1296, 1270, 1227, 1157, 1139, 938, 794, 754 cm^{-1}; ^{1}H-NMR (DMSO-d_6): δ = 1.31-1.45 (m, 3H), 1.73-1.77 (m, 3H), 1.90-1.95 (m, 1H), 2.63-2.67 (m, 1H), 3.62-3.71 (m, 1H), 5.04-5.09 (m, 1H), 5.96 (s, 1H, HC=N), 6.51 (s, 1H, HC=N), 6.79-7.16 (m, 4H), 7.20-7.23 (m, 3H), 7.29-7.32 (m, 1H), 9.68 (s, 1H, PhNH), 9.71 (s, 1H, PhNH); ^{13}C-NMR (DMSO-d_6): δ = 24.93, 25.58, 30.72, 31.96, 53.96, 63.76, 81 .24, 87.63, 113.29, 113.34, 118.03, 118.21, 120.87, 120.92, 127.28, 127.43, 129.27, 129.46, 136.47, 136.53, 151.33, 151.67; MS (CI-MS) m/z (%): 391.3 (100) [$MH^{+\cdot}$], 244.2 (73), [$MH^{+\cdot}$ — N=CH-Ph-NHCO]

Catalysis

Preparation of 1-Phenyl-1-propanol (6): The ligand (0.05 mmol, 5 mol %) was dissolved in dry toluene (6 mL) under nitrogen, diethylzinc (1.1 M solution in toluene, 0.1 mL, 0.11 mmol) was added, and the mixture was allowed to stir for 1 h at room temperature, then cooled to 0 °C or maintained at room temperature. The remaining diethylzinc (2.17 ml, 2.39 mmol) was added slowly. After five minutes the aldehyde (1 mmol) was added. The reaction was stirred until no more aldehyde was observed (TLC) and then quenched with 2 M KCl (6 mL). The layers were separated and the aqueous phase was extracted with Et_2O (3 × 10 mL). The combined organic extracts were dried with Na_2SO_4, filtered and concentrated under reduced pressure. The product was purified by short path distillation to give the alcohol as colorless oil. R_f = 0.32 (hexane/ethyl acetate 5:1). -$[\alpha]_D^{25}$ = +30.6 (c = 1.11, $CHCl_3$) for the (R)-enantiomer [13]; ^{1}H-NMR ($CDCl_3$): δ = 0.89 (t, 3H, J = 7.5 Hz, CH_3), 1.74-1.83 (m, 2H, J = 13.6, 7.5, 7.0 Hz. CH_2), 2.46 (s, OH), 4.59 (t, 1H, J = 7.0 Hz, CH), 7.29-7.37 (m, 5H, ArH); GC Analysis: HP 5890 II Chromatograph, FID Detector 300 °C, Injector Temperature 260 °C, Column Restek Rt âDEX cst, 30 m, 0.32 mm, 0.25 µm, Oven Temperature 85 °C, Carrier gas H_2, Column Head Pressure 3 bar. Retention times: 24.36 mm (R), 26.45 mm (S).

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[9] *A sample of 7.041 mg of 3 was heated under N2 from 25 to 300°C at a rate of 10 °C/min. The reaction set in at 259.1 °C and the sample lost 0.818mg in weight, which corresponds to the loss of* CO_2 *(theoretically 0.794 mg).*

[10] *The preparative synthesis of 4 thus never succeeded. Possible alternate ways of obtaining this compound could be to react the tetraaza ligand 1 with urea while heating (Davis, T. L.; Underwood Jr., H. W. J. Am. Chem. Soc. 1922, 44, 2595-2604), with phosgene in benzene (Jones, L. W.; Root, F. B. J. Am. Chem. Soc. 1926, 48, 181-195), with diphosgene in dioxane (Cordier, D.; Coulet, P. R. I Cheni. Soc. Perkin Trans. 2 1994, 4, 89 1-894) or with carbon dioxide in the presence of a strong base or with methyl chloroformate and* Et_3N *in* CH_2Cl_2 *(Naito, R.; Takeuchi, M.; Morihira, K.; Hayakawa, M.; Ikeda, K.; Shibanuma, T.; Isomura, Y. Chem. Pharm. Bull. 1998, 43, 8, 1286-1294).*

[11] *While with ligand 2 the racemic alcohol was obtained, ligand 3 gave the R-isomer in 6 % ee.*

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Declaration

The Declaration of the author for publication of Research Paper in The Indian Journal of Research Anvikshiki ISSN 0973-9777 Bi-monthly International Journal of all Research: I, *Anjani Kr. Choudhary, Research Scholar, L.N.M.U. Darbhanga (Bihar) India*. the author of the research paper / article entitled SYNTHESIS ANTI CATALYTIC ACTIVITY OF TWO NEW CYCLIC TETRAAZA LIGANDS declare that , I take the responsibility of the content and material of my paper as I myself have written it and also have read the manuscript of my paper carefully. Also, I hereby give my consent to publish my paper in The Indian Journal of Research, Anvikshiki ISSN 0973-9777 Bi-monthly International Journal of all Research , This article / research paper is my original work and no part of it or it's similar version is published or has been sent for publication anywhere else. I authorise the Editorial Board of The Indian Journal of Research Anvikshiki ISSN 0973-9777 Bi-monthly International Journal of all Research to modify and edit the manuscript. I also give my consent to the Editor of The Indian Journal of Research Anvikshiki ISSN 0973-9777 Bi-monthly International Journal of all Research to own the copyright of my research paper / article.

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STRESS AND ITS IMPACT ON MENTAL HEALTH: AN APPRAISAL

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Abstract

Stress is inescapable in today's complex and busy life. At one time or another, most people experience stress. The term stress has been used to describe a variety of negative feelings and reactions, which are accompanied with threatening or challenging situations. However, not all stress reactions are negative. A certain amount of stress is actually necessary for survival; it can help to perform under pressure and motivate to do best. Whereas, beyond a certain point, stress stops being helpful and starts causing major damage to mental and physical health. Stress is associated with various mental health problems like anxiety and depression. Stress can affect the behavior of a person in dealing with the whole environment. Persons under stress often develop poor attitudes and motivation about the job and about their personal health and psychological well-being.

Key Words: Stress, Mental Health & Impact.

Introduction

Stress has become a common theme of modern life as individuals try to cope with incessant demands that emerge from pressures at home, at work and even during leisure time which, for many, are overwhelming. Right from the time of birth till death, an individual is invariably exposed to various stressful situations. In fact, modern times have been called the "age of anxiety and stress" (Coleman, 1976).

There are a number of definitions of stress as well as number of events that can lead to the experience of stress. Stressful situations can be viewed as harmful, as threatening, or as challenging. With so many factors that can contribute to stress it can be difficult to define the concept of "stress".

The term "stress" has been derived from Latin word "stringere" meaning to draw tight. It has been used in the English language since about fifteenth century, when it had the meaning of pressure or physical strain. By the late twentieth century, stress was concerned with psychosomatic medicine to be a cause of ill health or mental disease (Dunbar, 1947).

Selye (1936, 1956) defines stress as a dynamic condition in which an individual is confronted with an opportunity, constraint, or demand related to what he or she desires and for which the outcome is perceived to be both uncertain and important, in other words he defined stress as "The force, pressure, or strain exerted upon a material object or person which resists these forces and attempt to maintain its original state." Selye (1982) points out that few people define the concept of stress in the same way or even bother to attempt a clear-cut definition. According to Selye, an important aspect of stress is that a wide variety of dissimilar

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situations are capable of producing the stress response such as fatigue, effort, pain, fear, and even success. This has led to several definitions of stress, each of which highlights different aspects of stress.

McGrath (1976) defines stress in terms of a set of conditions having stress in it. "Stress involves an interaction of person and environment. Something happens out there which presents a person with a demand, or a constraint or an opportunity for behaviour". Stress is ubiquitous in our society. It has become an integral part of everyday living.

According to Erkutly and Chafra (2006) stress generally can be defined as a reaction of individual to demands (stressors) impose upon them. It refers to situations where the well-being of individual is detrimentally affected by the failure to cope with the demands of their environment. Akinboye, Akinboye and Adeyemo (2002) were of the opinion that most people see stress as negative while others differentiate between negative and positive areas. According to them, distress is negative, while eutress is positive. Distress manifests as disappointment, failure threat, embarrassment and other negative experiences. Eutress (positive stress) manifested as positive exhilarating experiences of success followed by higher expectations.

Biopsychosocial Model of Stress

One of the most comprehensive models of stress is the Biopsychosocial Model of Stress (Bernard, & Krupat, 1994). According to the Biopsychosocial Model of Stress, stress involves three components: an external component, an internal component, and the interaction between the external and internal components.

External component of Stress

It involves environmental events that precede the recognition of stress and can elicit a stress response. We are usually aware of stressors when we feel conflicted, frustrated, or pressured. Most of the common stressors fall within four broad categories: personal, social/familial, work, and the environment. These stressful events have been linked to a variety of psychological physical complaints.

Internal component of Stress

The internal component of stress involves a set of neurological and physiological reactions to stress. Selye (1985) noted that a person who is subjected to prolonged stress goes through three phases: Alarm Reaction, Stage of Resistance and Exhaustion. He termed this set of responses as the General Adaptation Syndrome (GAS). This general reaction to stress is viewed as a set of reactions that mobilize the organism's resources to deal with an impending threat. Selye has noted that, in humans, many of the diseases like headaches, insomnia, high blood pressure, and cardiovascular and kidney diseases that caused by stress occur in the resistance stage and he refers to these as "diseases of adaptation."

Dienstbier (1989) questions the emphasis the GAS places on the role of chronic stress and proposes another model of stress- Physiological Toughening. This approach focuses on the duration of stressful events. Acute stressors are the briefest and often involve readily identifiable a tangible threats but chronic stressors are of a longer duration and are not readily identified as stressors because they are often ambiguous and intangible and hence pose a serious health risk if not recognized and properly managed. Physiological Toughening is concerned with the third category of stressors, intermittent stressors which are the most variable in duration, alternating between periods of stress and calm. If an intermittent stressor is viewed as a challenge, it may improve one's physiological resistance to stress by causing repeated, periodic increases in sympathetic arousal which conditions the body to better withstand subsequent stressors. This can be seen from research indicating that experienced subjects show few or none of the deleterious effects of environmental stressors.

Interaction between External and Internal Components

The third component of the biopsychosocial model, the interaction between the external and internal components, involves the individual's cognitive processes. Lazarus and colleagues (1984, 1978) have proposed a cognitive theory of stress which refers to this interaction as a transaction, taking into account the ongoing relationship between the individual and the environment and places the emphasis on the 'meaning' that an event has for the individual and not on the physiological responses. They believe that one's view of a situation determines whether an event is experienced as stressful or not, making stress the consequence of appraisal and not the antecedent of stress. The appraisal of the event plays a fundamental role in determining, not only the magnitude of the stress response, but also the kind of coping strategies that the individual may employ in efforts to deal with the stress.

According to the theory of transactions, stress arises only when a particular transaction is appraised by the person as relevant to his or her well-being. In order for an event to be appraised as a stressor, it must be personally relevant and there must be a perceived mismatch between a situation's demands and one's resources to cope with it.

Dienstbier (1989) offers a reformulation of the Transaction theory, which focuses on the emotional consequences of appraising an event as a stressor or as a challenge. He uses the term stress to refer to transactions that lead only to negative emotions and he uses the term challenge to describe a transaction that could lead both to positive and negative emotions. A series of studies by Frankenhaeuser (1986) and colleagues provide some support for Dienstbier's assertion that a stressor evaluated as a challenge should be viewed more positively than a harm/loss or threat event.

Mental Health

According to Cutts and Moslay (1941) mental health is the ability which helps us to seek adjustment in the difficult situations of our life. Jahoda (1958) presented six cardinal aspects of mental health as (1) the attitude towards the self, (2) growth and development and self actualization, (3) integration, (4) autonomy, (5) perception of reality and (6) environmental mastery.

Ferguson, Fersing and Allen et al. (1965) stated that mental health is the ability to cope with one's environment in such a way that one's instinctual drives are gratified. They considered that mental illness and mental health are two opposite ends of the continuum on which any individual can be placed depending on the soundness of his mind.

Menninger (1967) defined mental health as the adjustment of human beings to the world and each other with a maximum of effectiveness and happiness. It is the ability to maintain even temper, an alert intelligence, socially considerate behavior and a happy disposition.

World Health Organization (WHO) has included mental well-being in the definition of health. WHO famously defines health as:

> ... a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity (WHO 2001, p.1).

Three ideas central to the improvement of health follow from this definition: mental health is an integral part of health, mental health is more than the absence of illness, and mental health is intimately connected with physical health and behaviour. Mental health can be conceptualized without restricting its interpretation across cultures. WHO has recently proposed that mental health is:

> ... a state of well-being in which the individual realizes his or her own abilities, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to his or her community (WHO 2001a, p.1).

In this positive sense, mental health is the foundation for well-being and effective functioning for an individual and for a community. It is more than the absence of mental illness, for the states and capacities noted in the definition have value in themselves. Neither mental nor physical health can exist alone. Mental, physical, and social functioning are interdependent. Furthermore, health and illness may co-exist. They are mutually exclusive only if health is defined in a restrictive way as the absence of disease (Sartorius 1990). Recognizing health as a state of balance including the self, others, and the environment helps communities and individuals understand how to seek its improvement.

Psychological and Behavioral Reactions to Stress

Stress affects both the body and mind and can lead to a series of problems. Stress is a force that compels one part of the mind against another part of the mind, pulling and pushing against the positive forces or compressing emotions and thoughts. When this occurs, a person feels as though they're losing control of their life. This will often lead them to lean on their emotions to try to solve their problems. When a person leans on the emotions within them that create anger or sadness, often leads to negative thought patterns.

Stress can influence the occurrence of ill health is through its effects on a person's psychological and behavioral reactions. Thus, stress can affect psychological moods, work behavior, coping style and actions, motivation to report injury and motivation to seek treatment for a injury or symptoms of illness. Many times, diagnosis of a disorder is based on the nature and extent of pain reported by the person. Stress may serve to increase the frequency of reporting of upper extremity pain because of a general increase in personal sensitivity to pain brought on by negative psychological moods. Increased pain or greater severity of pain has been related to psychological stress among patients with spinal cord injury (Summers, et al., 1991), patients with low back pain (Atkinson, et al., 1988; Ryden, et al., 1985), and among large samples of adults (Mechanic, & Angel, 1987; Korff, et al., 1988). Thus, pain that is really non-clinical and a normal part of the general adaptation process to work activity may be perceived by the person as much more significant due to heightened psychological stress. If this same person were not under psychological stress the pain may not be perceived as significant and go unreported.

A related issue is a social psychological aspect of illness behavior. It is possible that a person under psychological stress could develop specific physical symptoms that would "legitimate" their general psychological discomfort and pain. Having pain in the wrists and fingers is an acceptable disorder, while feeling depressed may not be as acceptable. Thus, the effects of psychological disturbances may be reflected in physical disorders. This is similar mass psychogenic illness (Colligan, & Murphy, 1979) or psychosomatic disorders (Wolf, 1986) where psychologically induced disturbances lead to physical impairment.

Job stress can affect the behavior of a person in dealing with the work environment. For instance, a person who is stressed may become angry and this could lead to using improper work methods, or attitude problems, or violence. Persons under stress often develop poor attitudes and motivation about the job and about their personal health and well being (Kahn, 1981; Caplan, et al., 1975; Landy, 1989). They become apathetic. These same people are not likely to seek medical assistance until a serious health condition interferes with their ability to do their job duties. They are more likely to be absent from work because of sickness (USDHEW, 1979). Generally, maladaptive coping behaviors have been related to poor overall health, less energy and greater general fatigue. This could make people more susceptible to injury or disease (Fitzgerald, 1992) and lead to a diminished capacity to work.

Stress is, at its core, caused by mental perception of impending or existing personal difficulties. It is a fact of daily life and is the result of both the good and bad things that happen. Stress has both positive and negative

impact on mental health. Too much stress can cause serious health concerns, but there are many ways of dealing with stress that can reduce risk. Stress is an important factor in mental illness because it can worsen symptoms and lead to relapses. Sometimes the stress comes from something positive (like a new job, new apartment, or new relationship) and sometimes from something negative (like having an argument with someone, or being the victim of crime).

Treatment for stress should involve those methods that impact the mental and emotional processes which lead to insurmountable stress. Seeking counseling from a professional or simply seeking the perspective of someone you respect can be a fundamental form of temporary relief. Dealing with stress over time is, however, more of a lifestyle issue. Doing the things that minimize stress, that undermine the creation of stressful situations is a long-term answer to stress management.

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http://helpguide.org/mental/stress_signs.htm

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GENDER AND HABITAT DIFFERENCES ON MENTAL HEALTH AMONG ADOLESCENTS

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Abstract

Youth period is setting down age, productive age, problem age, a period of emotional tension and social isolation and it is a time of commitments. The aim of the present study is to find out the mental health status of urban and rural college going male & female adolescents. The study was conducted on 200 male & female adolescent students of urban area, and 200 male & female adolescent students of rural area, in age range of 15-21 years. Findings of the present study reveal that urban male & female and rural male & female adolescents have significant difference in overall mental health status. On the other hand male & female adolescent students have no significant difference in overall mental health status.

Keywords: Mental Health, Gender, Habitat, Adolescents etc.

Introduction

Mental health is one of the major problems of the world today. Because of rapid industrialization and sophistication of the modern social system, an individual often fails to maintain the balance between himself and his social environment. A person is said to have a good mental health when he succeeds to maintain harmonious relationship between himself and his environment. Mental health is the social and emotional adjustment of an individual. A mentally healthy person is socially useful and productive, whereas mentally unhealthy person is emotionally and socially maladjusted and it is a sort of burden on the society and nation (Srivastava, Rai and Rai, 1987).Mental health has been always a concept very difficult to define (Cowen 1994; Secker, 1998). However Ventis W. Larry (998) defines mental health by seven criteria derived from the literature as absence of mental illness, appropriate social behavior, freedom from worry and guilt, personal competence and control, self acceptance and actualization, unification and organization of personality and open mindedness and flexibility. The main causes of mental health are biological, psychological and socio-cultural. Biological causes are genes, infections, physical traumas, nutrition, hormones and toxins. Psychological causes are stressful life event, personality and gender. The socioeconomic and cultural causes are family, patterns of relationship, economic conditions, racism war etc (Rtchagar,I. & Venkatammal, P. 2003).

The concept of mental health is as old as human beings. Mental health commutates those behaviors, perceptions and feelings that determine a person's overall level of personal effectiveness, success, happiness and excellence of functioning as a person. Bhatia (1982) describes it as the ability to balance desires, feelings,

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ambitions and ideals in one's daily living. It may also be understood as the behavioral characteristics of a person. According to Kumar (1992), mental health is an index which shows the extent to which the person has been able to meet his environmental demands – social, emotional or physical. A mentally healthy person shows homogenous organization of desirable attributes, healthy values and righteous self-concept and a scientific perception of the world as a whole. Mental health presents a humanistic approach towards self and others. It is an important factor that influences an individual's various activities, behaviour, happiness and performance. However, when s/he finds himself/herself trapped in a situation s/he does not have matching coping strategies to deal with it effectively, s/he gets himself/herself mentally strained. This mental strain is generally reflected in symptoms like anxiety, tension, restlessness or hopelessness among others. If it is felt for too long and too extensively by the person, these symptoms may take a definite form (or get 'syndromised') representing a given illness. Mental health, therefore, should not be confused with mental illness. It is a study of pre-illness mental condition of the person. Mental health, as such, represents a psychic condition, which is characterised by mental peace, harmony and content. It is identified by the absence of disabling and debilitating symptoms, both mental and somatic in the person (Schneiders, 1964).

"Mental health as the adjustment of human being to the world and to each other with a maximum of effectiveness and happiness….. It is the ability to maintain an even temper, an alert intelligence, socially considerate behaviour and a happy disposition.(Menninger 1945).

The dimension of mental health is as follows: *Positive Self Evaluation (PSE)* It includes self-confidence, self- acceptance, self identity, feeling of worth while ness, realization of one's potentialities, etc. *Perception of Reality (PR)* It is related to perception free from need distortion, absence of excessive fantasy and broad out look on the world. *Integration of Personality (IP)* It indicates balance of psychic forces in the individual and includes the ability to understand and to share other people's emotions, the ability to concentrate at work and interest in several activities. *Autonomy (AUTNY)* It includes stable set of internal standards for one's action, dependence for own development upon potentialities rather than dependence on other people. *Group Oriented Attitude (GOA)* It is associated with the ability to get along with others, work with others and ability to find recreation. *Environmental Mastery (EM)* It is includes efficiency in meeting situational requirements, the responsibilities and capacity for adjustment (Jagadish, S. and Srivastava, A. K., 1983).

Age and mental health has a very close relationship. As it deals with adjustment problems at every stage of life; it helps a person to adjust his/her ways of thinking, feeling, behaving and attitudes in accordance with his/her make up, the environment and the newer developments. Adolescence is considered as the most important transition period of life. Adolescents face an intense turmoil because of the cognitive, biological and social changes taking place in this period. Further more, adolescence is a period of heightened risk with high rates of depression, conduct disorders, suicides, drug and alcohol addiction and antisocial behavior. Adolescent could navigate this transitional period with much success, happiness and confidence without much uncertainty and distress, but it could be possible, in only one condition i.e. with sound mental health. Numerous developmental studies have examined the effect of age and gender as well as their interaction on the epidemiology of mental health and have consistently revealed that problems are less common in early adolescence than in late adolescence (Fleming and Offord, 1990) and females experience higher rates of such problems than males (Sprock and Yoder, 1997).

Mental health during the youth period is very important for their future life. When they are not able to cope up with the problems they face in life, they become dejected and frustrated. Stress and mental agony lead them to mental disorders. The youth are often become victims of mental illness due to social discrimination, poverty, family burden and employment. So an attempt has been made to study the mental health of adolescents.

To examine the habitat and gender differences on mental health among adolescent students.

Method

Sample : The locale of the present study was confined to the Varanasi and Jaunpur district of Uttar Pradesh. A sample of 400 subjects was drawn 200 urban male & female and 200 rural male & female adolescents. The sample consisted college going adolescent students their age range from 15-21 years.

Tool: Following tool was used to collect the data:

Mental Health Inventory developed by Jagdish & Srivastava (1983) was used in the present study. This scale consists of 56 items. It provides scores for the following areas:- Positive Self Evaluation (PSE), Perception of Reality (PR), Integration of Personality (IP), Autonomy(AUTNY), Group Oriented Attitude(GOA), Environmental Mastery(EM).

Result & Discussion

Mean and SD for four groups (2 locale * 2 Gender) are shown in Table -1.The result of 2 * 2 ANOVA (2 locale * 2 Gender) on Overall Mental Health are given in Table-2.

T A B L E 1 *Mean and SD values of four groups (2locale*2gender) on Overall Mental Health.*

Habitate	Sex	N	Mean	SD
Rural	Male	100	164.41	12.92
	Female	100	161.90	8.41
	Total	200	163.16	10.95
Urban	Male	100	160.11	14.02
	Female	100	160.86	8.92
	Total	200	160.48	11.73

T A B L E 2 *Summary of 2 * 2 ANOVA (2 locale*2 gender) on Overall Mental Health.*

Source of Variance	Sum of Squares	df	Mean Square	F-Ratio
Locale	712.89	1	712.89	5.55**
Gender	77.44	1	77.44	0.66
Locale*Gender	265.69	1	265.69	2.07
Error	50869.02	396	128.46	——

Note : **=Significant at.05 level and **=Significant at .o1 level.*

The table 1 illustrates no effect on gender in mental health status of adolescent student statistically as the ANOVA showed non significance. It is noted that students of rural males (164.41) had slightly higher mental health scores in compression with rural females (161.90). Mental health scores of urban male & females were very similar among students.

In the table 2, it shows no difference among the gender on mental health score of adolescent students. The result showed significant difference among the habitat on mental health scores of adolescent students. The interaction effect was found non significance indicating the trend of modernization and globalization.

In the preview of modernization the true nature of Indian society is being thwarted. The joint family system is becoming un congenial by and large day by day. In the lack of definite aim of life people are moving to and fro. They are very much cautious about their own role but they are not ready to accept the role of others. In the changing society people are far away from their old traditions, customs and rituals. The adolescents and youth of modern age are living in the stage of uncertainty as they have not been given proper affection as well as guidance to cope with new situations. Man always desires and works hard to lead a happy life one's status of health is one of the most important determinant of his happy life. Psychologically, it happens to be the most important state of human existence that an individual or society longs for. Thus mental health is a core issue of human existence.

The twenty first century is an age of tremendous growth of knowledge in the fields of communication, pace,

technology, localization of marketing etc. At the same time the whole world struggles with the problems of terrorism poverty, health hazards like AIDS and HIV infections. There is a continuous struggle between the needs of the individual and his social environment. Every person has certain needs, for instance, need for affection and love, need for safety and security and so on. An individual becomes joyful when his needs are satisfied. He becomes sad and dejected when his needs remain unfulfilled. Thus it is difficult to find a person having all along a good consistent mental health. An individual tries to establish the balance between his needs and his capacity for realizing these needs. As long as this balance is satisfactorily maintained, the person remains adjusted and his mental health is retained. But when this balance is lost, he drifts towards maladjusted (Jyothi, Sreenivas & Raju, 2003).

Young people have a high rate of self-harm, and suicide is a leading cause of death in young people. An Indian study reported that suicide accounted for a quarter of deaths in boys and between half and three-quarters of deaths in girls aged 10-19 years (Aaron et.al., 2004). Poor mental health is strongly related to other health and development concerns in young people notably lower educational achievements, substance abuse, violence, and poor reproductive and sexual health (Patel et.al., 2007).

Mental functioning is inversely related to perception of specific type of community problem such as poverty, racism, unemployment and domestic violence (Hendryx Michael et.al., 1997). Another study revels that unemployment leads to poor mental health among the adolescents (Schaufeli Wilmer, 1997). Women are mentally healthier than men. Women have good mental balance and fewer mental problems than men (Holmstrom, 1989, Reijo, 1976).

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NUTRITIVE FUNCTION'S OF THE POPULAR AND PREVALENT FOOD STUFFS IN INDIA.

APARNA KUMARI*

The physiological evidence that these classes of aliments serve different purposes in nutrition is not as complete as that of their chemical difference.

A broad distinction must, of course, be drawn between the nitrogenous and non-nitrogenous substances. Modern researches, which have much modified our opinion of the direction in which the potential energy of the dietetic principles may be manifested (as heat or electricity or mechanical movement) and of the made in which the nitrogenous substances and in particular did or restrain the transformation do not impeach the proposition that the presence of nitrogen in an organized structure, and its participation in the action going on there, is a necessary condition for the Manifestation of any energy or any chemical change. Whether, when energy is manifested the nitrogenous framework of any nitrogenous structure is a mere stage on which other actors play, or whether it is used up and destroyed, or is on the other hand built up or renovated during action is, so far as classification of food is concerned, a matter of no consequence.

In the digestive tract, both animal and vegetable paroteids are transformed by the gastric Juice into syntonin albumoses and peptones, by the pancreatic Juice into peptones and an intermediate body, while part of the peptone is further split up into leucin and tyrosin. Gelotine is also transformed into albumoses by the stomach and small intestine,but keratin is not digested by the stomach, only by the pancreatic Juice. Brucke thinks that some of the native proteids, taken as food, may be absorbed as such but the more general opinion is that proteids are absorbed mainly if not only is the form of albumoses and peptones. Albumoses and peptones thus form an important element in artificial foods for invalids, but it is more than doubtful whether they possess the same nutritive value as the ordinary proteids of food. The great danger in regard to them is that when a large quantity is given, much of the peptone is split up by the pancreatic Juice into leucin and tyrosin, and may thus be lost as food to the organism.

The following consideration seems to prove the necessary participation of the nitrogenous structures in manifestation of energy. Every structure in the body in which any form of energy is manifested (Heat, Mechanical, Motion, Chemical or electrical action etc.) is nitrogenous. The nerves, the mussels and gland cells, the floating cells in the various liquids, the semen and the ovarian cells, are all nitrogenous. Even the non cellular liquids passing out into alimentary canal at various points, which have so great an action in preparing the food in

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different ways are not only nitrogenous, but the constancy of this implies the necessary of the nitrogen, in order that these action shall be performed, and the same constancy of the presence of nitrogen when function is performed, is apparently traceable through the whole world. Surely such constancy proves necessity. Then if the nitrogen be cut off from the body, the various functions languish. This does not occur at-once, for every body contains a store of nitrogen but it is length inevitable. Again if it is washed to increase the manifestation of the energies of the various organs more nitrogen must be supplied. The experiments of Pettin koter and Voit show that the nitrogenous substances composing textures of the body determine the absorption of oxygen. The condensation of the oxygen from the atmosphere, its conversion into its active condition and its application to oxidation are according to their experiments, entirely under the control of the nitrogenous tissues and are apparently proportional to their size and vigour and to changes occurring in them. The absorption of oxygen does not determiner the changes in the tissues, but the changes in the tissues determine the absorption of oxygen. In other words, without the participation of the nitrogenous bodies, no oxidation and no manifestation of energy are possible".

The experiments show that the absorption of oxygen by the lungs is dependent on its disposal in the body, and that this disposal in direct relation with the absolute and relative amount and action of the nitrogenous structure. Mechanical motion electricity or heat may be owing to the oxidation of fat or of starch, or of nitrogenous substance, but whatever be the final source, the direction is given by the nitrogenous structures.

The proteids are further a source of fats and possibly of carbohydrates, so that they really play two parts, first that of regulators of oxidation and of the transformation of energy and second they may form a non-nitrogenous substance which is oxidised and transformed. The fats are formed from protieds is shown by the following- Carnivora giving suck, when fed on plenty of flesh and little fat, yield milk rich in fat. Cow which produces one pound of butter daily does not take nearly this amount of fatty matter in her food. So that, the fat would appear to 60 formed in this case from vegetable proteids.

The use of fats in the organism is that they are source of energy and of heat to the body. In the majority of national dietaries, fat, finds a place, and in some cases as that of the Esquimaux it is greatly increased in the dietary. When hard work is to be done an excess of fat is in voluntarily taken. Whatever the mixture of fats taken is as food. The fat of the body always has the same composition, this fat agrees with the conclusion that the deposition and metabolism of fat in the body is due to cell activity, and that the fat comes in part from the proteid, and part from carbohydrate foods.

The consumption of carbohydrates spares not only proteid food, but also fat. They lessen the need of fat by being a source of energy in the body, and thus when present in a diet poor in fat; they diminish the oxidation of fat in the body. The experiments of E-smith, Haughton and others, on muscular action, prove that we must look for the main source of energy which is apparent during muscular action in the oxidation of the non-nitrogenous substances, but no experiments have yet shown, whether these are fats or Carbohydrates, it seems to be in fended that it is fat which is thus chiefly acted upon, but these opinion is rather derived from a reference to the Universal presence of fat when energy is manifested to the known necessity of it in diet earlike on fat free meat alone and from the law amount of energy its oxidation can produce than from actual observation. If it were true a broad distinction would be at once drawn in between fatty and starchy food, but it is not experimentally proved. There seems no reason why we should no extended the inference to man. In man it has been pointed out that as fermentative change occurs in the small intestines with the production of lactic acid, so the butyric acid fermentation may possibly take place is the sugar of the intestinal contents. By this change the sugar would be removed from the carbohydrate group in to the fatty acid group and as Foster says" put on its way to become fat.

An argument against the fats and Carbohydrates being mutually replaceable under ordinary conditions in the diet of man is drawn from a consideration of the diets used by all nations. The fats when taken into the body enter like the proteids are to the structure of the tissues of which fat forms in probably all cases an essential part. The salt and water are as essential as the nitrogenous substances. Lime chiefly in the form of phosphate is

absent from no tissue and there is reason to think no cell growth can go on without it, certainly in enlarging morbid growths, and in rapidly growing cells. It is a large amount.

When phosphate of calcium was executed from the diet, the bones of an adult goat were not found by H.Wesike to be poorer in lime, because probably line was drawn from other parts but the goat became weak and dull, so that nutrition was interfered with.

In addition to the substances composing these four classes, there are others which enter into many diets and which have been termed the various condiments which give taste to food or excite salivary or alimentary secretion, and tea, coffee, cocoa, alcohol etc, furnish the chief substance of this class. Much discussion has taken place as to the exact action in nutrition of these substances, but little is definitely known. It is generally admitted that the success oh Banting's treatment of obesity is owing to two actions. The increased oxidizing effect on fat consequent on the increase to all of meat, and the lessened interference with the oxidation of fat can so fluent in the deprivation of the starches. Health can not be maintained on protieds, salt and water alone, but on the other hand it can not be maintained the without them.

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DEMOGRAPHIC VARIATIONS IN HEALTH CONSCIOUSNESS AND PRACTICES

Dr. Umesh Kumar Jha*

Abstract

The study was conducted with a view to assess demographic variations in health consciousness and health practices. For this purpose 100 adults from middle socio-economic group and 100 adults of lower socio-economic group were selected and interviewed with the help of interview schedules. The results showed that respondents of lower socio-economics group had low health consciousness and poor quality of health practices. There is urgent need for implementing preventive and secondary community health intervention strategies, for individuals of middle and lower income groups.

Introduction

Demographic changes during the 21st century have direct implication for health care problems and costs. Only 4% of U.S. population lived to be more than 65 years of age compared with more than 17% today (Hobbs and Stoops, 2002). Although threats from infection diseases demand continued vigilance (Garrett, 2000), and research and advances in molecular biology provide powerful new weapons with which to combat the devastation of diseases (Kandel and Squire, 2000) entry into the 21st century has brought into view a new set of health problems.

Changes in society and health over the past century have drawn the social, behavioral, and behavioral sciences together to address how the brain integrates the regulatory forces of the body to cultivate health, while also promoting adaptation to the physical, while also promoting adaptation to the physical, psychological, and social challenges posed by extended life in contemporary society (Acioppo, Berntson, Sheridan, and McClintock, 2000). As Lewontin (2000) notes, as the people were better nourished and better clothed and had more rest time to recover from taxing labour, their bodies being in a less stressed physiological state, were better able to recover from the further severe stress of infection (p. 104). In this context Cacioppo and Berntson (2007) proposes balancing demands of the internal and external milieu, i.e., among the brain, homeostasis and health.

Health conscientiousness and health of control are the two core dimensions of health care system adopted by individuals internally, which are influenced by some demographic characteristics.

Present study was conducted to assess the role of health conscientiousness and health locus of control in decision making process of health care. Conscientiousness is a consistent tendency to be prudent, planful,

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persistent, and dependable. It seems relevant to pathways to health. Similarly health locus of control is the tendency to see the disease and illness as controllable and to use intervention strategies. Both traits seem to be associated with demographic characteristics of individuals. In this context it was hypothesized that individuals of upper socio-economic status would have better health conscientiousness and better locus of health control.

Method

(a) Sample : The sample comprised 200 households of middle and lower socio-economic strata of the society selected through stratified random sampling technique.

(b) Research Tool : Interview schedules were constructed by the investigates, and used to collect relevant data objectively, regarding.

Results

Socio-economic status and Health conscientiousness-

As regards association between socio economic status and health consciousness collected data were tabulated accordingly and chi-square as well as contingency coefficient of correlation were calculated obtained results are presented in Table 1.

T A B L E 1 *Association Between Socio-economic Class and Health Consciousness.*

Socio-economics status	Health consciousness		X^2	C	*Level of significance*
	High	Low			
Middle	71	29	*56.89*	*.47*	*<.01*
Low	*18*	*82*			

It is obvious from Table-1 that respondents of middle class were more health conscious than those of lower socio-economic class, as the obtained objective difference was significant beyond .01 level of confidence. From the interview protocol it was also apparent that members of lower social class do not pay serious attention over the sick person till the condition becomes serious. Even if the condition becomes serious the family members of the sick person firstly contact rural quakes who suggest medicine of lower cost, and when condition reached to the extreme only then the doctors are consulted. But the condition in middle class social group is somewhat better. Since they have better economic condition and better contact with mass-media they to their better health awareness compared to their lower socio-economic counterpart.

Demography and Health Practices

Regarding the health practices among middle and lower socio-economic group, and association between class and health practice was calculated. Obtained results are presented in following Table-2.

T A B L E 2 *Association Between Socio-economic Class and Health Consciousness.*

SES class	Health practice			X^2	C	*P-value*
	Private quack	Govt. Hospital	Private Clinic			
Middle	08	29	64	*47.05*	*.45*	*<.01*
Low	47	35	18			

It is obvious from Table-2 that there is inverse relationship between socio-economic chass and health practice. Large number of persons from low socio-economic status consult private quacks readily available in villages at lower cost, whereas majority of persons of middle socio-economic obtained statistical difference was significant beyond -.01 level of confidence. Reasons behind such finding may be that due to poverty and lower consciousness individuals of lower which ultimately prove to be costlier. In similar illness, viz, high fever,

individuals of middle income group visit private clinic and recover fastly than those of lower Govt. Hospital or private clinic in the beginning, but after the conditions become serious they do visit. Persons of low income group spend more time and financial loss due to illness than payment on medical consultation and medicines.

The situation in urban area is a little better but in rural areas poor people still are beyond the reach of health protection scheme. There is great need of community based health prevention programme involving primary, secondary and tertiary prevention strategies. Bihar has become one of the diseased states in the matter of HIV/AIDS patients. Even children below 10 years of age has been found carring HIV + Virus transmitted from their parents. Hence government as well as NGO's should performa Hurculion task of making poor people aware of illness and safe medical assistance.

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THE MOST VIBRANT AND NUTRITIOUS DIET- BREAD.

APRANA KUMARI*

There are practically two kinds of bread, namely that made by means of yeast, and accreted by chemical means or the non-fermented bread. The ordinary process of bread making consists really of these stages, namely, the preparation of the leaven or ferment the preparation of the sponge and the making of the dough.

One sack of flour, weighting 280 lb, is usually reckoned to yield from 376 to 384 lb of bread, or from 94 to 96 quartern leaves, and in making bread from this amount of flour the following procedure is usually adopted.

First the ferment or leaven is made with 8 to 12 lb of boiled potatoes mashed in to a thin paste. After cooling to about 80 F, or 27 c, quart of brewer's yeast and 2 lb of flour are added. In this mixture of potato starch, flour and yeast, the yeast decomposes the protieds of the flour and the starch, forming maltose, dextrin, and peptone like bodies. At the same time the yeast becomes very active the process is allowed to go on for five hours.

To the ferment when ready, one third of the sack of flour, 48 ounce of salt, and 30 quarts of water are added. If the flour is very good, salt is not necessary; and even with interior flours, if at all in excess, will check the fermentation. The resulting mixture constitutes the "sponge" in which very active fermentation goes on after about five hours, the sponge breaks, owing to the development of large quantities of carbonic acid and alcohol from the maltose and dextrin when the sponge has broken twice, the dough is formed by adding to the sponge the remainder of the sack of flour and some 30 quarts of water. This rises in an hour or so and is then transferred to an oven for an hour and a half. Though the temperature of the oven varies from 400 to 450 f, or from 204 to 232 c the actual temperature of the dough does not rise much over 212 f , or 100 c. In this stage the chemical process are not very active, but the bread gradually becomes well aerated and its constituents, undergoing a kind of automatic digestion improve both in flavour and aroma.

In the non-fermented breads, carbon-dioxide disengaged by mixing sodium or ammonium carbonate with the dough and adding hydrochloric tartaric, phosphoric or citric acids.Baking powders are compounds of these substances. In what is called Dauglish's patent aerated bread, the carbonic acid is called through the dough by pressure. About 20 cubic feet to CO2 derived from chalk and sulphuric acid are used for 280 lb of flour. It is claimed about II cubic feet are actually incorporated with flour. It is claimed for unfermented breads that they do not contain alcohol, acitic acid and other products or excessisve fermentation, but the advantage

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is a doutfull one, as the action of yeast partially digests the starch, changing it into maltose and dextrin, while the proteids of flour are also largely converted into albumoses or other peptone like bodies.

Chemical Composition

From what has been said about the making of bread composition of some ordinary breads are given in the following table:

Bread Quality	Water	Proteids	Fats	Starch	Cellulose	Salt	Ratio of Nitrogenous to non-nitrogenous food stuffs	
White Bread average quality	40.10	8.00	1.50	49.20	----	---	1.30	1 is to 6.3
White Bread fine quality	85.59	7.06	0.46	52.56	4.02	0.32	1.09	1 is to 7.5
White Bread coarse quality	40.45	6.15	0.44	49.04	2.08	0.62	1.22	1 is to 8.1
Whole meal bread	43.40	11.10	0.40	41.90	-----	1.70	1.50	1 is to 4.0

As an article of diet, bread has very similar advantages and disadvantages as flour. It is rich in protein and starch, but poor in fat and salts. Roughly sleeking its nitrogen is to the carbon as 1 to 21. To make it a perfect food, it therefore, requires more nitrogen. Its poverty in fat is curiously exemplified by the constant practice of using fat with it, butter for the rich and dripping for fat bacon for the poor. As to the relative advantages of the various methods of making bread. It must not be overlooked that yeast bread is nothing less than partially digested flour and as such holds a superior dietetic position to the non fermented forms of bread.

Special points about making of bread

It may be of bad colour from old flour, from grown flour and perhaps from bad yeast. The colour given by admixture of other grains, as already noticed under flour (rye, buckwheat, melamfoyrum sainfoin etc) bread may be acid from bad flour giving rise to an excess of lactic and perhaps acetic acids or it is from bad yeast. In finding the cause of acidity in bread look first to the flour which may be old and a little discoloured and acid if nothing can be made out. Examine the yeast and change the source of supply, then look to the vessel in which the dough is needed and to the water. Enforce great cleanliness on the part of the men who make up the dough.

Bread is frequently heavy and sodden from bad yeast fermenting too rapidly or when the fermentation has not taken place(cold weather, bad water or some other cause will sometimes hinder it)or when the wheat is grown, when too little or too much heat has been employed. It is said also that if the flour has been dried at too great a heat (above 200^0 F) the gluten is altered and the bread does not rise well. It is bitter from bitter yeast.

Bread becomes mouldy rapidly when it contains an excess of water. Rice is used as an addition because it is cheaper. It retains water and therefore, the bread is heavier. Rice bread (If 25 percent of rice be added) is heavier of closer texture, and generally used only in small quantity with the yeast. Alum is added to stop and excess of fermentation, when the altering glutin or cerealin acts too much on the Starch, and it also whitens the bread, it does not increase the amount of the water, it enables bread to be made from flour which otherwise could not be used.Sulphates of copper and of zinc, in very small amount, are sometimes employed for the some purpose.

Leaves are generally weighed when hot, and that is considered to be their weight. After being taken from the oven bread beings to lose weight. The loss of weight depend upon size, amount of crust, temperature and movement of air. In a sheltered place ordinary temperature , a 2-lb leaf , baked with curst all oveleses about 3/4percent in cooling and from 1 to 1-1/4 in five hours. A similar leaf with only top and bottom crust, loses 3

percent in cooling and about 4 Percent, in four and five hours . When become state they can be dipped in water and reabaked, they will then taste, quite fresh for twenty four hours after that day rapidly change.

Disease from from flour and Bread

Frequently the flour is originally bad, It may be ergoted, or grown and fermenting or effected with fungi. Fermenting flour produces dyspepsia and diarrhea, the heat and moisture of the stomach doubtless excite at once very rapid fermentation, the proteids already metamorphosing act energetically on the starch , and carbon-dioxide is rapidly developed , hence uncomfortable feelings flatulence, imperfect digestion and diarrhea. It is to remedy this condition of flour that alum is added and some of the effects ascribed to alum may be really owing to the flour. Lead poisoning is extremely rare as a consequence of the eating of bread. Alfored records a case in which is occurred, owing to hoks in some mill stones having been repaired with the molten metal and where old wood which had been painted was used for heating the backing oven.

The symptoms produced by bread compaining Lolium temuleutum have already been described, while as to effect of flour from grains other than wheat, it is not non whether the addition of potatoes , rice , barley, peas , etc. in any way insures health except as it may effect nutrition or digestion. Occasionally in times of famine , other substances are mixed –chestnuts acorns etc. in 1835 during famine fatal dysentery appeared in Konigsberg owing to the people mixing the flour with the pollen of the male catkin of the hazel bush . In India the use vetch, lathyrius sativous with barley or wheat gives rises to a paralysis to the legs when it exceed one twelfth part of the flour, L. cicera has the same effect

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