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The peer reviewed journal "Conscientia" is published annually to promote research in multidisciplinary fields and aims to facilitate discussions on important issues across varied disciplines, enfolding Science, Social Science and Humanities. It publishes original research papers, review works, short communication on subjects of academic as well as of popular interest. The journal also welcomes submissions on innovations in the teaching-learning process and/or learning experiences which focus on general dissemination of knowledge.

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FOREWARD

Dr. Sobhan Niyogi
Associate Professor and Officer in Charge
Krishnagar Government College

*It gives me immense pleasure to announce that volume V of **Conscientia**, the academic journal of Krishnagar Government College is being published. Over the last 170 years this college in an uninterrupted way carries the Legacy of quality of education since the British rules to the present scenario of the development of India. Today about 3,500 students use and share the same abode of learning with the greats like D.L.Roy, Umesh Dutta,JadunathMukherjee,Jadunath Bhattacharjee, Lalit Kumar Banerjee, Satish Chandra Dey as illustrious students. Teachers using the podium which once used by teachers like PanditMadan Mohan Tarkalankar, Babu RamtanuLahiri, Suresh Chandra Sengupta and many other names remembered with reverence.I am personally honoured to carry the Legacy of developing this more than 170 years old Institution following the footsteps of more than 70 eminent Principals like Roy Bahadur Jyoti BhusanBhaduri, Satish Chandra Dey, J.M. Sen. In less than last ten years this College has secured "A" grade twice in NAAC evaluation and very recently the University of Kalyani have declared this College as the "Best Performing College" of Nadia District. The College teachers are contributing significantly in academic research through various publications at various levels.*

***Conscientia,** the interdisciplinary journal of research findings launched by our College in 2011 continues to publish good quality articles since its inception. This Journal is an interdisciplinary and multilingual publication and articles include scientific research findings, socially relevant issues as well as literary contributions of humanities Departments. This volume is expected to evoke interest among various groups of readers for their academic enrichment and future thought provoking ideas.*

I wish to thank all the contributors from various Higher Educational Institutions for their submissions, the Editorial Board Members from our College, the Advisory Board Members from various well known Universities and Institutes of West Bengal and India for their active role for the publication of this particular volume.

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Geometry and Entanglement

*Ujjwal Das**

Abstract

Quantum Field Theory has been dramatically successful in describing all fundamental interaction of nature but when QFT applied to quantize gravity, it leads to different kind of divergence which seems almost impossible to tackle and left an impression that these two theories have deep contradiction at their very roots. However last 25 years of research in string theory e.g. Gauge-Gravity duality, Holographic principle, Ads/CFT correspondence hints at quite unexpected fact that Gravity and Quantum mechanics are inseparably and deeply connected. This **review** article is an attempt to describe how the above mentioned deeper connection of gravity and quantum mechanics is revealed in a very brief way.

Keywords

Wormhole, Quantum Entanglement, Anti-deSitter Space-time (AdS), Conformal Field Theory (CFT), String Theory

Introduction

Two papers on two totally different ideas, both were written in 1935 by Einstein and others. One paper was on "*Einstein-Rosen - Podolsky Paradox*"(Einstein A, Podolsky B and Rosen N 1935) on the peculiar behavior of quantum system called *Entanglement* and other was "*Einstein-Rosen Bridge*"(Einstein A and Rosen N 1935) on the Schwarchild solution of Einstein equation in vacuum revealing a spatial connection between two eternal black holes ,called "*Wormhole*". But after some fascinating discoveries in string theory (Gauge-Gravity duality, Ads/CFT correspondence by Juan Maldacena) since last 25 years it now seems that these two ideas of the above mentioned papers are in a sense deeply connected and can be fit together as pieces with the new ideas of string theory to solve the puzzle in searching the quantum theory of Gravity and

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leads to tempting conclusion that weird quantum entanglement can lead to creation the beautiful geometric structure of space-time.

EPR: **Einstein-Rosen - Podolsky Paradox**

Consider the following wave function describing a system consisting of two spin half particles. $|\psi> = |u_A d_B> - |d_A u_B>$. This carries all the information necessary to have complete knowledge about the system. However, it is impossible to get any knowledge about the parts of the system i.e. state of individual particles A or B. This goes against the classical intuition because complete information about the total system implies the full details knowledge of the part of the system. But the most strange thing about this very specially prepared state (*Entangled State*) of the system described by the above wave function is that if these two particles are separated and moved away to far distance even a light year, then if one of the particle measured to be spin up state then other particle surely measured to be in spin down state and vice versa. This curious behaviour seems to indicate a faster than light communication. However, it can be shown that no message sending is possible because the result of measurement can't be decoded as a message conveyed by the sender in any way. But this phenomenon breakdown the concept of locality in physics and this non-local behaviour is paradoxical with the behaviour (famous as *Einstein-Rosen - Podolsky Paradox*) of the quantum system which troubled Einstein very much.

ER: **Einstein-Rosen Bridge**

Einstein and Rosen in their paper on general relativity when exploring the maximally extended of Schwarzschild solution in vacuum found that there is a connection through space at a given moment of time which indicates the existence of a bridge (called *Einstein-Rosen Bridge or Wormhole*) between two black holes as can be seen from its Penrose Diagram shown in the figure. But for a real black hole formed by the collapsing matter there is no such wormhole. However, these wormholes are not traversable as in science fiction because the positive energy condition must be satisfied by all known laws of physics.

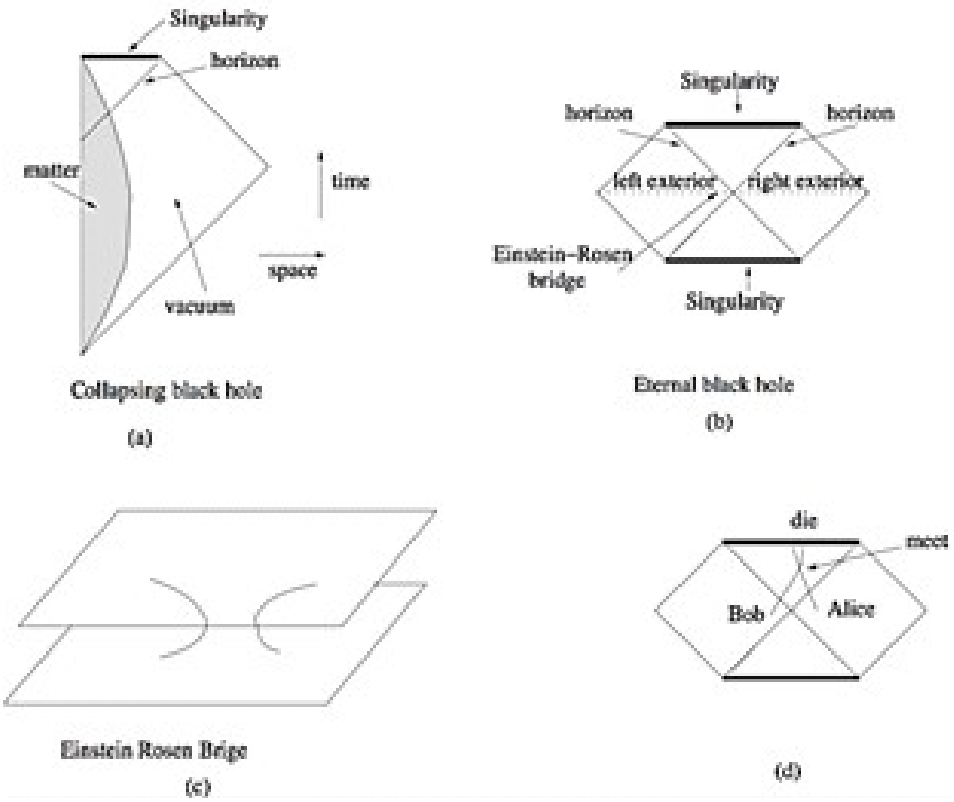

Fig (a) shows Penrose diagram of a real black formed by collapsing star. Fig (b) indicates Penrose diagram of eternal black hole showing existence of Einstein Rosen Bridge. Fig(c) Einstein Rosen Bridge. Fig (d) Alice and Bob by jumping into the horizon of their respective black holes can meet and faces singularity.

AdS/CFT-Duality

Maldacena's arguments in discovering the duality can be expressed in a very crude way. During investigation of the behavior of D_3 brane system it is found that the low-energy limit of that D3 brane system can be described by a (10-dimensional) string theory with just closed strings (close strings represent Graviton) in $AdS_5 \times S_5$ (compact spherical manifold) when coupling is strong and by a (4-dimensional) super Yang-Mills SU (N) gauge theory for weak coupling. But since the gauge theory is well defined at any coupling, this description in fact applies even when coupling is large, i.e. in the same regime as where the closed string description holds. This observation led Maldacena (1999) to conjecture that

String theory (Quantum Theory of Gravity) on $AdS_5 \times S_5$ dual to SU (N), N=4, gauge theory in 4D. The two sides are simply different languages which describe the same physics. The statement is known as the AdS/CFT correspondence.

ER=EPR

This relation can be best understood by following the examples and arguments of Prof. Leonard Susskind. Consider that Alice who is trying to do some experiments have a silicon shell which is hollow inside. Behavior of this shell can be described and well-engineered by degrees of freedom of a CFT (Conformal Field Theory) similar to the CFT gauge Field theory mention in *AdS/CFT* duality and so must be dual to a theory describing a bulk. Now if Alice try to investigate the behavior of the shell in different possible ways then she will always find with surprise that results of every experiments on the shell always can be explained by either considering only the degrees of freedom of CFT living on the boundary i.e. on the shell only OR by the physics inside the hypothetical bulk as if there is a some magical conspiracy and Alice will be forced to believe in the existence of a bulk inside hollow shell according to the conjecture of *AdS/CFT*. For example if she starts to heat the shell by Laser light then its dual description will give birth to a black hole in the bulk and this black hole can ring with quasi normal modes. Alice can even detect the ringing of black hole.
Now Prof. Leonard Susskind and Juan Maldacena (2013) goes even further which almost looks like science fiction. Here Alice and Bob construct a bunch of Bell pairs in the laboratory and move them apart and by the method of parametric down conversion form two entangled black holes can be formed. According to his conjecture there develops an *Einstein-Rosen Bridge or Wormhole* (but can't be traced in the laboratory in any way) between these two *Entangled Black holes* which are far apart and can be described by Penrose diagram of eternal black holes as in Fig. However, Wormhole is also non-traversable as before. But most interesting thing is that if Alice staying outside the horizon of her black hole wants to send something to Bob who is also outside the horizon of his black hole. She sends or through the object inside horizon and then make some measurement on the black hole and send this result to Bob which in itself has no meaning but guide Bob what to do and the object will pop out on the side of the Bob by a protocol or procedure called *Quantum Teleportation.* And by this way, it may even be possible to get some imprint of the events inside the Wormhole on the object when passing through it and can be used a way to explore the Wormhole itself.

Conclusion

So these recent research and discoveries of string theory and quantum teleportation providing fuel to the search for a theory of quantum gravity in radically different way and motivating the experimentalist to test this new fascinating idea of quantum gravity even in the laboratory in the near future.

References

Einstein A., Podolsky B. and Rosen N. (1935): "Can quantum mechanical description of physical reality be considered complete?", *Phys Rev,* 47: 777-780.

Einstein A. and Rosen N. (1935): "The Particle Problem in the General Theory of Relativity", *Phys Rev,* 48: 73-77.

Maldacena J.M. (1999): "The Large N limit of superconformal field theories and supergravity", *Int J Theor Phys,* 38:1113–1133.

Maldacena J. and Susskind L. (2013): "Cool horizons for entangled black holes", *Progress of Physics,* 61: 81-811.

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A Brief Review on Polyimide Blend

*Dr. Sobhan Niyogi**

Abstract

Polyimide (PI) one of the finest film forming high performance polymer was introduced to the world only in 1950s. Only certain few aromatic dianhydrides and diamines can form fully aromatic polyimide with very outstanding properties in terms of their thermal and chemical resistance, mechanical properties, dielectric properties and low coefficient of thermal expansion. Therefore researchers both in academic and in industrial research are continuing to carryout research so that more and more polyimide with desired properties can be introduced. One of the easiest methods is blending of two different polymers to have a new polymeric material with new set of properties. The miscibility of the polyimide enables one to tailor the composition of the material to optimize the gas separation and mechanical properties also.

Key words

Polyimide, Blend, Miscibility, Film, Permeability, Poly (amic acid).

Introduction

Many methods are and may be used for the development of a new material for commercial applications. Out of these methods synthesis of new polymers, copolymers and blending are the most accepted. In principle the most economical method is the blending of miscible materials, resulting in a product with properties different from the two individual components – sometimes in between those of the two base polymers or sometimes some superior properties to those of the base components are also there. Blending of an amorphous polymer with a crystalline polymer is a convenient way of improving the impact strength, toughness and ductility properties of polymers.

Polymer blends are physical mixtures of polymers. But the properties of polymer blends are controlled by the miscibility and phase behavior of the mixture1. Polymer blends may be either homogeneous or heterogeneous. In homogeneous blends both blend components lose part of their identity and the final properties usually are

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the arithmetical average of both blend components. In heterogeneous blends the properties of all blend components are present. In a few exceptional cases, some properties of the either homogeneous or heterogeneous blend can be better than those of the individual components 2.

The glass transition temperature (T_g) [3-5] and the surface morphology[2] are the two most widely used techniques for the determination of nature of blend i.e. homogeneous or heterogeneous and recently the use of solid state ^{13}C NMR with Cross Polarization/Magic Angle Spinning Nuclear Magnetic Resonance (CP/MAS NMR) Spectroscopy has started [6-8] to determine the nature of blend. In case of homogeneous blend, single T_g, intermediate between the two individual components' T_g is obtained from DSC (differential scanning calorimetry) study but if the blend is heterogeneous in nature, two separate T_gs corresponding to the individual T_g's are obtained. In the case of heterogeneous blend two types of morphologies are observed: (i) a dispersion of one polymer in the matrix of the other polymer and (ii) a co-continuous two phase morphology. Which type of morphology is obtained depends on the nature of blend components, viscosity etc.

This nature of homogeneous and heterogeneous phase behaviors may easily be explained by considering the thermodynamics of the system. A blend could be homogeneous if the free energy of mixing is negative i.e., $\Delta G_{mix} = \Delta H_{mix} - T.\ \Delta S_{mix}$.

However, if two high molecular weight polymers are blended, the gain in entropy, ΔS_{mix} is negligible and the free energy of mixing can only be negative if the heat of mixing, ΔH_{mix} is negative. In other words, the mixing must be exothermic which is only possible in case of specific interactions between the blend components. These interactions may range from strongly ionic to weak and non-bonding interactions, e.g., hydrogen bonding, ion-dipole, dipole-dipole and donor-acceptor interactions. But these interactions are rarely observed.

Depending on the miscibility only, blends may be categorized into three classes:

i) In completely miscible blends when $\Delta H_{mix} < 0$ due to specific interactions, homogeneity is observed at least on a nanometer scale, if not as the molecular level and this type of blend shows one T_g only.

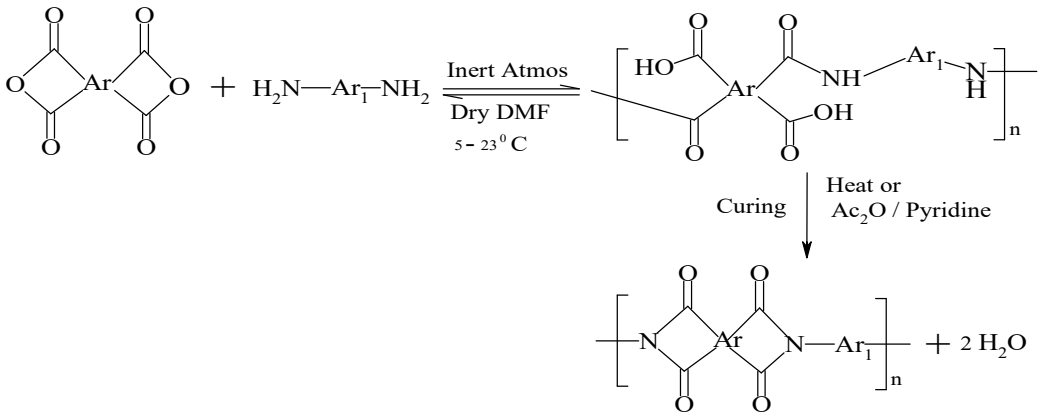
ii) In partially miscible blends a small part of one blend component is dissolved in the other. This type of blend which exhibits a fine phase morphology and satisfactory properties, is referred to as compatible. Both blend phases are homogeneous and have their own T_g.

iii) Fully immiscible blend shows two T_gs (one for each component) and has a coarse phase morphology with sharp interface.

Till date many blends have been prepared where "true" polyimides have been used. **Table 1. 4** shows various types of blends containing "true" polyimides so far prepared. Also Scheme-1 shows a general scheme for polyimide preparation.

Table 1. 4 Various types of blends of "true polyimides"

Polyimide / Co-polyimide	Other Polymer	Reference
Polyimide	Polyimide	1, 9-41, 115
	Polytetraflouroethylene	42-45
	Polyaniline	46-50
	Polypyrrole	51-53
	Aramid	54, 55
	Polyetherimide	54, 56-66
	Polybenzimidazole	67-88
	Polyester	89-103
	Polyetheretherketone	104-108
	Polyethersulfone	109-114
	polysulfone	63-65, 115-121
	Polyurethane	122
	Polyvinylidene fluoride	123
	Co polyimide	124
	Polybenzothiazole	125
	Polynapthimidazole	126
	Polyacrylates	127
	Poly(p-phenylene benzobisthiazole)	128
	Polyphenylene sulfide	63-65, 129-131
Co polyimide	Co polyamideimide	132



Scheme-1: Preparation of poly(amic acid) and polyimide formation, where Ar and Ar_1 are respectively aromatic ring structures of dianhydride and diamines part.

Blend Formation:

From Table 1.4 it is observed that blends of "true" polyimides are "only few" and others are blends of polyimides with different high performance polymers. It is astonishing that polyimide blends of true type are very less. But from known dianhydrides and diamines which are known to chemists one can speculate that there is enough scope of preparing numerous polyimides and co-polyimides. So this tells about the possibility of more number of blends arising out of such newer polyimides. But this is not observed in practice. Reasons for such limitation may be due to the fact that the rigidity, bond angle, interaction parameters, space and length of the dianhydride significantly controls the molecular packing and miscibility tendency of two different polyimides to form a successful blend [21]. Apart from this, thermodynamic constraints arising mainly from very low combinatorial entropy of mixing[133-135] in high molecular weight (so also high viscosity) precursor poly(amic acid) controls the formation of a miscible polyimide blend. Another reason which is apparent from the work of Feger [136], Huang [137] and Ree *et.al..* [138] that when two poly (amic acids) are mixed an exchange reaction either in solution or in solid phase[139] takes place and as a result a blend of simply two polyimides are not obtained rather polyimide blends/polyimide block copolymers/blends or polyimide copolymer is obtained. This exchange reaction is perhaps inevitable because it is well known that the poly (amic acid) remains in equilibrium with its constituent dianhydride and diamine [86,140-144]. So when two such different poly (amic acids) are mixed in a mutually common solvent, that may lead to the formation of random co-polyimide or block polyimides via transamidation reactions rather than blends mixed at the molecular level depending on the time and temperature[144] of mixing. Though no one has discussed the reason of transamidation in the line of ionization potential (I. P.) and electron affinity (Ea) of diamine and dianhydride respectively, I think it is the predominant cause because reactivity of a diamine as nucleophile towards two different dianhydrides is solely determined by this E_a and I. P. values.

So all the reasons discussed above prohibit the formation of a very large number of polyimide-polyimide blends. Makhija *et.al..*[1] prepared polyimide–polyimide blend from commercial LARC–PAA and thermoplastic P84. Upto certain composition ranges a miscible blend with single T_g was obtained only by thermal cyclodehydration whereas chemical cyclodehydration lead to phase separation for the same composition.

PI-PI Blend Formation:

Kim *et.al..*[7] prepared polyimide –polyimide blend from BPDA–PDA (Biphenyltetracarboxylic Dianhydride – para phenylene diamines) and BPDA–ODA(oxydianiline) through the poly (amic diethyl ester) route. The blend films were transparent and showed single T_g behavior.

Y. Kim[9] et.al.. prepared a PI-PI composite films, which showed a single T_g behavior. However, for the composite of 30 wt % BPDA-PDA dispersed in the matrix of 70 wt % BPDA-ODA, a smectic crystalline like aggregation of the BPDA-PDA component was detected on wide angle x ray diffraction patterns, indicative of microscopic phase separation between the two components.

J-H. Jou et. al.[11] showed that adhesion property of PMDA (Pyromellitic Dianhydride) -ODA polyimide on silicon surface increases to a very good extent when 20 to 40 % BPDA - PDA polyimide is blended.

M. R. Coleman et[12] al studied the misicibility of fluorinated polyimide in a systematic manner and observed that single Tg ids obtained in case of a miscible blend formation and two Tg s when blends became immiscible.

Tang *et.al..*[32] have shown that BPDA–ODA and 4, 4' thiodiphthalic anhydride –ODA polyimides form miscible blends over the entire composition range but phase separation takes place when annealed around T_g. In another study by Hasegawa *et.al..*[39] the thermal expansion coefficient is lower in case of s-BPDA–PDA (80%) and a-BPDA derived polyimides (20%) blend and also this blend shows certain extent of thermoplasticity above the T_g.

Han *et.al..*[12] observed a lower T_g (compared to each component) in case of PMDA–ODA and BPDA–PDA polyimide blend films. They also observed that when two such films were laminated a strong adhesion was there. Hasegawa *et.al..*[13] studied the molecular orientation in a miscible blend of BPDA–PDA and BPDA–ODA polyimides and observed that spontaneous orientation of BPDA-PDA decreases with increase in BPDA–ODA content in the blend.

Jou *et.al..*[11] observed that when 20 or 40% of BPDA-PDA polyimide is blended with PMDA-ODA polyimide the resulting blend shows much higher peel strength on silicon substrate.

Matsuura *et.al..*[16] have prepared polyimide blends from two fluorinated poly (amic acids) 6FDA–TFDB {2,2-bis(3,4-anhydrodicarboxyphenyl)-hexafluoropropane (6FDA) -2,2′-bis(trifluoromethyl)-4,4′-diaminobiphenyl} and PMDA–TFDB. After curing the resulting blend films show increase in coefficient of thermal expansion and decrease in in-plane refractive index with increase in the amount of 6FDA–TFDB in the blend.

H.C. Liou[18] et.al. have shown that in various blends of PMDA or BPDA based with crosslinking oligomer addition changes the anisotropic properties of the blends due to semi IPN formation.

T.S. Chung et.al.[23] have successfully prepared few fully and partially PI blends using fluorinated diamines and PMDA/ BPDA dianhydrides.

T. Takeichi[25] et.al. have prepared PMDA/BPDA and PDA/ODA based PI blend in their precursor form but adding oligomides and acetylenic cross linking features in dianhydrides and ultimately resulted in the films better mechanical behavior.

H Tang[32] et.al. have prepared PI/PI blends where the components are miscible at the molecular level but T_g value does not corresponds and lower than as predicted by Fox equation and also phase separation occurs when the blends are annealed about T_g value.

J. T. Macheras[37] in his US patent have claimed that particular PI/PI blend formation by solution casting process and film thus produced shows superior fluid separation properties.

Jou *et.al.*.[41] have prepared PMDA–PDA polyimide and BPDA–PDA polyimide blends and have studied the water uptake and water diffusion characteristics on those films.

W Jang et.al[115]. have prepared a blend where acid base where one component PI is basic and another is acidic in nature and according to them these two PIs when forms a blend shows superior properties when Pi having basic nature is higher in percentage.

Y. He et.al..[116] have been able to prepare electrospun blend-polyimide nanofibers with high tensile strength and toughness using suitable choice of rigid and flexible poly (amic acids) followed by thermal imidization.

PI-non PI Blend Formation:

Though the number of polyimide-polyimide blend is reported in a number of cases but the existence of a blend of polyimide with a non polyimide is still lower. Although in some cases a few have been prepared successfully for example, among these blends prepared between polyimide and polytetrafluoroethylene by Davis *et. al.*[42], the percentage of polyimide in the blend is between 0.2-5% only. Though they are calling it a blend but they have used it to impart some special property in polytetrafluoroethylene by using polyimide as a dopant.

Konda *et.al.*.[36] have shown that polyimide liquid crystal (PI–LC) and thermoplastic polyimide (N–TPI) blend is miscible when the system is rich in PI–LC.

Similarly very few blend systems have been successfully prepared by incorporation of conducting polymer like polyaniline (PAN1)[46-50] and polypyrrole (PPy)[51-53] into polyimide. Though conductivity of the blend/composite polyaniline or polypyrrole films have improved markedly mainly due to the molecular orientation property of polyimide which induces chain orientation in the blend system, but the properties like thermal, mechanical and chemical resistivity have not been discussed. Han and Im[48-49] have prepared polyaniline-camphorsulfonic acid complex blend films with poly (amic acid) but they could not cure the films upto 300^0 C to get complete polyimide as high temperature has detrimental effect on conductivity of the blend films. They could cure only upto 150^0 C and could not achieve total imidization (achived 76.4 % imidization). But in all the cases of this type of blends the other important properties like mechanical, chemical and thermal stability are either not reported or are very low compared to the control polyimides. Solution casting process was used for blend film preparation using a common solvent like NMP (n methyl pyrrolidine) and also CSA (camphor sulphonic acid) was used to protonate the PANI. The forces like hydrogen bonding between the CSA protonated PANI Hydrogen and carbonyl carbon of imide portion and also any polar polar interaction makes the blend formation feasible. Again Tim M. Su et.al [50] have shown that 1:1 polyimide (BTDA/ODA) polyaniline free standing films shows better gas permeability properties than polyimide virgin films but lower than polyaniline. But for pervaporation study 3:1 PI/PANI blend shows superior behavior.

Aromatic polyamide (aramid) and polyamideimide have got some similarity with polyimides. Still the number of blends containing "true" polyimide or co-polyimide and the above mentioned polymers are a few.

So it is apparent that the same reasons as discussed for PI/PI blend are also valid here. The blend prepared by Onder *et.al..*[132] shows improved elongation and tear strength. Ekiner *et.al..*[114] have prepared a gas separating membrane of superior quality from PI and a polyamide. Nakata *et.al..*[55] have prepared a blend based on 4,4'ODA/BTDA (Benzophenone Tetracarboxylic Dianhydride) polyimide with 3,4'ODA/IPA (iso-phthalic acid) polyamide.

The blend between polyimide and polyetherimide prepared[56-66] mainly contain Ultem range of polyetherimide of GE Plastics as one of the components. Depending on the solubility of polyimide, extruded or solution cast blend films were produced. The blend composition varied depending on the nature of polymers used.

Macheras[56] *et.al..* in their U. S. patent have mentioned the formation of fluid and gas separating anisotropic membrane from polyetherimide and phenylindane containing polyimide. But the weight ratio of polyimide is less than 0.2 in the blend.

Konda *et.al.*[57] in 1998 have shown that fibre with higher tensile strength is obtained when a blend polyetherimide is prepared with low amount of polyimide liquid crystal. But when the amount of the polyimide is increased immiscibility develops.

Fukai *et.al..*[58] observed that due to blending the modulus and tensile strength becomes higher compared to those of pure (virgin) polyimide.

Campbell *et.al..*[59] observed that the density of the blend becomes higher due to the filling of free volume in virgin polyimide with simultaneous increase in thermal resistance.

Ma *et.al.* [60] have studied the phase behavior of a blend prepared from new thermoplastic polyimide with polyetherimide by DSC and small angle X-ray scattering. They have concluded that amorphous content of the blend increases with increase in the amount of polyetherimide in the composition. But other properties of the blend are not discussed.

Blizard *et.al..*[61] observed that crystallization of pure PI is reduced in presence of PEI (polyetherimides). Goodwin[62] have shown that when polyetherimide (Ultem 1000, of GE Plastics) is blended with thermoplastic polyimide (Aurum 450) at 400^0 C produces a miscible blend. Miscibility was studied by DMTA (Dynamic Mechanical Thermal Analysis) and DSC

Polybenzimidazole blend with polyimide was first reported by Leung *et.al..*[67] in 1986. The blend of this class prepared [21-38] mainly deals with the formation of a new polyimide/copolyimide blend with a polybenzimidazole either end capped or not and their characterization and miscibility in details. Many authors have studied the miscibility of these two high performance polymers by spectroscopic study[67-68, 80] and have concluded that hydrogen bonding is the predominant cause of miscibility. This finding that polybenzimidazole and polyimide form miscible blend[69-71,85] has opened a new approach to the formation of matrix materials.

Jaffe *et.al..*[87] also observed that when polybenzimidazole is blended with a fluorinated copolyimide (1:1) phase separation takes place. Therefore, it may be concluded that fluorinated polyimides inhibit the formation of hydrogen bonding which is the main cause of miscibility and as a result phase separation results.

Janarthanan *et.al..*[88] observed that when fluorinated polyimide is used for blending with polybenzimidazole a phase separated blend results when more than 20% of PI is used. But with the same polybenzimidazole when a benzophenone based polyimide is used no phase separation takes place. But how this blending behavior affects the tensile strength and modulus of the blend is not discussed.

The blends of polyimide with polymer liquid crystals (PLC) prepared[89-103] are normally blend of polyimides with aromatic polyesters.

Haghighat *et.al..* [89] in 1989 have shown for the first time that LARC-TPI (Langely Research Centre - thermoplastic polyimide) and Xydar liquid crystal polymer may be blended directly in extruder for the preparation of biaxial film having 30 weight percent of the polyester in the blend. Due to the incorporation of Xydar polyester processability greatly enhanced and coefficient of thermal expansion reduced. But they observed a reduction in the tensile property of the films probably due to the inefficient mixing of the two polymers.

Blizard *et.al..*[90] also observed an improvement in mechanical property for a 90:10 New TPI/Xydar blend film and have concluded that the LCP acts as a fibrillar reinforcement in the film matrix. They have also observed an increase in dielectric constant value for the blend as mentioned earlier, compared to pure TPI over a temperature range from room temperature to 300°C.

In their U. S. patent [91] Kaku *et.al..* have shown that a blend of polymer liquid crystal with polyimide has got good physical characteristics and injection molding capability. They have also observed that when 10% of polyester in LCP form is blended with polyimide (PMDA/ODA) increase in tensile property takes place, but when 30% of PLC is used tensile strength slightly decreases.

Brostow *et.al..*[92] have shown that when PLC (Zenite 7130) is blended with thermoplastic polyimide (Aurum PD 450) a decrease in crystallization temperature is observed. Also they observed the onset of degradation at lower temperatures when PLC concentration increases. But no other properties like tensile strength, electrical properties or chemical durability are discussed.

BASF in its patent[93] DE 4138764 A have described the preparation of a film and fiber forming blend from polyimide and aromatic polyester.

Elandjian[48, 98] have shown that when 30% of liquid crystalline polymer (LCP) is blended with thermoplastic polyimides (TPI) tensile modulus and tensile strength increase appreciably.

Polyetheretherketone (PEEK) is a high performance engineering thermoplastic and exhibits both good chemical and thermal properties. But till date only few blends of this high performance polymer with "true polyimides" are reported[104-108].

Sauer *et.al..*[106] have shown that a blend of New Thermoplastic Polyimide (N-TPI) with PEEK is incompatible in nature.

Kong *et.al..*[108] have prepared a completely miscible blend from PEEK and YS-30 polyimide.

Polyethersulfone is a high performance polymer so it was tried to prepare blends from polyimide and polyethersulfone so that the resulting blend would also behave as a high performance material. But only a few have successfully been prepared[60-65] .

Ekiner[109] have prepared a gas separating membrane by solution blending of polyimide, polyethersulfone and poly(amide imide) in any ratio but have mentioned that a 50:50 polyethersulfone and polyimide blend shows high selectivity towards gas separation.

Liang *et.al.*.[115] have shown that a fully miscible blend from polyimide {Matrimid 5218} and polyethersulfone (Victrex) is possible.

Cha and coworkers [61] have prepared blend of polyethersulfone and polyimide and have studied the phase separation behavior of the blend by various techniques. When a 50:50 weight percentage of polyimide and polyethersulfone are blended highest mechanical properties are obtained.

Blizard and coworkers [112] have studied the blend of Matrimid 5218 and Victrex 4100G polyethersulfone and have shown that a completely miscible blend with good thermomechanical property is obtained from the blend.

Mochizuki and coworkers[113] have prepared polyethersulfone and polyimide blend by incorporating only 2-10% of polyimide in the blend system.

Except the blends of polyimides so far discussed blends with other types of polymers like, polyurethane, polyvinylidenefluoride, copolyimide, polyphenylene sulfide polysulfonepolybenzothiazole, polynapthimidazole, polyacrylates and copolyamideimide have also been produced in few cases.

Conclusion:

It has been observed in this review article that the various blends which has been prepared by various scientific groups around the world are opening up new avenues for application of polyimides other than its conventional uses in electronics and in other areas. But it is also observed that though scientist have prepared so many new blends of various types all are not of commercial importance rather limited to academic research. The future directions which all these research shows is that blend formation being a comparatively easier process for development with new set of properties but it does not work very well with polyimide, rather new polyimide or co-polyimide with tailored structure may be tried to incorporate new set of properties in the new material and the possibility is endless.

Referrence:

1. S. M. Makhija, E. M. Pearce and T. W. Kwei, *J. Appl. Polym. Sci*., 917, **44** (1992).
2. C. Konig, M. V. Duin, C. Pagnoulle and R. Jerome, *Prog. Polym. Sci*., 707, **23(4)** (1998).
3. S. Zheng, J. Huang, Y. Li and Q. Guo, *J. Polym. Sci. Part- B. Polym. Phys*. 1383,**35 (**1997).
4. W. B. Wu, W.Y. Chiu and W.B. Liau, *J. Appl. Polym. Sci*., 411, **64** (1997).
5. S. K. Mukhopadhyay, D. Basu and A. Banerjee, *J. Appl. Polym. Sci.*, 2075, **65** (1997).
6. E. O. Stjskal, J. Schaefer, M. D. Sefcik and R. A. McKay, *Macromolecules,* 275, **14** (1981).

7. C. M. G. De Souza, M. I. B. Tavares, *J. Appl. Polym. Sci.,* 2990, **74** (1999).
8. A. Simmons and A. Natansohn, *Macromolecules*, 3651, **24** (1991).
9. Y. Kim, M. Ree, T. Chang, C. S. Ha, T. L. Nunes and J.S. Lin, *J. Polym. Sci. Part B. Polym. Phys*., 2075, **33** (1995).
10. Y. Yamamoto, S. Satoh and S. Etoh, "*National SAMPE Symposium and Exhibition*", 30th, Anaheim, CA, March 19-21, 1985, Proceedings (A86-13076 03-23). Covina, CA, Society for the Advancement of Material and Process Engineering, p- 903-911 (1985).
11. J-H. Jou, C-H. Liu, J-M. Liu and J-S. King, *J. Appl. Polym. Sci*., 1219, **47(7)** (1993).
12. M. R. Coleman, R. Kohn and W.I. Koros, *J. Appl. Polym. Sci*., 1059, **50** (1993).
13. M. Hasegawa, I. Mita, M. Kochi and R. Yokota, *Polymer*, 3225, **32(17)** (1991).
14. B. J. Han, J.M. Park and C.C. Gryte, *Polym. Engg. Sci*., 901, **33 (14)** (1993).
15. M. Hasegawa, K. Okuda, M. Horimoto, Y. Shindo, R. Yokota and M. Kochi, *Macromolecules*, 5745, **30** (1997).
16. T. Matsuura, N. Yamada, S. Nishi and Y. Hasuda, *Macromolecules*, 419, **26** (1993).
17. H. C. Liou, P. S. Ho and B. Tung, *J. Appl. Polym. Sci.,* 261,**70(2)** (1998).
18. H. C. Liou, P. S. Ho and B. Tung, *J. Appl. Polym. Sci*., 273, **70(2)** (1998).
19. T. S. Chung, R. E. Kafchinski, U. S. Pat. 5155179 (1992).
20. R. S. Kohn, M. R. Coleman, T. S. Chung, U. S. Pat. 5055116 (1991).
21. F. W. Burgoyne, Jr, M. Langsam and R. H. Bott, U. S. Pat. 5061298 (1991).
22. T. S. Chung and E. R. Kafchinski, *Polymer*, 1635, **37(9)** (1996).
23. L. R. Hyman, S. H. Clyde, U. S. Pat. 5516876 (1996).
24. R. H. Lubowitz and H. C. Sheppard U. S. Pat. 5344894 (1994).
25. T. Takeichi, K. Nakjma, M. Zuo and R. Yokota, *High Perform. Polym*., 111, **10(1)** (1998).
26. Y. Kim, M. Ree, T. Chang and C.S. Ha, *Polym. Bull*., 175, **34(2)** (1995).
27. R. Yokota, R. Horivchi, M. Kochi, T. Takahashi, H. Soma and I. Mita, SPE. Mid. Hudson, Ellenville, New York, 2nd-4th Nov. 1988, pp.6-9.
28. M. K. Gerber and R. H. Pater, SAMPE, Qtly., 53, **23(4)** (1992).
29. H. Feng, C. Ye, P. Zhang, Z. Sun and Z. Feng, *Makromol. Chem. and Phys*., 2587,**196(8)** (1995).
30. D. J. Progar, T.L. St. Clair and F.J. Boerio, 15th Annual Meeting of the Adhesion Soc. Conf. Proccedings, 16th-19th, p-103, Feb.1992.
31. T. Takeichi, N. Takahashi and R. Yokota, *J. Polym. Sci. Polym. Chem*., 167, **32(1)** (1994).
32. H. Tang, L. Dong, H. Feng, Z. Feng, *Eu.Polym. J*., 183, **33(2)** (1997).
33. H. Tang, L. Dong, J. Zhang, M. Ding and Z. Feng, *Eu. Polym. J*., 1221, **32(10)** (1996).
34. A. A. Mizoguchi JP 8080580 (1996).
35. H. Tang, L. Dang, J. Zhang, M. Ding and Z. Feng, *Makromol. Chem. and Phys*. 543, **197(2)** (1996).

36. M. Konda, M. Tanaka, M. Miyamoto, Y. Kimura and A. Yanaguchi, *High. Perform.Polym.*,93, **10(1)** (1998).
37. J. T. Macheras, U. S. Pat. 5635067 (1997).
38. T. S. Chung, P. Foley and M. Jaffe, *Polymers for Advanced Technologies,* 537, **8(9)** (1997).
39. M. Hasegawa, N. Sensui, Y. Shindo, R. Yokota, *J. Polym. Sci. B: Polym. Phys.,* 2499, **37** (1999).
40. M.E. Rezac, E.T. Sorensen and H. W. Beckham, *J. Membrane Sci.*, **136**, 249 (1997).
41. J. H. Jou, R. Huang, P. T. Huang and W. P. Shen, *J. Appl. Polym. Sci.,* 857, **43 (5)** (1991).
42. C. R. Davis, J. A. Zimmerman, *J. Appl. Polym. Sci*., 153, **54(2)** (1994). 43.Product – Lenzing, *High Perform. Textiles*, 6, **9(12)** (1989).
44. C. R. Davis, F. D. Egitto and S. L. Buchwalter, *Appl. Phys*. 227, **B54** (1992).
45. F. D. Egitto and C.R. Davis, *Appl. Phys*. **B 55**, (1992).
46. S. I. Yaniger and R. E. Cameron, U. S. Pat. 4855361(1989).
47. M. Angelopoulos, R. Saraf, Antec'93, Conf. Proc.New Orleans, vol-II, 9-13th p-1650, May 1993.
48. M. G. Han and S. S. Im. *J. Appl. Polym. Sci*., 1863, **67(11)** (1998).
49. M. G. Han and S. S. Im. *J. Appl. Polym. Sci*., 2169, **71(13)** (1999).
50. T. M. Su, I.J. Ball, S.-C. Huang, R. K. Larson, S. L. Nguyen, B. M. Lew, R. B. Kaner, J. A. Conklin, *Synthetic Metals*, 801, **84** (1997).
51. B. Tieke and W. Gabriel, *Polymer*, 20, **31** (1990).
52. K. I. Levin, Zgonnik and V.L. Frolov, *Polymer Sci*., 1426, **35(10)** (1993).
53. F. Selampinar, V. Akbulut and L. Toppare, *Macromol. Rev*., 309, **A33** (1996).
54. O. M. Ekiner and J. W. Simmons U. S. Pat. 5248319 (1993).
55. S. Nakata, M. Kakimoto and Y. Imai, *Polymer. J. (Jap),* 569, **25(6)** (1993).
56. J. T. Macheras, B. Bikson, J. K. Nelson, U. S. Pat. 5443728 (1995).
57. M. Konda, M. Tanaka, M. Miyamoto, Y. Kimura and A. Yamaguchi, *High Perform. Polym.,* 93, **10(1)** (1998).
58. T. Fukai, J.C. Yang, T. Kyu, S.Z.D. Cheng, S.K. Lee, S.L.C. Hsu and F.W. Harris, *Polymer*, 3621, **33(17)** (1992).
59. J. A. Campbell, A. A. Goodwin, F. W. Mercer and V. Reddy, *High Perform. Polym.,*263,**9(3)** (1997).
60. S. P. Ma and T. Takahashi, *Polymer*, 5589, **37(25)** (1996).
61. K. Blizard and M. Druy, Antec'95, vol-II, Conf. Proceed., 7th-11th May, 1995, p-3124.
62. A. A. Goodwin, *J. Appl. Polym. Sci*., 543, **72(4)** (1999).
63. M. Ohta, S. Kawashima, K. Iiyama, S. Tamai, H. Oikawa and A. Yamaguchi, U. S. Pat. 5157085 (1992).
64. M. Ohta, S. Kawashima, K. Iiyama, S. Tamai, H. Oikawa and A. Yamaguchi, U. S. Pat. 5086125 (1992).

65. S. Tamai, M. Ohta, S. Kawashima, K. Iiyama, H. Oikawa, A. Yamaguchi, K. Ohkoshi and M. Oshikawa, U. S. Pat. 5288843 (1994).
66. W. Huang, Y. Li, J. Xu and M. Ding, *Polymer,* 4261, **38 (16)** (1997).
67. L.Leung, D.J. Williams, F. E. Karasz and W. J. MacKnight, *Polym. Bull*., 1457, **16(5)** (1986).
68. M.Jaffe, M. I. Haider, J. Menczel and J. Rafalko, *Polym. Engg. and Sci*. **32(17)**,1236 (1992).
69. T. K. Ahn, M. Kim and S. Choe, *Macromolecules*, 3369, **30** (1997).
70. G. Guerra, D. J. Williams, F. E. Karasz and W. J. MacKnight, *J. Polym. Sci. Part B. Polym. Phys*. 301, **26** (1988).
71. D. J. Williams, L. Leung, F. E. Karasz, E. Frank, W. J. MacKnight, and M. Jaffe, U.S. Pat. 4973629 (1990).
72. S. Stankovic, G. Guerra, D. J. Williams, F. E. Karasz and W. J. MacKnight, *Polym. Commun*. 14, **29(1)** (1988).
73. T. A. Kostereva, N. G. Stepanov, A. V. Gribanov, L. A. Shibaev, G. N. Federova and Y. N. Sazanov, *Polym. Sci.,* 1304, **36 (9)** (1994).
74. S. Choe, T. K. Ahn, *Polymer (Korea)*, 633, **19** (1995).
75. S. H. Kim, E. M. Pearce and T. K. Kwei, *J. Polym. Sci. Polym. Chem*., 3167, **31(13)** (1993).
76. Z. Peredy, *Int. Polym. Sci. Technol*., p-T/78, **24(11)** (1997).
77. E. Fekete, Z. Peredy, E. Foldes, F. E. Karasz and B. Pukanszky, *Polym. Bull*. 93, **39(1)** (1997).
78. P. Musto, F.E. Karasz and W.J. MacKnight, *Polymer*, 1012, **30** (1989).
79. G. Guerra, S. Choe, D. J. Williams, F.E. Karasz and W.J. MacKnight, *Macromolecules*, 231, **21** (1988).
80. P. Musto, F. E. Karasz and W. J. MacKnight, *Macromolecules*, 4762, **24** (1991).
81. P. Musto, F. E. Karasz and W. J. MacKnight, *Polymer*, 1012, **30** (1989).
82. K. Liang, G. Banhegyi, F. E. Karasz, W. J. MacKnight, *J. Polym. Sci. Part B: Polym. Phys.*, 649, ***29 (6)*** (1991).
83. V. Janarthanan, F. E. Karasz and W.J. MacKnight, *J. Polym. Mater. Sci. Engg.*, 397, **63** (1991).
84. S. Choe, T. K. Ahn, *Polymer (Korea)*, 115, **14** (1990).
85. L. Leung, D. J. Williams, F. E. Karasz, M. Jaffe, W. J. MacKnight, U.S.Pat. 4973630 (1990).
86. M. M. Glick, E. C. Chenevey, W. M. Cooper, M.I . Haider and M. Jaffe, Industry-University Advanced Materials, Conf. Proc. Denver, Mar.1989.
87. M. Jaffe, Preprins, IUPAC, Intl. Symp., *Polymer* 91, Polymer Div., p-27 (1991).
88. V. Janarthanan, F. E. Karasz and W.J. MacKnight, *Polymer*, 3388, **33(16)** (1992).
89. R. Haghighat, L. Elandjian and R. W. Lusignea in Polymer based molecular composites; Proceedings of the Symposium, Boston, MA, Nov. 27-30, 1989 (A91-2822610-23). Pittsburgh, PA, Materials Research Society, p-395 (1990).
90. K. G. Blizard and R. R. Haghighat, *Polym. Engg. Sci*., 799, **33(13)** (1993).

91. M. Kaku, R. R. Luise, U. S. Pat. 5470922 (1995).
92. W. Brostow, N. A. D'Souza and B. Gopalanarayanan, *Polym. Engg. Sci*., 204,**38(1)** (1998).
93. *High Perform. Polym*. 1993, p.12, DE 4138764A to BASF Germany.
94. Y. M. Koo, M. H. Kim, M. Lee and J. D. Kim, *Molecular Crystals and Liquid Crystals,* 247, **304** (1997).
95. T. Tsutsumi, T. Nakakura, S. Morikawa, K. Shimamura, T. Takahahashi, A. Morita, N. Koga, A. Yamaguchi, M. Ohta, Y. Gotoh, M. Amano, H. Oochi and K. Ito, U. S. Pat. 5312866 (1994).
96. W. Brostow, N.A. D'Souza and B. Gopalanarayanan, Antec'97, vol-II, Conf. Proceed., 27th April-2nd, p-1499, May 1997.
97. W. Brostow, N.A. D'Souza and B. Gopalanarayanan, Antec'98, vol-II, Conf. Proceed. Atlanta Ga. 26th – 30th, p-2377, April 1998.
98. L. Elandjian, R. Hagighat, R. Lusignea & R. Wallis, Proc. 35th Intl. SAMPE Symp. April 1990.
99. R. D. Jester, *SAMPE Int. Electro. Packaging Conference,* 428 (1992).
100. L. S. Rubin, K. Jayaraj and J. M. Burnett, *Int. Electro. Packaging Conference,* 664 (1994).
101. T. E. Noll, K. Blizard, K. Jayaraj and L. S. Rubin, NASA-CR-189338.
102. Y. Aihara and P. Cebe, *Polym. Engg. Sci*., 1275, **34** (1994).
103. A.Yoshihiko and C. Peggy, *Polym. Pre.*, 633, **33(2)** (1992).
104. B. C. Auman, 5th Int. Conf. on Polyimides, "New Trends in Polyimide Science and Technology", Retec. Proceed. N.Y. Ellenville, 2nd-4th Nov.1994, p.110.
105. B. B. Sauer and B. S. Hsiao, *Polymer*, 3315, **34(15)** (1993).
106. B. B. Sauer, B. S. Hsiao and K.L. Faron, *Polymer*, 445, **37(3)** (1996).
107. X. Kong, F. Teng, H. Tang, L. Dong and Z. Feng, *Polymer*, 1751, **37(9)** (1996).
108. X. Kong, H. Tang, L. Dong, F. Teng and Z. Feng, *J. Polym. Sci. Part B: Polym. Phys.*2267, **36 (13)** (1998).
109. O. M. Ekiner, U. S. Pat. 5608014 (1997).
110. Y. J. Cha, E. T. Kim, T.K. Ahn and S. Choe, *Polymer J. (Jap.)*, 1227, **26(11),** (1994).
111. K. Jexemic, F. E. Karasz and W. J. MacKnight, *New Polym. Mat*., 165, **3 (3),** (1992).
112. K. G. Blizard, M. A. Druy and F. E. Karasz, Antec'92 Plastics, vol-I, Conf Proceed. Detroit, 3rd-7th pp.582, May 1992.
113. A. Mochizuki, K. Yamada, M. Veda and R. Yokota, *Polymer J. (Jap.)*, 339, **29(4),** (1997).
114. O. M. Ekiner and J. W. Simmons U. S. Pat. 5248319 (1993).
115. W. Jang, S. Sundar, S. Choi, Y.-G.-Gun Shul, H. Han, J. Memb. Sci., 321, 280(1-2), 2006
116. Y. He, D. Han, J. Chen, Y. Ding, S. Jiang, C. Hu, S. Chen and H. Hou, RSC Advance, Issue 104, 2014

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In Vivo Effects of Cadmium Chloride on Cytochrome P450arom Gene Expression and Aromatase Activities in Ovary and Brain in Sexually Mature Common Carp *Cyprinus carpio*

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Abstract

Ovarian and brain cyp19a1 mRNA expression and P450 aromatase activities were measured in vivo in sexually mature common carp, *Cyprinus carpio* after a short-term exposure to cadmium chloride ($CdCl_2$). In vivo exposure of fish to sub-lethal dose of $CdCl_2$ for 7 days caused marked attenuation in ovarian cyp19a1a gene expression and P450 aromatase activity while same dose of toxicant significantly up-regulated brain cyp19a1b mRNA expression and aromatase activity with increasing time. Results thus, show that sub-lethal dose of $CdCl_2$ has the endocrine disruptive potential and the effect is mediated via changes in ovarian and brain P450arom gene expression and aromatase activity in vivo.

Keywords

Cadmium chloride, P450arom gene, Aromatase, Cyprinus carpio

Introduction

Heavy metal cadmium is a highly toxic environmental pollutant, discharged in large amount into the aquatic system by a number of industries like paints, paper pulp, metal finishing, ceramic, photography, pharmaceuticals etc. (Jarup et al. 1998; Bhattacharyya et al. 2000).

Chronic contamination of this heavy metal in the aquatic environment is a severe problem particularly to the living organisms. The situation is especially serious for its long time persistence in the environment with a half-life of 15-30 years (Hensen and Anderson 2000) and accumulation over time in blood, kidney and liver (Varga et al. 1993; Hensen and Anderson 2000; Bhattacharyya et al. 2000), as well as in reproductive organs (Varga et al. 1993; Orlando et al. 2002). All these prompted numerous investigators to study the effects of this metal on the biological functions of fish.

Increasing attention has been paid to the reproductive system of animals as a bio-indicator of exposure to environmental pollutants. Exposure of mammals to cadmium results in down-regulation of pituitary hormones releases namely, gonadotropins, prolactin, thyroid stimulating hormone and growth hormone (Lafuente et al. 2003). All these lead to failure of ovulation, defective steroidogenesis and oocyte maturation in amphibian and

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mammals (Yu et al. 1985; Lienesch et al. 2000; Piasek et al. 2002). Cadmium exposure attenuated gonadotropin-induced free-cholesterol utilization in the ovary and inhibition of ovarian steroidogenesis in common carp, *Cyprinus carpio* (Mukherjee et al. 1992; Das and Mukherjee 2013). One enzyme whose activity is altered by various environmental pollutants is the P450 aromatase, encoded by *cyp19a1* gene, which convert aromatizable androgens to estrogens. (Orlando et al. 2002; Fan et al. 2007; Cheshenko et al. 2008). In addition to gonad, this enzyme has also been identified in many other non-gonadal tissues like brain, liver and kidney of all vertebrates including fish (Simpson et al. 1994; Callard et al. 1978; 1984; Goto-Kazeto et al., 2004; Sawyer et al. 2006). In mammals, there is a single *cyp19a1* gene for all the tissues (Simpson 2002), whereas in fish, there are two distinct isoforms: *cyp19a1a*-gonad-specific and *cyp19a1b*-brain-specific (Kazeto et al. 2001; Berney et al. 2008). Recent studies reported for attenuation of ovary-specific *cyp19a1a* mRNA expression *in vitro* in $CdCl_2$ exposed common carp (Das and Mukherjee 2013) and attenuation of its expression in phenol exposed carp ovary both in *vivo* and *in vitro* (Das et al. 2013; 2016). Interestingly, in vivo studies on alteration of *cyp19a1* gene expression and aromatase activities in brain and ovary of $CdCl_2$ exposed fish have not yet been reported.

The objective of the present study is to investigate the *in vivo* effect of $CdCl_2$ on brain and ovarian *cyp19a1* gene expression and aromatase activities in short-term exposure of sexually mature female *C. carpio.*

Materials and Methods

- *Chemicals*

Cadmium chloride was purchased from Merck India (Cat. No. 61813101001730). Total RNA isolation reagent (Tri reagent) was purchased from Ambion Inc. (Foster City, USA). RNAse free DNAse-I, DEPC-treated water, RNAse inhibitor, RevertAid M-MulV reverse transcriptase, Oligo dT, nuclease free water, deoxy-NTPs and *Taq* polymerase were procured from Thermo Fischer Scientific Inc., (Hanover, MD, USA). Labelled [^{3}H] testosterone (sp activity 95.0 Ci/mmol) was purchased from Amersham Biosciences. All other chemicals used in the experiment were of analytical grade.

- Animals

Adult female *C. carpio* at vitellogenic stage (400-500 g. body wt), collected from a local fish farm during the month of September to October were kept in outdoor concrete tanks (300 L capacity) at 23 ± 1^{0}C at least for 5 days prior to experiment. They were fed with commercial fish food (Shalimar fish food, Bird and Fish food manufacturer, Mumbai). Follicular developmental stage was determined according to the procedure described previously (Paul et al. 2008; 2010). During the month of September to October, ovaries of female carp in the plains of West Bengal, India comprise mostly vitellogenic follicles (0.3-0.4 mm in diameter) with oocyte containing centrally located germinal vesicle. The cytoplasm was filled with yolk granules and cortical granules were shown to cover the entire oocytes.

- *In vivo* exposure of fish

Toxicity bioassay of $CdCl_2$ was conducted according to the standard procedure outlined by Doudoroff et al. (1951). For the study of *cyp19a1a* and *cyp19a1b* gene expression and cadmium accumulation within fish tissues, altogether 25 healthy vitellogenic fish were exposed to the sub-lethal concentration of $CdCl_2$ (10% of TLM conc. of $CdCl_2$ i.e., 0.65mg /L) for 1, 2, 4 and 7 days. A parallel control was performed simultaneously. Both control and test solution was renewed daily, and sampling of fish was done after 1, 2, 4 and 7 days of exposure respectively. Fish were killed by decapitation and ovary and brain tissues from each fish were taken out, washed in PBS, and minced under ice. A portion of minced ovarian and brain tissues was kept for RNA isolation. Another portion was subjected to determine aromatase activity.

- **Reverse transcriptase polymerase chain reaction (RT-PCR)**

Total RNA was isolated from ovarian and brain tissues using TRI reagent according to manufacturer's instruction and the method described earlier (Chomczynski and Sacchi 1987). RNA purity was determined by A260/ A280 ratio, and quality was checked by agarose-formaldehyde gel electrophoresis. RT-PCR was done following the procedure of Paul et al. (2008; 2010); Das et al. (2013). Briefly, First-strand cDNA synthesis was carried out with 2.0 mg total RNA using RevertAid M-MulV reverse transcriptase and incubated at 42°C for 1 h. From the cDNA prepared, 2.0 ml was used as template for RT-PCR with gene-specific primers (*cyp19a1a* for ovary and *cyp19a1b* for brain), and relative expression was observed with *gapdh* primer. Gene-specific oligonucleotide primers were developed using Primer 3 beta software (Whitehead Institute/ MIT center genome research, Cambridge, MA, USA) from the published sequence *cyp19a1a* and *cyp19a1b* of *C. Carpio*.The forward primer of *cyp19a1a* of *C. carpio* was a 20-mer oligonucleotide corresponded to position 546-565 (5' GGTTTGCATCACTTCCACAA 3′) and (Gene Bank accession number DQ534411) the reverse primer was complimentary to position 743-762 (5′AATACGGTCTGCCAGGTGTC 3'). Predicted size of the RT-PCR product was 198 bp. Forward and reverse primer for *cyp19a1b* were (5′ TTACTGCTGCTGACGGGAAC 3′) and (5′CATCCAGAGGAACCGACTG 3′) respectively and predicted size of the RT-PCR product was 148-bp. For internal control, a *gapdh* fragment that consist of 185-bp produced from an upper primer (5′ GGGGCTCAGTATGTTGTGG 3′) and a lower primer (5′ AGGAGGCATTGCTGACAACT 3′) was used.

A 50 µl PCR volume was made by adding 2.5 U *Taq* DNA polymerase for a PCR mixture containing 10x reaction buffer (50 mM KCl, 10 mM Tris-HCl (pH 8.3), 0.1% Triton-X-100 and 2.5 mM $MgCl_2$), 20 µM of each deoxyNTPs and 20 pmol of each primer. The PCR was performed for 35 cycles of denaturation at 94^0C for 30s (5 min in the first cycle), annealing at specific temperature for each set of primer for 30s, and extension at 72^0C for 30s (10 min in the last cycle). The RT-PCR product was cloned, sequenced and used for expression purpose.

- P450 aromatase activity

Aromatase activity in the brain and ovarian tissues was estimated by *in vitro* conversion of labelled testosterone (T) to labelled E_2 according to the method of Chan and Tan (1986) and as described previously (Paul et al. 2008; Das et al. 2013).

- Statistical calculations

Data obtained from three replicate incubations of all the tissues from a single donor fish showed similar tendency and mean of them was considered as one experiment. All data were expressed as mean ± S.E.M. of five such experiments taking samples from five donor fish. Following test for normality and homogeneity, the significance of treatment effect was determined by one-way ANOVA, followed by Bonferroni's multiple comparison test using SPSS (Chicago, IL, USA) with a significance level $p<0.01$ and $p<0.05$.

Results

- Effects of $CdCl_2$ on ovarian and brain P450arom gene expression *in vivo*

Fig. 1 demonstrates a high expression of P450arom mRNA both in ovary and brain tissues of carp *C. carpio* with no $CdCl_2$ exposure at vitellogenic stage. Exposure of fish to sub-lethal concentration (0.65 mg/L) of $CdCl_2$ for 7 days caused a gradual and significant ($p<0.01$) inhibition of *cyp19a1a* mRNA expression in ovary (Fig.1A) with increasing time and a minimum was recorded after day 7 of exposure. A similar exposure of the $CdCl_2$ on the contrary, caused gradual and significant ($p<0.01$) up-regulation in the expression of brain *cyp19a1b* mRNA (Fig.1B) with a maximum after day 7 of exposure. Both in ovary and brain, *gapdh* mRNA was used as loading control.

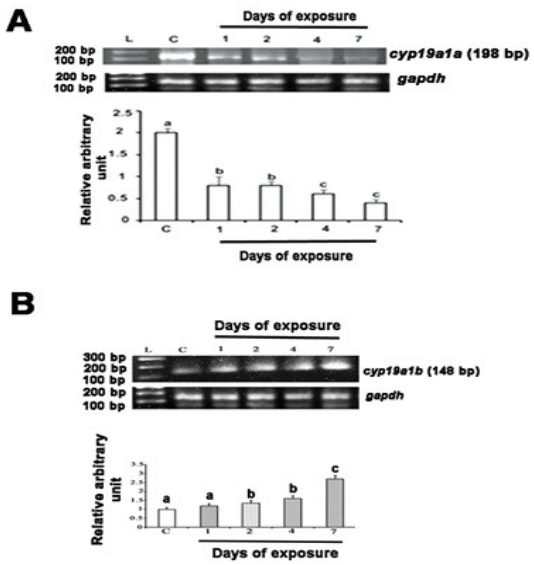

Figure 1*In vivo* **effects of sub-lethal dose of cadmium chloride (0.65 mg/l) on expression of ovarian** ***cyp19a1a*** **(A) and brain** ***cyp19a1b*** **(B) mRNA in vitellogenic stage female** ***C. carpio*****. PCR amplification was performed as described in "Materials and Methods" section.** ***gapdh*** **mRNA was used as loading control. The pixel densities of the bands were quantified with ImageJ Software, National Institute of Health (NIH) and have been represented in bar diagram as relative arbitrary units considering the control value as 1. Experiment was performed five times in triplicate taking tissues from five donor fish and values are mean ± SEM.** ***Bar*** **associated with different letters in Fig. A and B are significantly (*p<0.01*) different. 'C'- Control.**

- Effects of $CdCl_2$ on ovarian and brain aromatase activity *in vivo*

Aromatase activity in ovary and brain tissues was estimated after *in vivo* exposure of $CdCl_2$ to vitellogenic fish from day 1 to day 7 (Fig. 2A and B). $CdCl_2$ at sub-lethal concentration (0.65 mg/L) caused a gradual and significant (*p<0.01*) inhibition of ovarian aromatase activity (Fig. 2A) with increasing days, whereas similar exposure of the toxicant caused gradual and significant increase (*p<0.01*) of aromatase activity in brain (Fig. 2B).

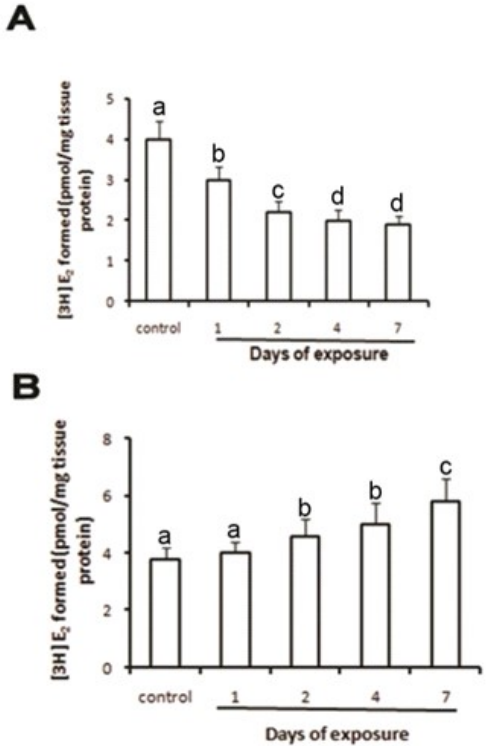

Figure 2 ***In vivo*** **effect of cadmium chloride (0.65 mg/L) on ovarian (A) and brain aromatase (B) activity in vitellogenic stage** ***C. carpio*****. For aromatase activity determination, control and cadmium chloride exposed fish tissues were incubated in the presence of [^{3}H] testosterone (1 X 10^6 c.p.m., 154 pmol). Experiments were performed five times in triplicate taking tissues from five donor fish and values are mean ± SEM. Bar associated with different letters are significantly (*p<0.01*) different. C- Control.**

Discussion.

In the present study, it has been found that short-term *in vivo* exposure of common carp *C. carpio* to sub-lethal concentration of $CdCl_2$ during vitellogenic stage significantly attenuated the ovarian *cyp19a1a* mRNA expression and P450aromatase activity, while same dose of $CdCl_2$ up-regulated brain *cyp19a1b* mRNA expression and aromatase activity with increasing time.

Results obtained in this *in vivo* study on attenuation of ovarian *cyp19a1a* gene expression after short-term exposure of $CdCl_2$ in common carp at vitellogenic stage corroborates the earlier findings with reduced expression of *cyp19a1a* gene and aromatase activity in $CdCl_2$-exposed vitellogenic ovarian follicle *in vitro* in *C. carpio*

(Das and Mukherjee 2013). Inhibition of rainbow trout P450aromatase activities in brain and ovarian microsomes by various environmental substances has been reported (Hinfray et al. 2006). Lyssimachou et. al. (2006) studied brain cytochrome P450arom gene isoforms and activity levels in Atlantic salmon after exposure to normal environmental concentrations of pharmaceutical ethynyl-estradiol and antifoulant tributyltin. Various effects of $CdCl_2$ on reproductive physiology of animals have been reported. Downregulation of gonadotropins, prolactin, ACTH, growth hormone and thyroid hormone release has been reported in metal exposed rodents (Lafuente et al. 2003). Cadmium also inhibits progesterone synthesis in cultured granulosa cells of both rat and humans (Paksy e. al. 1997; Piasek et al.1994; Piasek et al. 1999). Contrary to this observation, stimulatory effect of Cd^{2+} on ovarian progesterone synthesis has also been reported. Cadmium chloride exerts dose dependent stimulatory and inhibitory effect on P50scc mRNA expression and progesterone synthesis in steroidogenically stable JC porcine granulosa cells (Chedrese et al. 1998). Decrease in ACTH-stimulated steroid production by $CdCl_2$ in mouse Y-1 adrenal tumour cells has also been demonstrated (Mgbonyebi et al. 1993). In the present in vivo study, attenuation of *cyp19a1a* gene expression was accompanied by decreased levels of ovarian aromatase activity indicating the deleterious effects of $CdCl_2$ on E_2 production.

Reports on the effects of environmental toxicants on *cyp19a1b* expression and aromatase activity in fish are mixed. Both up- and down-regulation of brain P450arom gene expression and aromatase activities are reported by various workers (Kazeto et al. 2004; Hinfray et al. 2006; Kallivretaki et al. 2006; Chung et al. 2011; Brion et al. 2012). In this in vivo study, a gradual and significant increase of brain *cyp19a1b* expression and aromatase activity after $CdCl_2$ exposure corroborate the earlier findings on up-regulation of brain *cyp19a1b* gene expression and aromatase activity in fish after exposure of xeno-estrogenic endocrine disruptors like ethinyl-estradiol, estrone, gentesin and zeralenol (Diotel et al. 2010; Chung et al. 2011). Observed increase in the expression of *cyp19a1b* and aromatase activity after $CdCl_2$ exposure in the present study add to growing evidence showing the ability $CdCl_2$ to affect brain function at molecular, cellular, organ and functional levels. Further study is requiredto elucidate the mechanism by which $CdCl_2$ up-regulate the brain *cyp19a1b* mRNA expression and aromatase activity in fish.

Conclusion

In conclusion, this study indicates that cadmium chloride is effective in inhibiting ovarian *cyp19a1a* gene expression and aromatase activity in ovary and increased the same in brain *in vivo* and this might lead to altered production of E_2 in both the tissues.

Acknowledgments

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Conflict of interest

Author states there is no conflict of interest that would prejudice for impartiality of research.

References

Bhattacharyya M.H., Wilson A.K., Rajan S.S., Jonah M. (2000):"Biochemical pathways in cadmium toxicity",in: Zalup R.K. Koropatnick J. Eds. Molecular Biology and toxicology of metals, London: Taylor and Francis, 1-74

Brion F., Yann L.P., Benjamin P., Sok-Keng T., Bon-chu C., Olivier K. (2012):"Brain Aromatase (*Cyp19a1b*) is a highly sensitive gene to estrogens and xeno-estrogens", *Endocrin Disrupt Munich*, Germany

Callard G.V., Petro Z., Ryan K.J. (1978):"Phylogenetic distribution of aromatse and other androgen–converting enzymes in the central nervous system",*Endocrinology,* 103, 2283-2290

Chan W.K., Tan C.H. (1986): "FSH–induced aromatase activity in porcine granulose cells: non–competitive inhibition by non aromatizable androgens",*J Endocrinol*, 108, 335-341

Chedrese P.J., Rodway M.R., Swan C.L., Gillio–Meina C. (1998):"Establishment of a stable steroidogenic porcine granulosa cell line",*J Mol Endocrinol,* 20, 287-292

Cheshenko K., Pakdel F., Segner H., Kah O., Eggen R.I.L. (2008):"Interference of endocrine disrupting chemicals with aromatase *cyp19* expression or activity and consequences for reproduction of teleost fish",*Gen Comp Endocrinol*,155, 31-62

Chomczynski P., Sacchi N. (1987):"Single step method of RNA isolation by acid guanidium thiocyanate–phenol–chloroform extraction",*Annal Biochem*, 162, 156-159

Chung E., Gencoa M.C., Megrelisa L., Rudermana J.V. (2011):"Effects of bisphenol A and triclocarban on brain-specific expression of aromatase in early zebrafish embryos",*PNAS,* 108 (43), 17732-17737

Das S., Majumder S., Gupta S., Dutta S., Mukherjee D. (2016):"Effects of phenol on ovarian P450arom gene expression and aromatase activity in vivo and antioxidant metabolism in common carp *Cyprinus carpi", Fish Physiol Biochem*, 42(1), 275-286

Das S., Majumder S., Mukherjee D. (2013):"Effect of phenol on ovarian secretion of 17b-estradiol in common carp *Cyprinus carpio", Arch Environ Contam Toxicol,* 65,132-141

Das S., Mukherjee D. (2013):"Effect of cadmium chloride on secretion of 17b-estradiol by the ovarian follicles of common carp, *Cyprinus carpio",Gen Comp Endocrinol,* 181, 107-114

Diotel N., Le Page Y., Mouriec K., Tong S.K., Pellegrini E., Vaillant C., Anglade I., Brion F., Pakdel F., Chung B.C., Kah O. (2010):"Aromatase in the brain of teleost fish: expression, regulation and putative functions",*Front Neuroendocrinol* 31, 172-192

Doudoroff P., Anderson B.G., Burdick G.E., Galtsoff P.S., Hart W.B., Patrick R., Strong E.R., Surber E.W., VanHorn W.M. (1951):"Bioassay methods for the evaluation of acute toxicity of industrial wastes to fish", *Sew Ind Wastes*, 23, 1380-1397

Fan W.Q., Yanase T., Morinaga H., Gondo S., Okabe T., Nomura M., Komastu T, Morohashi K.I., Hayes T.B., Takayanagi R., Nawata H. (2007):"Atrazine–induced aromatase expression is SF–1 dependent: Implications for endocrine disruption in wildlife and reproductive cancers in humans",*Environ Health Perspect,* 115, 720-727

Goto-Kazeto R., Kight K.E., Zohar Y., Place A.R., Trant J.M. (2004):"Localization and expression of aromatase mRNA in adultzebrafish",*Gen Comp Endocrinol*, 139, 72-84

Hinfray N., Porcher J.M. Heath, Brion F. (2006):"Inhibition of rainbow trout (*Oncorhynchus mykiss)* P450aromatase activities in brain and ovarian microsomes by various environmental substances",*Comp Biochem Physiol*, Part C, 144, 252-262

Jarup L., Berglund M., Elinder C.G., Nordberg G., Vahler M. (1998):"Health effects of cadmium exposure–are view of the literature and risk estimate, Scand J Work Environ Health. 24(suppl1) 1-52

Kallivretaki E, Eggen R, Neuhauss S, Alberti M, Kausch U, Segner H (2006) Aromatase in zebrafish: A potential target for endocrine disrupting chemicals",*Mar Environ Res*, 62 ,187-190

Kazeto Y., Ijiris I., Place A.R. , Zohar Y., Trant J.M. (2001):"The 5' flanking regions of CYP19A1 and CYP19A2 in Zebrafish*", Biochem Biophys Res Commun,* 288, 503-508

Kazeto Y., Place A.R., Trant J.M. (2004):"Effects of endocrine disrupting chemicals on the expression of CYP19 genes in zebrafish (*Danio rerio*) juveniles",*Aqua Toxicol*, 69 (1), 25-34

Lafuente A., Cano P., Esquifino A.I. (2003):"Are cadmium effects on plasma gonadotrpins, prolactin, ACTH, GH and TSH levels, dose dependent?",*Biometal,* 16, 243-250

Lienesch L.A., Dumont J.N., Buntle J.A. (2000):"The effect of cadmium on oogenesis in *Xenopus laevis:,Chemosphere,* 41,1651-1658

Lyssimachou A., Jenssen B.M., Arukwee A. (2006):"Brain cytochrome P450 aromatase gene isoforms and activity levels in Atlantic Salmon after waterborne exposure to nominal environmental concentrations of the pharmaceutical ethynylestradiol and antifoulant tributylin",*ToxicolSci,* 91, 82-92

Mgbonyebi O.P., Smothers C.T., Mrotek J.J. (1993):"Modulation of adrenal cell function by cadmium salts1.cadmium chloride effects on basal and ACTH–stimulated steroidogenesis", *Cell Biol. Toxicol,* 9, 223-234

Mukherjee D., Guha D., Kumar V. (1992):"Effect of certain toxicants on gonadotropin–induced ovarian non–esterified cholesterol depletion and steroidogenic enzyme stimulation of the common carp *Cyprinus carpio in vitro",Biomed Environ Sci,* 5(2), 92-98

Orlando E.F., William P.D., Guillette Jr. L.J. (2002):"Aromatase activity in the ovary and brain of the eastern mosquito fish (*Gambusia holbrooki*) exposed to paper mill effluent", *Environ Health Perspect*, 110, 429-433

Paksy K., Rajczy K., Forgacs Z., Lazar P., Bernard A., Gati I., Kaali G.S. (1997):"Effect of cadmium on morphology and steroidogenesis of cultured human granulosa cells",*J Appl Toxicol*, 17, 321-327

Paul S., Kundu S., Pramanick K., Bandopadhyay A., Mukherjee D. (2010):"Regulation of ovarian steroidogenesis in vitro by gonadotropin in common carp *Cyprinus carpio*: interaction between calcium and adenylate cyclase–dependent pathways and involvement of ERK signaling cascade*", J Mol Endocrinol*, 45, 207-218

Paul S., Mukherjee D., Pramanick K., Kundu S., Bhattachryya S.P., De P., Mukherjee D. (2008):"Stimulation of Salmon calcitonin on secretion of 17â–estradiol by the ovarian follicles of common carp, *Cyprinus carpio",J Endocrinol*,196*,*1-13

Piasek M., Laskey J., Kostial K., Blanusa M. (2002):"Assessment of steroid disruption using cultures of whole ovary and or placenta in rat and in human placental tissue",*Int. Arch Occup Environ Health*, 75, 36-44

Piasek M., Laskey J.W. (1994):"Acute cadmium exposure and ovarian steroidogenesis in cycling and pregnant rats",*Reprod Toxicol,*8,495-507

Piasek M., Laskey J.W. (1999): "Effects of *in vitro* cadmium exposure on ovarian steroidogenesis in rats",*J Appl Toxicol,*19**,** 211-217

Sawyer S.J., Gerstner K.A., Callard G.V. (2006):"Real-Time PCR Analysis of Cytochrome P450 Aromatase Expression in Zebrafish: Gene Specific Tissue Distribution, Sex Differences, Developmental Programming, and Estrogen Regulation", *Gen Comp Endocrinol*,147 (2), 108-117

Simpson E.R., Mahendro M. S., Means G.D., Kilgore M.W., Hinshelwood M.M., Graham–Lorence S., Amarnah B., Itoy Fisler C.R., Michael M.D. (1994): "Aromatase cytochrome P450, the enzyme responsible for estrogen biosynthesis",*Endocrinol Rev*, 15, 342–355

Simpson E.R., Clyne C., Rubin G., Boon W.C., Robertson K., Britt K., Speed C., Jones M. (2002):"Aromatase- a brief overview",*Annu Rev Physiol*, 64, 93–127

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Toxicological impacts of Endosulfan on Histopathology and Haematological parameters of Fish: A Review

Shrabani Ghosh[1] and ***Chandan Sarkar***[2]

Abstract

The harmful chemical toxicants, like pesticides are employed in agricultural sector in order to regulate crops' yield with low effort and labour. Through the use of pesticide many non-target organisms, fish being one among them, get exposed to toxicity. The toxicants try to enter into fish body through different routes via inhalation, dermal, oral and several other routes. Sometimes acute concentration of pesticides may cause mortality, while the sub lethal concentration results in different lethal changes. Through the pesticide accumulation in aquatic organism including fish, human health is also affected via biological magnification and ecological cycling. Among the different group of pesticides, endosulfan is a broad spectrum organochlorine pesticide, known to be highly toxic to aquatic life causing behavioural changes to biochemical and histopathological changes in fish. It is primarily used to kill insect pest and also mites on crops including fruits, vegetable, ornamental shrub, trees and cereal grains. Endosulfan moves through surface runoff into natural water and is accumulated in living organism in water, especially in fish and water bodies are polluted continuously. Endosulfan inhibits acetylcholinesterase activity and cause neurological, behavioural, oxidative, endocrine and histological alteration in fish included hyperplasia in interlamellar epithelium, hypertrophy in gill, testicular damage and pycnotic nuclei and hydropic degeneration in liver. The present study reviews the effects of endosulfan in histology and haematological parameters of fish.

Key Words: *Toxicity, Histopathology, Endosulfan, Haematology, Fish.*

Introduction

Pesticides are chemical or biological agents that are meant to control pests, destroying insects or other organism harmful to cultivated plants and animals. United Nations Environment Programme has defined pesticides, as any substance or mixture of substance, which has been intended for preventing, destroying, repelling or mitigating any pest (UNEP 2005). Pesticide is important for the development of agriculture and protection of public health because the Indian tropical climate is unable to control or reduce pest breeding (Kumar and

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Prasad 2010). But, nowadays it is a serious problem when aquatic ecosystem is contaminated with pesticides; as a result fishes are frequently illuminated to these pollutants and may enter into gills, skin and through the contaminated food (Ling et al. 2011). The evolutionary development of aquatic ecosystem vastly depends on fish because pollutants make the food chain and are liable for adverse action and death in the aquatic systems (Farkas and Specziar 2002). Organochloride has the most hazardous effect to aquatic environment, since they are very persistent, non-biodegradable and accumulate in food chain.

Endosulfan (6,7,8,9,10,10- hexachloro-1,5,5a,6,9,9a- hexahydro-6, 9-methano- 2,4,3-benzodioxanthiepine,3-oxide), CAS No. 115-29-7 is a broad spectrum organochlorine insecticide (Naqvi and Vaishnavi 1993). Endosulfan is a broad spectrum insecticide–acaricide of the cyclodiene subgroup which consists of two biologically active isomers, alpha and beta in the ratio of 7:3 (Wan et al. 2005).

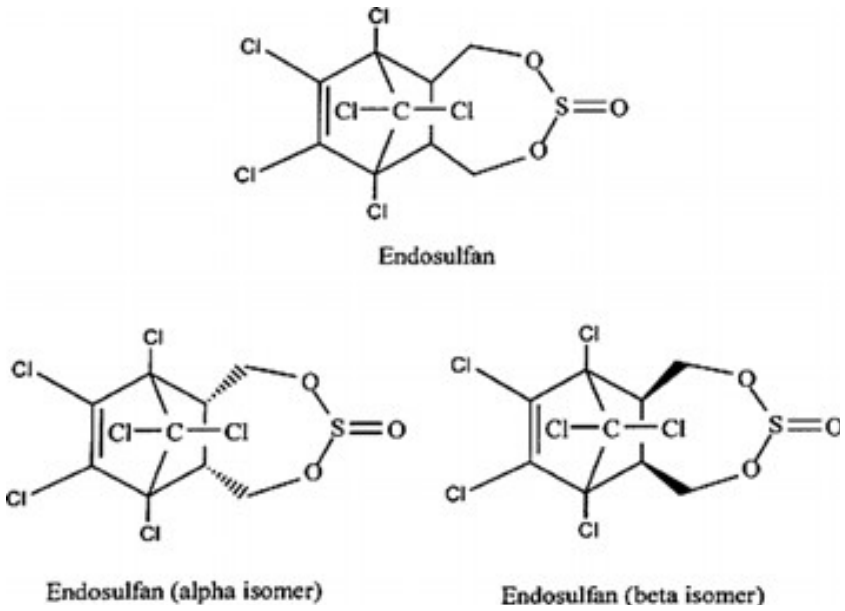

Figure 1: Molecular structure of endosulfan and its two isomers (Source: Kumar and Philip 2006*)*

Endosulfan sulphate is the main environmental metabolite present in water, sediments and tissues (Rand et al. 2010). It is one of the cyclodiene pesticides which is still used in the world (Stanly et al. 2009). It is commercially used for the regulation and control of pest and disease on a variety of agricultural and horticultural crops, including vegetables, cereals, fruits and tobacco (Tuduri et al. 2006; Sutherland et al. 2004).

Endosulfan is a neurotoxic (US Environmental Protection Agency 2002) and highly toxic to fish with a report of 96h LC_{50} value of 2.6μgL^{-1} for teleost fish (Kegley et al. 2009). It has been reported that the impact of endosulfan on haematological parameters can reduce haemoglobin and haematocrit value (Velisek et al. 2009) and also change the phagocytic activities (Giron-Oerez et al. 2008). It can pass into water bodies through surface runoff and air drift from nearby agricultural field and cause adverse effect on non-target aquatic organisms including fish.

The major studies of endosulfan toxicity in fish have been achieved using acute exposures. Through acute studies, it is reported that histopathological changes in gills leading to respiratory distress and ionoregulatory disturbances (Capkin et al. 2006, Cengiz and Ünlü 2002, Jonsson and Toledo 1993a) and Liver necrosis (Capkin et al. 2006, Cengiz et al. 2001, Jonsson and Toledo 1993a, Nowak and Kingsford 2003), as well as necrosis in haematopoietic tissue and renal tubules of rainbow trout (*Oncorhynchus mykiss*) are also observed (Capkin et al. 2006). Endosulfan exposure can cause haematological disturbances and increases red blood cell count, haemoglobin and haematocrit (Naidu et al. 1987). Endosulfan has high toxicity to fish and shellfish (Petri et al. 2006) and increase depression of immune system through susceptibility to the infection (Jekins et al. 2003; Giron-Perez et al. 2008). The review work is taken up to find out impact of endosulfun on haematological parameters and histology of organ tissues like muscle, liver, gills of fish.

Endosulfan: An Organochlorine Pesticide

Endosulfan (6,7,8,9,10,10- hexachloro-1,5,5a,6,9,9a- hexahydro-6, 9-methano- 2,4,3-benzodioxanthiepine,3-oxide, CAS No. 115-29-7) is a broad spectrum organochlorine pesticide, still popular in different parts of world in order to increase agricultural productivity (Kullman and Matsumura 1996). The concentration of organochlorine in sea around India is considered to be higher compared to other regions (Tanabe and Tatsukawa 1980). It is reported that large amount of endosulfan residues are found in Indian estuaries (Bhattacharya et al. 2003).

Cultural evolution has increased the use of pesticides for pest regulation and in turn increased pollution continuously in aquatic system. Organochlorine pesticides have a variety of chemicals which are primarily composed of carbon, hydrogen and chlorine that include among others polychlorinated biphenyls (PCBs), polychlorinated dibenzofurans (PCDFs), dichlorodiphenyltrichloroethane (DDT), dieldrin, chlordane, heptachlor, toxaphenes, mirex, lindane, dicofol, hexachlorobenzene, chlordecone and endosulfan (Van and Pletschke 2011). Organochlorine pesticides not only have strong insecticidal properties but also have broad applications due to their low cost of large scale production. However, many countries have banned some organochlorine pesticides due to their persistent residual characteristics and also unexpected toxicities to non-target organismsin the environment (Brunelli et al., Sharma et al 2011). But with much less persistency than other organochlorines, endosulfan is known to be highly toxic to fish (Neupath et al 2006, USEPA 2002).

Physicochemical properties of Endosulfan

Table 1: Chemical and physical properties of Endosulfan

Sl.No.	Variable	Information
1.	Chemical name	6,7,8,9,10,10- hexachloro-1,5,5a,6,9,9a- hexahydro- 6, 9-methano- 2,4,3-benzodioxanthiepine, 3-oxide
2.	Chemical formula	$C_9H_6Cl_6O_3S$
3.	Trade name	Beosit,Thiodan,Thiofor
4.	CAS number	115-29-7
5.	Molar mass	406.93 g/mol
6.	Color	Beige
7.	Melting point	70°C-100°C
8.	Density	1.735 g/Ml
9.	Physical state	Crystaline-waxy solid
10.	Water affinity	Lipophilic

Source : pubchem.ncbi.nlm.nih.gov

Chronic toxic effects of endosulfan on haematological parameters and histopathology of fish species

A. *Haematological Changes*

Haematological changes due to pesticide exposure showed a significant reduction in haemoglobin, erythrocyte and leucocytes which result in anaemia for erythrocyte destruction in haematopoietic organ. This reduction in haemoglobin content brings oxidation of haemoglobin rapidly into methaemoglobin or release of oxygen radicals by pesticide stress. The anaemic condition in fish may lead to higher susceptibility to infection, diminished feeding and breeding behaviour. The exposure of low to high concentration of endosulfan in *Cichlasoma dimerus* showed significant decrease in MCV (for dose 2,3,4 $\mu g/^{L-1}$, 112.1±9.5, 101.8±4.9, 98.6±1.4), MCH (for dose 2,3,4 $\mu/^{L-1}$, 5.9±1.7, 13.9±1.5, 13.8±4.7) and MCHC (for dose 2,3,4 $\mu g/^{L-1}$, 4.2±0.5, 13.0±0.8, 14.1±5.0). By the exposure of endosulfan to control fish, *Cichlasoma dimerus* showed a loss in haemoglobin content and size of erythrocytes which signals microcytic, hypochromic anaemia (Cuna et al. 2011).

- The diminution of haematological parameters or variables PVC, Hb, RBC of exposed fish because of haemolysis of red blood cells due to the effect of endosulfan can lead to decrease in haematocrit value resulting in anaemia in control fish *Clarias gariepinus*. It is reported that PVC, MCV and RBC show notably reduction at 0.0050 ppm through experimental periods in treated fish where no changes in MCH and MCHC value but WBC have variation pattern at 30 (1.161±0.13) and 60 (1.149±0.085) days.

Reduction in haemoglobin content declines haemoglobin synthesis as well as oxygen carrying capacity resulting in interference of endosulfan by heam or globin synthesis pathway (Yekeen and Fawole 2011).

B. Histopathological changes

Alteration in fish liver and gills morphology indicate prior exposure to environmental stressors or toxicants. Several experiments have revealed the histopathological effect of endosulfan on gill, liver, kidney, ovary, testes of different fishes.

Liver: Hypoaemia, hydropic degeneration, enlarged nuclei, focal necrosis, interstitial oedema, pancreatic tissue necrosis, pyknotic nucleus and hemorrhage in the hepatocytes were observed in *Chanos chanos* through exposure to endosulfan (19.5-21.5 µg/L) (Kumar et al. 2016).

- Low dose endosulfan-exposed liver tissue of *Labeo rohita* caused compactly arranged hepatocytes, cytoplasmic vacuolization with increased basophill and pyknotic nuclei but through high dose of endosulfan hepatocellular necrosis, breakdown of cell boundaries were observed (Indirabai et al. 2010).
- Fish *Cichlasoma dimerus* when treated with endosulfan at the level of 2µg/L concentration level various changes in histology including hydropic degeneration and pycnotic nuclei were reported (Cuna et al. 2011).
- Marked fatty changes and necrosis of acinar cells of pancreatic tissue were seen in *Channa punctatus* when it is treated with endosulfan (Sharma et al. 2012).

Gill: Lamellar hyperplasia and lamellar fusion were observed through endosulfan included exposure in *Danio rerio* (Zebrafish) (Velasco-Santamaria et al. 2011).

- The effect of endosulfan on primary gill lamellae makes mild congestion of blood vessels, fusion of lamellae and also marked hyperplasia of the branchial arches. Dilation of blood capillaries, hyperplasia of the epithelial lining, abnormal raising or swelling of epithelium, necrosis and shortening as well as fusion of the secondary lamellae had been reported in *Labeo rohita* under the effect of endosulfan. A thick stratified epithelium is seen in primary gill lamellae that contains numerous mucous and chloride cells responsible for excessive mucus secretion (Indirabai et al. 2010)
- If gill of *Chanos chanos* are exposed to endosulfan at different concentration level, epithelial hyperplasia, lamellar fusion, shorting of secondary lamellae are reported (Kumar et al. 2016).

Kidney: When the kidney sections are exposed to endosulfan in *Labeo rohita,* disintegration of convoluted tubules with large intracytoplasmic vacuoles in the epithelial cells and lumen with invariably in-filtered mononuclear cells and shrinkage of glomeruli with increased space within the Bowman's capsule had also been seen (Indirabai et al. 2010).

Stomach: The histological effects of endosulfan in the intestinal lesions revealed large changes in *Channa puntatus* including, focal deformation with mucosal epithelial layer necrosis, enlargement of intestinal villi, dissociation and reduction of muscular bundles were also observed (Haloi et al. 2013). Sometimes columnar epithelial layer between intestinal villi carrying hair like extension and lymphatic sinuses were also detected in endosulfan exposed *Labeo rohita*.

Reproductive organs:

Testes: The impairment of spermatogenesis and testis functionability was found in control fish *Cichlasoma dimerus* through the exposure of endosulfan (Cuna et al. 2011). In addition to *C.dimerus*, disruption of lobules and damaged Sertoli cells had been detected due to endosulfan exposure in bluegill fish (*L. macrochirus*).

Ovary: The endosulfan also affects the reproductive organ of female fish. As a result, ovaries are surrounded by an interstitial theca with pre-vitellogenic and vitellogenic oocyte in control fish *Cichlasoma dimerus,* when exposed to endosulfan (Cuna et al. 2011).

Discussion

Endosulfan can induce pathogenicity in intestine and stomach. Because this organochlorine insecticide react with HCl, which is secreted in stomach, as a result an acidic compound is formed which damage mucous secreting cells of intestinal lining. Earlier research has suggested effect of endosulfan causing damage to mucosal lining, loss of microvilli, cracked clay appearance of duodenal mucosa and desquamated epithelial cells of gastric mucosa. Histological analysis of intestine tissue of *Channa striatus* and *Heteropneustes fossilis* inhabiting in polluted water has been showing alternation in serosa, mucosa and submucosal layers, necrosis, proliferation and desquamation of superficial parts of villi (Kumari and Kumar 1997).

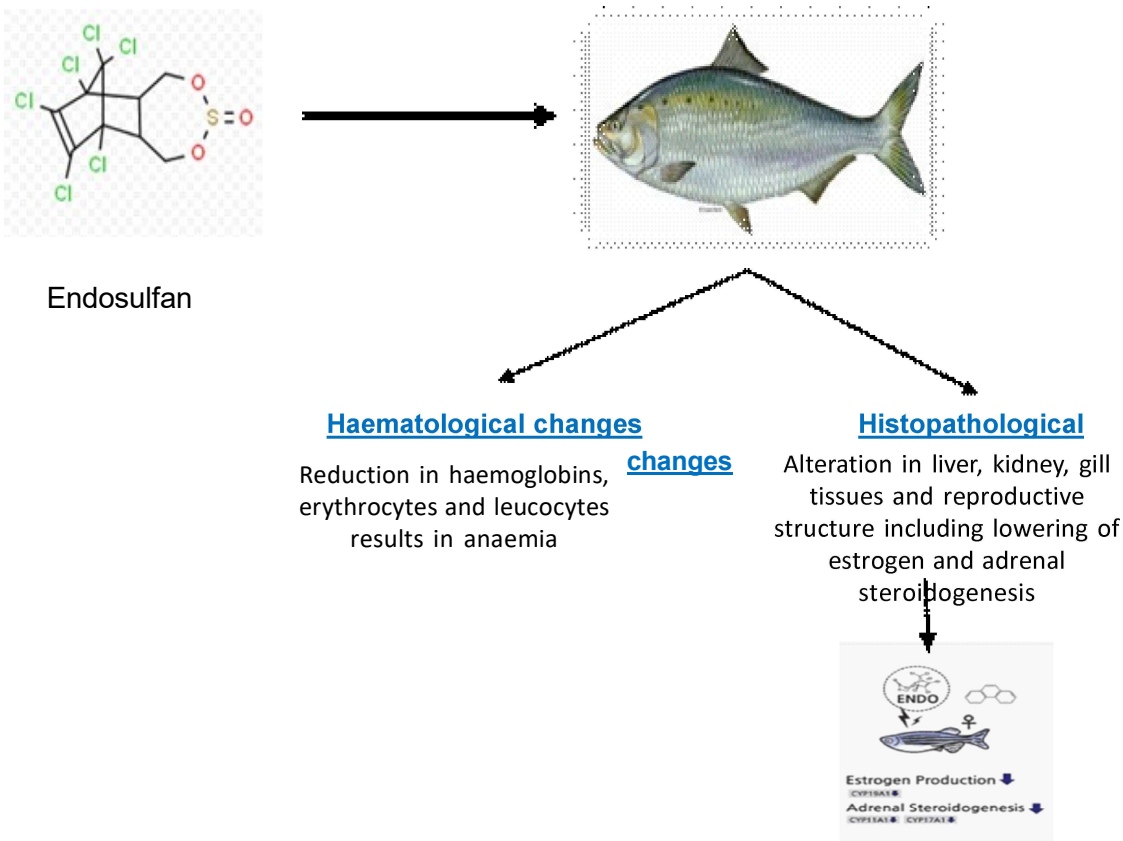

Figure 2: Schematic representation of chronic toxic effects of endosulfan on fish special reference to haematological and histopathological changes

Liver in fish is the main organ for detoxification of organic xenobiotics. There are varieties of insecticides; therefore liver is affected by the harmful effects of toxicants which gradually tend to accumulate at high concentration in the liver (Metelev et al. 1971). In short-term exposure, the liver tissue of the control fish showed normal histological architect without any indication of deformities; but with 96 h of endosulfan exposure, several changes were reported. Sastry and Sharma 1979 has suggested that enlargement of hepatic cells and their nuclei, degeneration of parenchyma, and localised necrosis in *C .punctatus* when exposed to toxicant, extensive degeneration of cytoplasm with pyknosis of nuclei in the liver of *Heteropneustes fossilis* had been reported due to acute toxicity (Narayan and Singh 1991). Swollen hepatocyte and mild congestion in *L .rohita* are found upon exposure to toxicity (Das and Mukherjee 2000). Regarding the long-term toxic effects, remarkable changes in the liver histopathology were reported. The degree of congestion of the blood vessels, which were severely congested, and also vacuolation in hepatic tissues varies significantly in the fishes treated by endosulfan with control group fish.

Haemoglobin content in blood is a very useful index of fish as well as for human health (Haniffa et al. 1986). Pesticides have catalyzing effect on ion incorporation into haemoglobin. Increase in Ht and Hb results in

impairment of gas exchanges through the gill and also increase the size of RBC. But long term exposure of endosulfan to *E. suratensis* decreased Hb content of blood (Sastry and Siddiqqui 1982). The present investigation suggests that haematological changes by endosulfan exposure show significant reduction of haemoglobin, erythrocyte and leucocytes that indicates anaemia due to erythrocytes destruction in haematopoietic organs. Low-Jinde and Niimi 1986 has reported that anaemia is probably due to erythrocyte destruction and reduction in synthesis or release in circulatory system.

Conclusion

Pesticide exposure to the aquatic organisms brings a constant health hazard for human population who will be consuming toxicated fish. This toxic chemical can enter into food chain and cause bio-magnifications in different strata of the food chain. It not only affects target organism but also non-target organisms also. Through the investigation, it is reported that endosulfan makes drastic reduction in hematological parameters and histology of fish. Fishes are very sensitive to the presence of endosulfan in minute quantities and also to several stress. The overall observation suggests that exposure of endosulfan has both acute and chronic impact on haematology and histopathology of fish organism. Many researchers had studied endosulfan effect and suggested that at chronic level, it causes diverse effects including oxidative damage, developmental changes, endocrine disruption, genotoxic or mutagenic effects and neurotoxic effects especially inhibition of AChE activity. Continuous use of endosulfan has an adverse effect on non-target organisms like fish, thus it has become necessary to regulate the use of this pesticide. Endosulfan in the environment, like other similar organochlorine compounds, can induce lethal or sublethal effects in fish. Therefore, for greater concern for public health it is necessary to frequently monitor the endosulfan residues in foods and humans, in order to assess the population exposure to this pesticide. Moreover, for a safe use of this pesticide more scientific experimental work and government formulated several action plans must be executed to detect the exact concentration and time of exposure to investigate prominent toxic effects on fish. Finally, it is proposed that the use of this pesticide in agricultural fields should be under control, which reduces the effects on non-target species. Individuals also need to be sensitized so that they understand the harmful effects this pesticide has on them as well as ecosystem.

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References

Banerjee T. K. (2007): "Histopathology of respiratory organs of certain air-breathing fishes of India", *Fish Physiol. Biochem*, 33: 441-454. D01:10.107/s10695-007-9170-5

Bhattacharya B., Sarkar S. and Mukherjee N. (2003): "Organochloride pesticide residues in sediments of a tropical Mangroove Estuary, India ; Implication for monitoring*", Environ. Int.,* 29, 587-592

Brunelli E., Bernabo I., Berg, C., Lundstedt-Enkel K., Bonacci A. and Tripepi S. (2009): "Environmentally relevant concentrations of endosulfan impair development, metamorphosis and behavior in *Bufo bufo* tadpoles", *Aquatic Toxicology*, 91, 135-142

Capkin E., Altinok I., Karahan S. (2006): "Water quality and fish size affect toxicity of endosulfan, an organochlorine pesticide, to rainbow trout", *Chemosphere,* 64, 1793–1800

Cengiz, E.I. and Ünlü E., (2002): "Histopathological changes in the gills of mosquitofish, Gambusiaaffinis exposed to endosulfan", *Bull. Environ. Contam. Toxicol*. 68, 290–296

Cengiz E.I., Ünlü E. and Balci K.(2001): "The histopathological effects of Thiodan® on the liver and gut of mosquito fish, *Gambusia affinis*", *J. Environ. Sci. Health B*, 36, 75–85

Cuna R.h.D., Vazquez G.R.,Pilo M.N., Guerrero N. V.,Maggese M.C. andNostro F.L.L. (2011): "Assement of the acute toxicity of the organochloride pesticide endosulfan in *Cichlasoma dimerus* (Teleostei, Perciformes)", *Ecotoxicology and Environmental Safety,* 74, 1065-1073

Das B.K., Mukherjee S.C. (2000): "A histological study of carp (*Labeorohita*) exposed to hexachlorocyclohexane", *Vet Arhiv,* 70, 169–180

Farkas A, Salanki J, Specziar A (2002) Relation between growth and the heavy metal concentration in organs of bream *Abramis brama* L. populating Lake Balaton, Archives of Environmental Contamination and Toxicology, 43(2), 236-243

Giro´n-Pe´ rez M.I., Montes-Lo´pez M., Gracý´a-Ramý´rez L.A., Romero-Ban˜uelos C.A. and Robledo-Marenco M.L.(2008):"Effect of sub-lethal concentrations of endosulfan on phagocytic and hematological parameters in Nile tilapia (*Oreochromis niloticus*)", *Bull. Environ. Contam. Toxicol*., 80, 266–269

Haloi K.,Kalita M. andNath R. (2013): "The study on the histopathological changes of stomach of *Channa punctatus* (bloch) by used pesticide endosulfan", *Global Journal Of Frontier Research Biological Science*,13, 0975-5896

Haniffa M.A.,Murugesan A.G. and Porchelvi M. (1986): "Haematological effects of distillery and paper mill effluents on *Heteropneustes fossilis* and *Sarotherodon mossambicus*", *Pro. Indian Acad. Sci. (Anim. Sci.)*, 95, 155-161

Indirabai W.P.S.,Tharani G.G and Seetha P. (2010): "Impact of sublethal concentration of endosulfan on biochemicals and histology of organ tissues of freshwater fish, *Labeo rohita* (Hamilton, 1822), *The Bioscan,* 5(2), 215-218

Jonsson C.M. and Toledo M.C.F.(1993a): "Acute toxicity of endosulfan to the fish *Hyphessobryconbi fasciatus* and *Brachydanio rerio", Arch. Environ. Contam. Toxicol*, 24, 151–155

Jenkins F, Smith J, Rajanna B, Shameem U, Umadevi K, Sanhya V, Madhavi R (2003): Effect of sublethal concentration of endosulfan on hematological and serum biotechnical parameters in carp", *Cyprinus carpio*. Bull Environ Contam Txicol 70: 993-559.

Kegley S.E., Hill B.R., Orme S. and Choi A.H. (2009): PAN Pesticide Database. Pesticide Action Network, North America (San Francisco, CA) /http://www.pesticideinfo.orgS

Kullan S.W. and Matsumura F. (1996):"Metabolic pathways utilized by Phanerochaetehrysosporium for degragation of the cyclodiene pesticide endosulfan", *Appl.Environ. Microbiol,* 62, 989-1000

Kumar M and PhilipL. (2006): "Enrichment and Isolation of a Mixed Bacterial Culture for Complete Mineralization of Endosulfan", *Journal of Environmental Science and Health Part B,* 41:81–96, DOI:10.1080/03601230500234935

Kumar M., Prasad M.R., Srivastva K., Tripathi S. and Srivastva A.K. (2010): "Branchial histopathological study of Catfish *Heteropneustes fossilis* following exposure to purified neem extract, Azadirachtin", *World Journal of Zoology*, 5(4), 239-243

Kumar N.,Ambasankar K.,Krishnani K.K., Gupta S.K., Bhusan S. and Minhas P.S. (2016): "Acute toxicity, biotechnical and histopathological responses of endosulfan in *Chanos chanos*",*Ecology and Environmental Safety*, 131, 79-88

Kumari A. S. and Kumar N. S. R. (1997): "Effects of water pollution on histology of intestine of two fresh water fishes from Hussainsagar lake (A. P.)", *Indian J. Environ. Toxicol*., 7, 68-70

Ling X.P., Zhang Y.H., Lu YH, Huang H.Q. (2011): "Superoxide dismutase, catalase and acetyl cholinesterase: biomarkers for the joint effects of cadmium, zinc and methyl parathion contamination in water", *Environmental Technology*, 32(13), 1463-1470

Lowe-Jinde J. and Niimi J. (1986): "Haematological characteristics of rainbow trout*, Salmo gairdneri* (Richardson) in response to cadmium exposure". *Bull Environ Contam Toxicol.,* 37, 375-381

Metelev V.V., Kanaev A.L., Diasokhva N.G. (1971): *Water toxicity.* Amerind Publishing Cooperation Private Limited, New Delhi

Miglioranza K.S.B., Gonza´lez Sagrario M.A., Aizpu´ n de Moreno J.E., Moreno V.J., Escalante A.H. and Osterrieth M.L.(2002): "Agricultural soil as a potential source of organochlorine pesticides into nearby pond", *Environ. Sci. Pollut. Res. Int.*, 9, 250–256

Naidu K.R.P., Kumari J.P. and Naidu B.P.(1987): "Impact of endosulfan on the hematology of the fish *Cyprinus carpio*", *Environ. Biol*., 5, 713–716

Naqvi S.M. andVaishnavi C. (1993): "Bioaccumulative potential and toxicity of endosulfan insecticide to non-target animals", *Comparative Biochemistry Physiology*, 105, 347-361

Narayan A.S. and Singh B.B.N. (1991): "Histopathological lesions in *Heteropneustes fossilis* subject to acute thiodon toxicity*", Acta Hydrochem Hydrobiol*,19, 235–243

Neuparth T., Bickham J.W., Theodorakis C.W., Costa F.O. and Costa M.H. (2006): "Endosulfan-induced genotoxicity detected in the Gilthead seabream, Spa-rusaurata L., by means of flow cytometry and micronuclei assays", *Bulletins of Environmental Contamination and Toxicology*, 76, 242-248

Nowak B.F. and Kingsford M.J.(2003): "Exposure to Thiodan® results in lipofuscin accumulation in hepatocytes of the freshwater catfish *Tandanus tandanus*", *Dis. Aquat. Org*., 56, 135–143

Petri D, Glover CN, Ylving S, Kolas K, Fremmersvik G, Waagbo R, Berntssen MHG (2006): "Sensitivity of Atlantic salmon (*Salmo salar*) to dietary endosulfan as assessed by haematology, blood biochemistry and growth parameters", *Aquat Toxicol* 80:207-216.

Ramesh M. and Saravanan M. (2008): "Haematological and Biochemical responses in freshwater fish, *Cyprinus carpio* exposed to chlorpyrifos", *Int. J. Integrative Biol.,* 3, 80-83

Rand G.M., Carriger J.F., GardinaliP.R. and Castro J. (2010): "Endosulfan and its metabolite, endosulfan sulfate, in freshwater ecosystems of south Florida: a probabilistic aquatic ecological risk assessment", *Ecotoxicology*, 19, 879–900

Sastry K.V. and SiddiquiA.A. (1982): "Effect of endosulfan and quinalphos on the intestinal absorption of glucose by the intestine of freshwater fish, *Channa punctatus", Toxicol.Lett.*, 12, 289- 293

Sastry K.V., Sharma K.S. (1979): "Endrin induced hepatic injury in *Channa punctatus* (Ham)",*Ind J Fish*, 26, 250–253

Seth N. and Saxena K. K. (2003): "Haematological responses in freshwater fish, *Channa punctatus* due to fenvalerate", *Bull. Environ. Contami.Toxicol.,* 71, 1192-1199

Sharma A., Mishra M., Ram K.R., Kumar R., Abdin M.Z. andChowdhuri D.K. (2011): "Transcriptome analysis provides insights for understanding the adverse effects of endosulfan in Drosophila melanogaster", *Chemosphere*, 82, 370-376

Sharma K., Pal A. K.,Sahu N.P.,Dalvi R.S., Chatterjee N., Mukherjee S.C. and Baruah K. (2012). "Acute and chronic effect of endosulfan on haemato-immunological and histopathological responses of a threatened freshwater fish, spotted murrel, *Channa punctatus"*, *Fish Physical Biochem*, 38, 499-509

Suratensis,*International Journal of Innovative Science and Research Technology*, 3(6), 540-544

Stanley K.A., Curtis L.R., Simonich S.L.M., Tanguay L.R. (2009): "Endosulfan I and endosulfan sulfate disrupts zebrafish embryonic development", *Aquatic Toxicology*, 95 (4), 355–361

Sutherland T.D., Horne I., Weir K.M., Russell R.J., Oakeshott J.G. (2004): "Toxicity and residues of endosulfan isomers", *Rev. Environmental Contamination Toxicology*, 183, 99–113

Tnabe S. andTatsukawa R. (1980): "Chlorinated hydro-carbons in the North Pacific and Indian Oceans", *J. Oceanogr.Soc. Jpn,* 36, 217- 226

Tuduri L., Harner T., Blanchard P., Li Y, Poissant L., WaiteD.T., Murphy C. andBelzer W.A.(2006): "Review of currently used pesticides (CUPs) in Canadian air and precipitation: part 1: lindane and endosulfans", *Atmosphere Environment*, 40, 1563–1578

UNEP (2005): Ridding the world of persistent organic pollutant: A guide to the Stockholm convention on persistent organic pollutants. United Nations Environment Programme, Chemin des Anemone, Geneva, Switzerland

US Environmental Protection Agency, 2002. Reregistration eligibility decision for Endosulfan, EPA 738-R-02-013

Van Dyk J.S. andPletschke B. (2011): "Review on the use of enzymes for the detection of organochlorine, organophosphate and carbamate pesticides in the environment", *Chemosphere*, 82, 291–307

Van M.T., Kuo J.,Buday C., Schroeder G., Van Aggelen G. and Pasternak J. (2005): "Toxicity of á-,â-, (á+â)-endosulfan and their formulated and degradation products to Daphnia magna, Hyalella azteca, *Oncoryhychus mykiss*, *Oncorhychus kisutch*, and biological implication in stream*", Environmental Toxicology Chemistry,* 24, 1146-1154

Velasco-Santamaria Y.M., HandyR.D. and Sloman K.A. (2011): "Endosulfan affects health variables in adult zebrafish (*Danio rerio*) and induces alternation in larvae development", *Comperative Biochemistry and Physiology, part C Toxicology & Pharmacology*, 15(3), 372-380

Velisek J., Svobodova Z., Piackova V. and Sudova E. (2009): "Effects of acute exposure to metribuzin on some hematological, biochemical and histopathological para-meters of common carp (*Cyprinus carpio* L.*)", Bul. Environ Contam Toxicol*., 82, 492–495

YekeenTaofeek A. and FawoleOlatunde O. (2011): "Toxic effects of endosulfan on haematological and biochemical indices of *Clarias gariepinus"*, *Artificial journal of biotechnology,* 10(64), 14090-14096

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Problem and Prospect of E-Rickshaw—An Overview

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Abstract

Movements of people, goods and information have always been fundamental components of human societies. Transportation developments have taken place since the beginning of the industrial revolution being linked with growing economic opportunities. Road transport has become dominant land transport system of today. No other form of transport is able to provide such a comprehensive door to door or origin to destination service nor does any other mode have such an extensive route network. Public transport system is used by majority of commuters in India because it is available to the public of all economic ranges and is accessible to very remote parts in any place. To emphasize the e-rickshaw issues in any small town, Berhampore Town has been chosen for a case study. Berhampore is the administrative headquarters of the Murshidabad district. Berhampore is located at $24^0 06'$ N $88^0 15'$ E / 24.1^0 N 88.25^0 E. having area of 31.42 sq.km.with a population of 305,609 (Census 2011). Inter district bus service is not well developed in this town. Buses are available for Kolkata, Asansol, Siliguri, Islampur and Beldanga. Good transport facility with Tuktukor Toto as a mode of transportation is a very recent arrangement.Before the arrival of toto Berhampore was facing an inefficient and costly mode of transport in the form of Rickshaw.The main objectives of the study are to investigate the present infrastructure of transport system existing in the city, to find out the reason behind the popularity of Toto and to enquire the problem of the emergence of Tuktuk etc.For the purpose of this study primary data has been collected from selected households of different wards of Berhampore Municipality. Secondary data were gathered from different sources like books, journals, articles, Berhampore Municipality etc. Several quantitative, statistical and cartographic techniques have been used to analyze the data.

Key Words

Transport, Development, Tuktuk, Connectivity

Introduction

Inefficient transport system not only hinders the development of the country but also slows down the day to day process. At each stage of human societal development a particular transport mode has been developed or adapted. Each transport mode and technology is linked to certain aspects of economic opportunities, notably in terms of market areas, types of commodities that can be transported including passengers and

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economies of scale. Transport by itself is not a sufficient condition for development; however the lack of transport infrastructure can be seen as a constraining factor for development.Transport involves two aspects- a vehicle or unit of conveyanceand a medium upon which to move.

Road transport has become dominant land transport system of today. The vast importance of contemporary road transport is very much a reflection of this unrivalled convenience to the user, especially in the conveyance of persons. No other form of transport is able to provide such a comprehensive door to door or origin to destination service nor does any other mode have such an extensive route network. Apart from this, road transport also provides a feeder or connection with other modes. The outstanding characteristic of road transport is its flexibility (H.M. Saxena2009).

Electric rickshaw (also known as TukTuk) have been becoming more popular in some cities since 2008 as an alternative to auto rickshaws and pulled rickshaws because of their low fuel cost and less human effort compared to pulled rickshaws and door to door service. They are being widely accepted as an alternative to petrol/Diesel/CNG auto rickshaws. They have three wheels pulled by an electric motor ranging from 650-1400 watts. Battery operated rickshaws could be low emitter complementary transport for all, mainly for low income group of people.

The electric automobile did not easily develop into a viable means of transportation. Research started from 1920-1960 until environmental issues of pollution and diminishing natural resources reawakened the need for a more environmental friendly means of transportation. In 1837, Robert Davidson of Scotland appears to have been the builder of first electric cars. During the late 1890's, the roads of the United States were populated by more electric automobiles with internal combustion engines.

Electric rickshaws are most popular in Asia. China is the largest manufacturer of electric rickshaws in the world due to low labour cost, high production rates and encouraging government policies on foreign trade. They import a large number regularly, thus the low cost Chinese version has been the first to show upon streets. They are mostly used in China, India, Bangladesh and Nepal. They have been showing up in other parts of Asia though in low numbers. Respective governments has made efforts to run them and made plans to issue licenses.

The first attempt to design electric rickshaw was done by Nimbkar Agricultural Research Institute in late 1990's. They modified the cycle rickshaw and converted it to an electric one. In India they are popularly known as e-rickshaws and are widely spread all over India. They gained popularity in India since 2011. They provide service in the city and also contribute in providing livelihood to people in India. Due to their low cost and high efficiency they are widely accepted in the Indian streets. But government policies have been threatening the e-rickshaw and banned them in the capital city of Delhi. Chinese imported rickshaws are much popular in India. The cost varies from Rs.85000 to Rs.125000. The cost escalates due to battery(Lead Acid Battery) which costs around Rs.17000 to Rs.22000.

Study Area

Berhampore is the seventh largest city in West Bengal (after Kolkata, Howrah, Asansol, Durgapur,Siliguri and Malda) and situated in central part of West Bengal. Berhamporehas been nominated for becoming a municipal corporation. In earlier days it was known as Brahmapur because many of the Brahmin families settled there. Berhampore is the administrative headquarters of the Murshidabad district. It is located about 200 km from Kolkata (earlier known as Calcutta), the state capital.Berhampore is located at 24^0 06′ N 88^0 15′ E / 24.1^0 N 88.25^0 E. It has an average elevation of 18 metres (59 feet).The city is located approximately 200 km north and is situated on the eastern side of the Bhagirathi River, a major distributary of the Ganges. Present area under Berhampore municipality is 31.42sq.km.In the 2011 Census, Berhampore Urban Agglomeration had a population of 305,609, out of which 156,489 were males and 149,120 were females. Modern Berhampore emerged just after the Plassey battle was over, in around 1767, when an army cantonment was built and the township grew undoubtedly around the cantonment gradually. Later the area of the township increased and finally in 1876, by the establishment of Berhampore Municipality, the cantonment and some adjacent areas were included within the greater municipal domain. Among them Saidabad in the north and Cossim bazaar in the north east were of age old origin.

Objectives

1. To investigate the present infrastructure of transport system existing in Berhampore city
2. To find out the reason behind the popularity of Tuktuk as a mode of transport
3. To enquire the effect of the emergence of Tuktuk in the society

Methodology

The methodologies that govern different stages of my study are the pre-field study, field study and the post field study. A structured questionnaire study has been carried out during the field study.

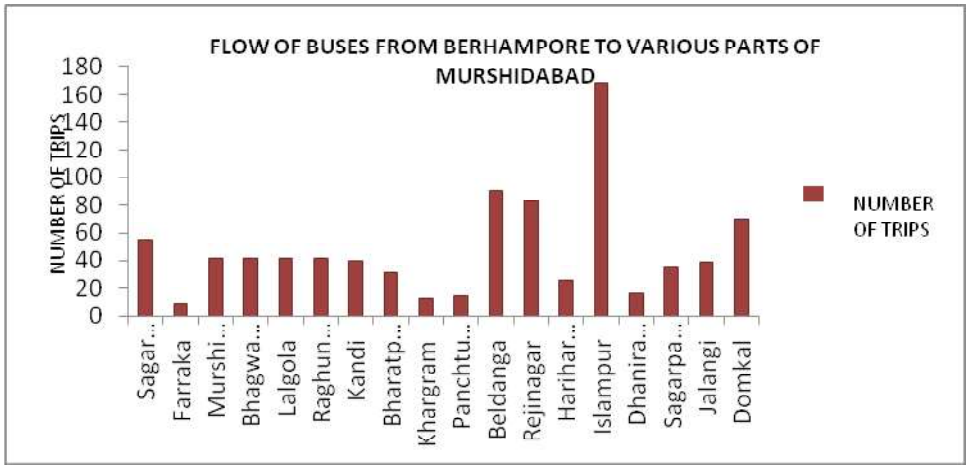
Central Queries

- What is the present status of transport facility of Berhampore Municipality?
- What are the reasons behind the emergence of Tuktuk and its popularity within a short span of time?
- What are the conditions of other income group after the emergence of Tuktuk?
- What are the opinions of the passengers regarding Tuktuk in Berhampore Municipality?

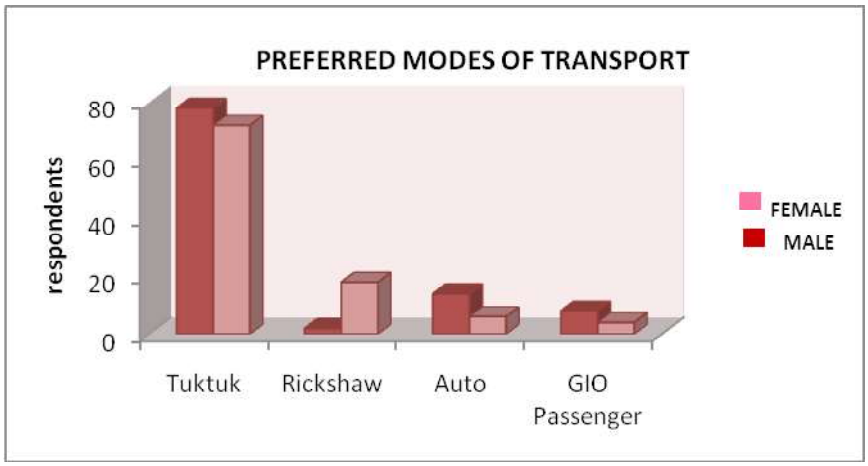
Discussion

Role of Population- Towns and cities have shaped up as centres of administrative and cultural significance through the centuries. Towns are strong points of power and military force and they express the preparatory stage of urbanization.Decadal population in Berhampore Municipality is showing an increasing trend. In the

1991 Census the total population was 115,144 and in 2001 Census the total population increased to 160,168 while in 2011 Census the total population further increased to 195,363.The density of population of the municipality is 3500 persons per sq.km (Census 2011). The study reveals thatamong 25 wards, ward 2 bears the lowest population desnsity i.e. 2194 persons per sq.km. and ward number 6 and 13 has the highest density of population. Road infrastructure of the municipality is favourable for the development of local transport facility in and around the municipal area.



Source: Bus Federation of Berhampore

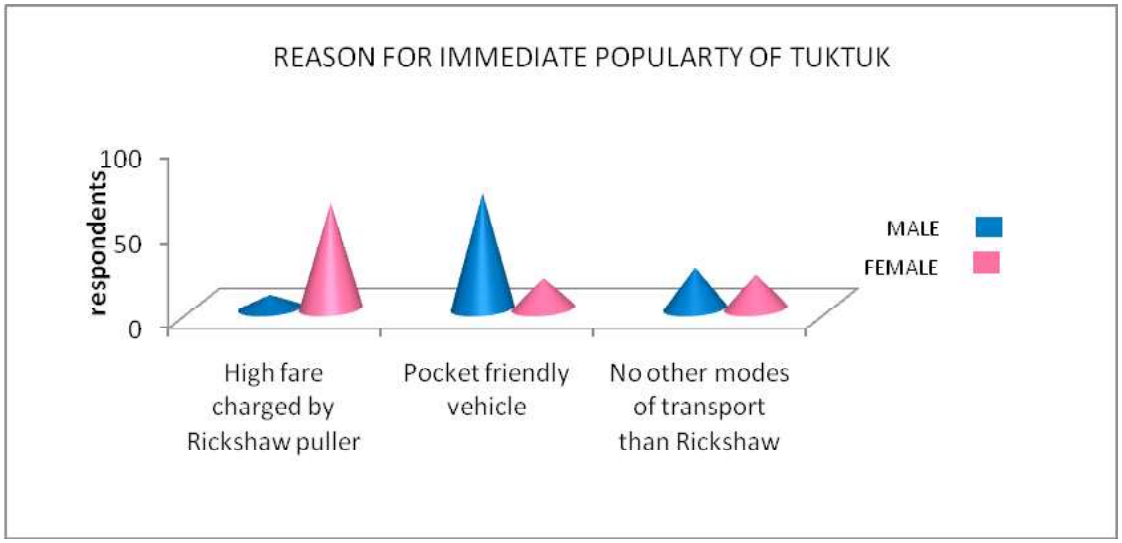


Source: primary data

Present status of transport facility within the city-Though population within the city is remarkably dense but bus services are not so frequent all around to satisfy the need of the local people. They had to depend solely on the rickshaw pullers. Citizens of Berhampore were fed up of bargaining with those rickshaw pullers. Fares charged in rickshaw was so high as if the citizen were awaiting something very new in the city and therefore the popularity of Tuktuk is skytouching.

Preferred modes of transport

Tuktuk became a very popular mode of transport as it met with all the demand of citizens since its inception in Berhampore Municipality. This vehicle is equally preferred by male as well as female population because of certain reasons. After the introduction of tuktuk almost door to door accessibility has been possible, high charge of rickshaw pullers were unbearable and moreover the cheap and fixed fare for each person have been more attractive.So most of the people who are solely dependent on public transport,they happily accept tuktuk as an alternative mode of transport. Due to huge popularity within a short period tuktuk, both registered and unregistered started running on the road while rickshaws lost its importance.



Source: primary data

Reason for Buying Tuktuk

Tuktuk became very popular mode of transport within few days after its introduction and therefore; the craze for buying Tuktuk was very high. Huge income with least effort, particularly the new generation prefers to choose this as their profession and want to be an independent earner - these are few of the reasons to buy

Tuktuk. It is evident that highest percentage of Tuktuk drivers belong to the age group of 25 years to 34 years i.e. the young generation has chosen this profession in maximum number.

Age Group	Total number of Tuktuk drivers in percentage
< 25	19
25-29	25
30-34	27
35-39	14
40-44	9
> 45	6

Source: primary data

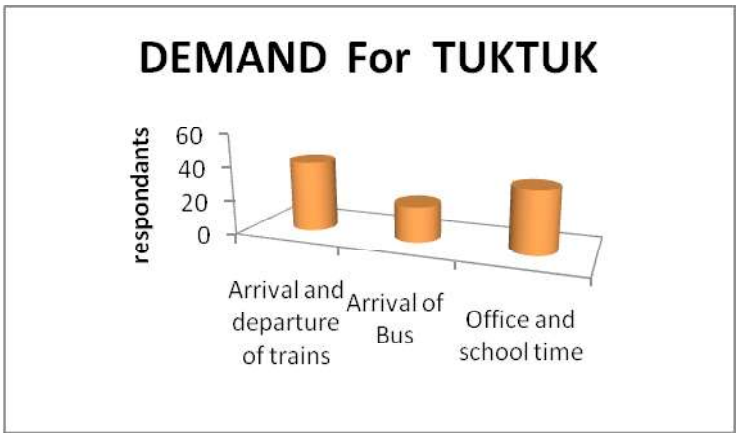
New job opportunity has opened up for the young generation in Berhampore Municipality. Not only the people within the city could avail this advantage but also in areas outside the municipality this new job generation is being appreciated. This profession has attracted very few migrants from areas outside this C.D Block.Tuktuk drivers are local residents of Berhampore C.D.Block and only few percent of Tuktuk drivers migrated from other places. Migrated drivers mainly consists of ofTuktuk drivers from Murshidabad Municipality who migrate to earn more profit in Berhampore Municipality area.

Possession of Vehicles

The cost of Tuktuk vehicles ranges from Rs.90000 to Rs.130000, therefore it is not affordable for everyone to buy this vehicle. But to gain maximum profitTuktuk drivers has been trying to own this vehicle.

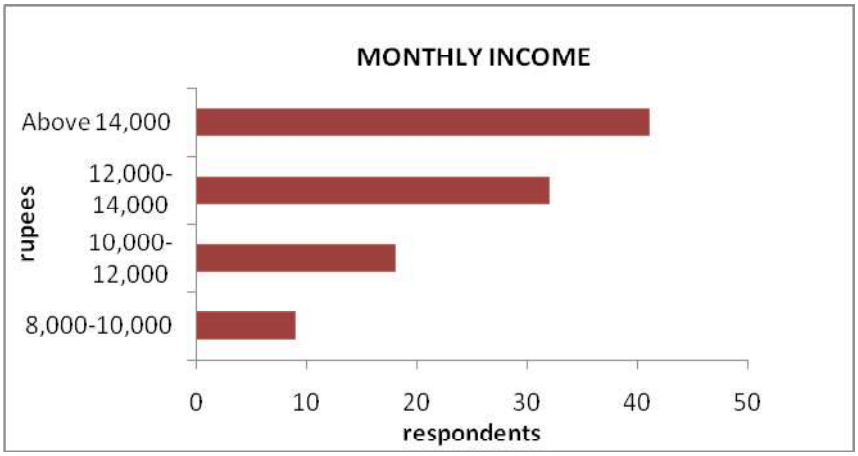
Demand of Tuktuk & Number of trips per day

Demand of Tuktuk is generally constant throughout the day. There are some peak period which generates high demand forTuktuk. Following figure shows that demand forTuktuk is high during the arrival and departure of trains i.e. 42 percent. 37 percent of demand forTuktuk is during office hours and 21 percent of demand generates on the arrival of the buses. Most of the Tuktuk drivers make their maximum trip from the Bus terminus to Station and vice versa. It is evident that number of trips per day ranges from 9 to more than 14 trips per day. 11 percent of Tuktuk drivers make 9 to 11 trips per day, 58 percent of Tuktuk drivers make 12 to 14 trips per day and 31 percent of Tuktuk drivers make above 14 trips per day.



Source: primary data

Monthly Income and Expenditure of Tuktuk Drivers- The income of Tuktuk drivers was quite high during its introduction in BerhamporeMunicipaity. Looking at the high potentiality and profitability in this profession many people came in and now the number of Tuktuk drivers has crossed its entire limit. Monthly average income of Tuktuk drivers in general is Rs.12000. From the income diagram it is evident that monthly income of 9 percent Tuktuk drivers is between Rs.8000 to Rs.9999, Tuktuk drivers of this income group basically drives rented cars as they has to pay Rs.250 per day as a rent to their owners. Monthly income of 18 percent Tuktuk drivers is between Rs.10000 to Rs.11999. This income group basically consists of unregistered Tuktuk drivers as they move with less number of passenger, often one. Monthly income of 32 percent of Tuktuk drivers is between Rs.12000 to Rs. 14000. Monthly income of 41 percent Tuktuk drivers is above Rs.14000.Average expenditure of all the Tuktuk drivers is same. Daily expenditure for charging the battery of Tuktuk is Rs.50.A Registered Tuktuk has to bear the yearly tax of Rs.1800 charged by Berhampore Municipality. Other expenditures such as repair work for punctured tyre-tube, oiling of vehicle etcgoes on regularly.



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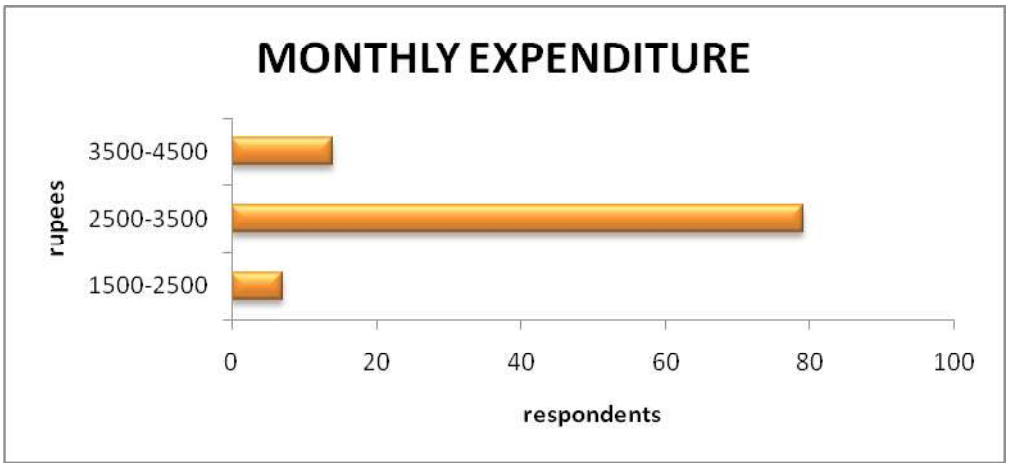
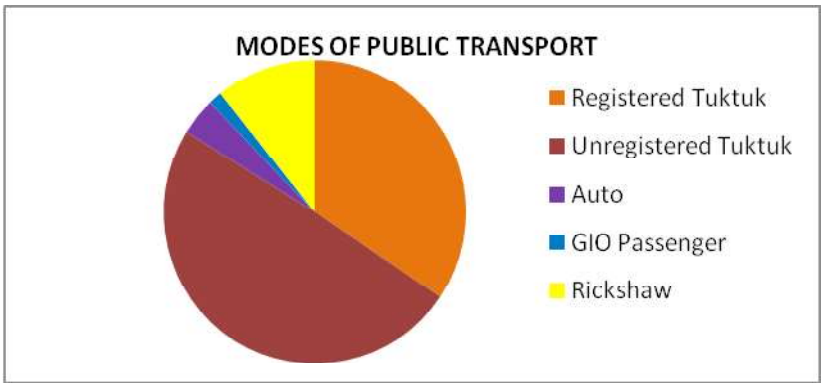


Source: primary data

Generation of New Employment

According to the Chairman of Berhampore Municipality Tuktuk has generated a pool of new employment opportunities in Berhampore. He added there was also dearth of popular modes of vehicle in the area. So the municipality decided to issue the permits for many Tuktuk. But for the lust for new employment, lot of unregistered Tuktuk were running on the roads illegally and the municipality has not taken any steps yet.



Source: primary data

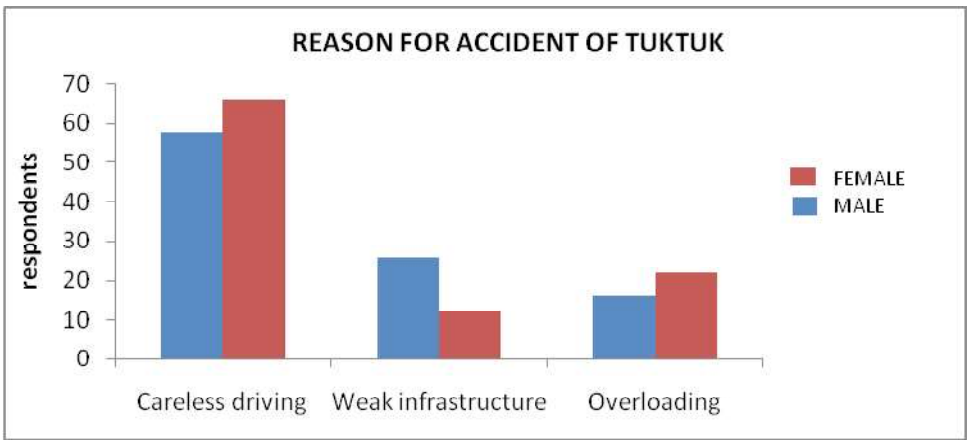
Effect of Tuktukon the society

After the emergence of Tuktuk, rickshaw pullers have been very badly affected. As the fare of Tuktuk is much cheaper than rickshaw, passengers have shifted to Tuktuk. So rickshaw pullers lost their passengers and their monthly income hasgotreduced. Most of the time they had to sit idle without passenger. Economic condition of the rickshaw pullers of Berhampore can be said to be worst. Neither do they have any option to change their profession nor any educational background, and above all miserable poverty force them to continue this

profession. To sustain in this profession they reduced their fare and increased the number of trips to maintain their average per day earning. Still their situation hasn't improved as the number of passengers have declined.

Perception analysis regarding new mode of transport

Initiative of Berhampore Municipality at the beginning was very good but the present situation in Berhampore is quite devastating, the number of unregistered vehicles has surpassed the number of registered vehicles. Traffic congestion in and around the city due to unregistered Tuktukhas been a daily event. Moreover road accident due to careless driving and overloading of Tuktuk has been increasing day by day. Many people opined that weak infrastructure and poor maintenance by municipality is the root cause. Unregistered Tuktuks have no such permanent stand and they are the main headache of pedestrian and cyclist. Municipality do not increase the parking space and Tuktuk drivers are bound to keep theirTuktuk here and there.



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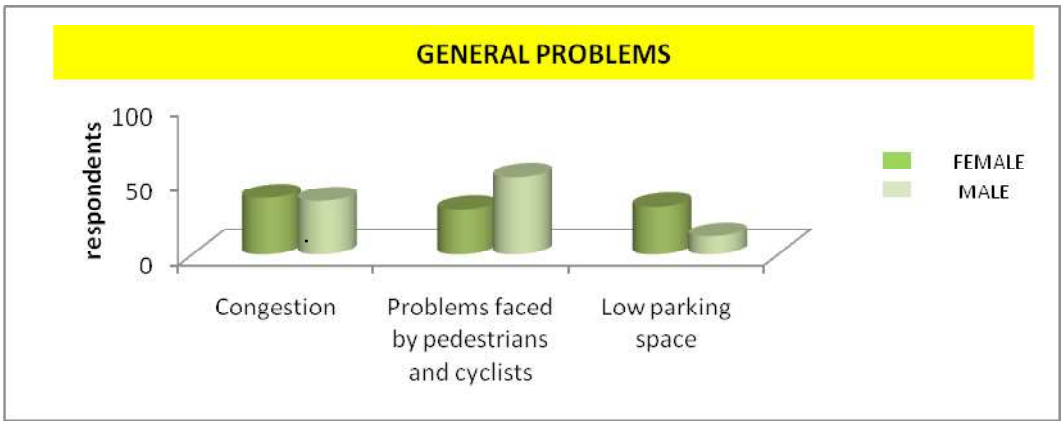

Source: primary data

Findings

- Berhampore has good road infrastructure, availability of buses from Berhampore to various other places outside Berhampore is good enough but bus services are not available within the Municipality.
- Passengers are benefited and preferring Tuktuk as a popular mode of transport because of its several advantages.
- Berhampore Municipality has promoted Tuktuk to modify modes of transport in Berhampore.
- New and popular mode of transport Tuktuk within Berhampore Municipality has replaced the age old rickshaw pulling.
- The rickshaw pullers are moving under the grudge of poverty.
- Main concern in Berhampore Municipality have been - problems related to huge congestion and problems faced by pedestrians, both because of Tuktuk.
- Berhampore has good road infrastructure, availability of buses from Berhampore to various other places outside Berhampore is good enough but still Bus Services are not available within the Municipality.
- Passengers are benefited and preferring Tuktuk as a popular mode of transport because of its several advantages.
- Berhampore Municipality has promoted Tuktuk to modify modes of transportsystem inBerhampore.
- New and popular mode of transport Tuktuk within Berhampore Municipality has replaced the age old Rickshaw pulling.
- Rickshaw puller is moving under the grudge of poverty.
- Problems of huge congestion and problems faced by pedestrians because of Tuktuk are the main concern in Berhampore Municipality.

Problems

Tuktuk are comparatively lighter in weight and hence cannot cope with larger weight. There is always a chance of Tuktuk being toppled over if it exceeds the permissible weight.

- No proper regulations and guidelines have been fixed. As a result, the drivers are not fully trained to drive these E-Rickshaws. Most of them do not even have a driving license. This is a matter of serious concern.
- Often worst is the problem where lanes are narrow; it becomes an important contributor of huge congestion and a regular problem to pedestrians and cycle riders.
- This new vehicle in Berhampore is silently replacing the jobs of the rickshaw pullers, therefore generating a pool of unemployed workers.

Suggestion

Curbing of Unregistered Tuktuk from Berhampore Municipality, as these are the main reason for congestion in Berhampore, is widely recommended.

- Only Registered Tuktuk with driving license should be allowed in Berhampore Municipality.
- Proper Tuktuk Stand with proper regulations should be maintained.
- Some initiative must be taken to improve the condition of the rickshaw pullers.

Conclusion

After all the discussion and findings we are aware of the fact, that the transportation facilities desperately needed modification which led to the emergence of Tuktuk. The arrival of Tuktuk in Berhampore was a gift to the population of Berhampore. It was indeed in need of a modern and fast moving vehicle. Rickshaw provides slow as well as high fare charge which was a true disadvantage for the population. ThereforeTuktuk received warm welcome from the Municipality as well as the population. But Tuktuk has not been properly managed by Berhampore Municipality therefore; the number of Unregistered Tuktuk rose to its peak which has led to serious problem of congestion in Berhampore. Problems faced by rickshaw pullers due to the emergence of this new mode of transport need proper attention of the Berhampore Municipality. The Municipality should provide them with some kind of subsidy or some other arrangements which may help them to run their family. As Tuktuk is the main source of problems in Berhampore therefore it needs to be properly managed. The study depicts that efficient management of Tuktuk has emerged as the dire need of the people of Berhampore.

References

Akhter S., Ahmad S., IqbalM.(2013): "Study on Merits and Demerits of Two Transport Systems : Battery Operated Easy Bike with CNG Operated Auto Rickshaw at Sylhet City in Bangladesh,*IOSR Journal of Mechanical and Civil Engineering*, Vol 5, PP 25-32,(Mar-Apr.2013)

HossainS., Mitra,S K., Rana,S., Roy,S S. (2013): "Exploring operational Characteristics of Battery operated Auto-Rickshaws in Urban Transportation System", *American Journal of Engineering Research*, Vol2, Issue4, pp-01-11

MonzurulMamun, A H M. (2015)," Electric Three Wheelers and Municipal Transportation in Bangladesh", *International Journal of Innovative and Applied Research*, Vol 3,Issue 2,pp 12-16

RajvanshiA.K.(2002): " Electric and improved cycle rickshaw as a sustainable transport system for India" , *Current Science*, Vol3,No 6

Roy A. (2016):"the importance of e-rickshaw service in the urban transport sphere of Burddhaman",*International* Journal of Scientific and Research Publications,volume 6, issue9,pp 702

Sing S. (2010): "A comprehensive study of the battery operated e-rickshaws in the state of Delhi", Center for Civil society, pp 2-32

www.berhamporemunicipality.org (15.12.17)

https://en.wikipedia.org/wiki/Electric_rickshaw(21.02.18)

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A Case Study of Human Resource Development Index of Birbhum Districts, India: A Cartographic Representation

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Abstract

In this paper the main observable issue is human resource development of Birbhum district. For this analytical work, data have been collected from District Statistical Handbook, District Census Report of 2001 and District Human Development Report 2009. In Birbhum district a large part of this district is still backward with respect to human resource development. The main aim of this paper is to study the causes of backwardness of this district. The Birbhum district is very famous for Santinikatan, Bolpur the work place of Rabindranath Tagore. "HRD is the process of determining the optimum methods of developing and improving the human resources of an organization and the systematic improvement of the performance of employees through training, education and development and leadership for the mutual attainment of organizational and personal goals" (Smith). Human resource development has always been crucial not only for an organisation but is also relevant for economic development of our society.

Keywords

Human resource, Human resource management, Urbanization, Cartographic

Introduction

Human Resource Development (HRD) concept was first introduced by Leonard Nadler in 1969 in a conference in US. He defined Human Resource Development (HRD) as "those learning experience which are organized, for a specific time, and designed to bring about the possibility of behavioural change". Human Resource Development is the ultimate goal of national development. HRD is the process of increasing the knowledge, skills and the capacities of all the people in a society (Nadler 1969). Human Resource Development

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(HRD) is the part of human resource management that specifically deals with training and development of the employees in the organization (Roy Debasish, Mondal Anushri 2014). Human Resource Development (HRD) is a positive concept, as an area of managing human resources. It is based on the belief that it is imperative and constructive for an organization to invest in human beings to bring substantial benefits in the long run. It aims at the overall development of the human resource in order to contribute for the well-being of the employees, organization and the society at large. Out of the fundamental areas of Management, Human Resource Management is adjudged as the most important area of study and concern. The efficiency of the whole lot of activities carried out in an organization starting from the production process to the management of various areas of administration depends to a large extent on the level of Human Resource Development (Swarajaya Lakshmi 2004). Human Resource Development (HRD) is an area of study which is getting broader and broader with time. Many eminent writers have contributed in this regard and the concept is been getting wider. From National to Western concept of Human Resource Development (HRD) and now with the advent of globalization Global and New concept of the subject has been knocking the doors of researchers (Rao and Pereira: 1986). According to M.N. Khan, Human Resource Development (HRD) is the blend of increasing knowledge, capabilities and positive work attitudes of all people working at all levels in a business undertaking (Khan, M.N. 1987). "HRD is a development oriented planning effort in the personnel area which is basically concerned with the development of human resources in the organization for improving the existing capabilities and acquiring new capabilities for achievement of the corporate and individual goals" (Sanker, C.S.1984).

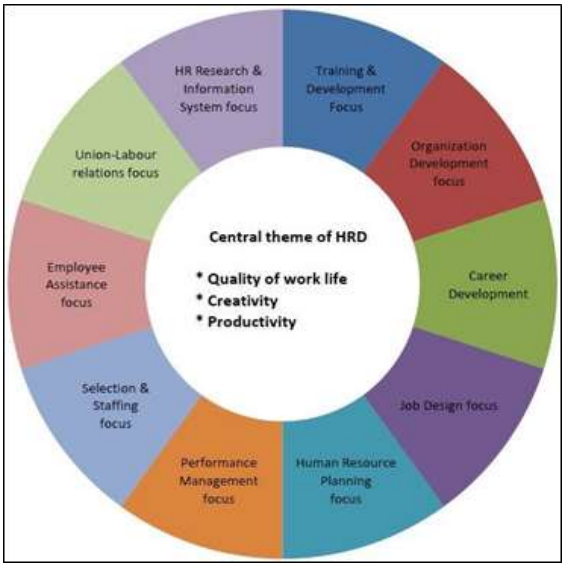


Figure 1 Human Resource Development Wheel (the main focus of HRDI)

HRD is basically a human process. Every organization consists of man, material, machines or infrastructure and many of these human factors are of special category not only because they have their own ideas, feelings,

hope, aspirations but also because they are the prime movers behind the other factors, ...'' (B.L.Raina 1998).The Birbhum district originates in the Chotonagpur plateau region of Jharkhand and slopes across the districts in west east direction. The district is characterized by an undulating topography. In economic term, it could be described as the accumulation or amalgamation of human capital and its effective investment in the development of an economy. In most of the blocks of this district the irrigation facilities are very poor, health care facilities are not favourable. From the social and cultural points of view, the development of human resources helps people to lead fuller and richer lives, less bound by tradition. Human Resource Development (HRD) is an important discipline and relevant study to understand the present situation or condition of the society (Roy Debasish; Mondal Anushri 2014). Birbhum district is situated between 23^0 33' and $24^0$35' north latitude and between 87^0 10′ and 88^0 2′ east longitude Fig 2. Birbhum is the northern most district of the Burdwan division. The extension of Birbhum district is 1752 square miles, and according to the Census of 2011 the total population is 3502387. Suri is the principal town, which is also the Administrative Headquarters of Birbhum district. The Birbhum district is characterized by an undulating topography caused by the Chhotanagpur plateau that passes through the western borders of the district. The land terrain slopes down towards the east and merges with the alluvial plains of the Ganga. Among the total population of this district sixty-nine percent of population depend on agriculture, 11.7 per cent on industries, and 0.4 per cent on commerce.

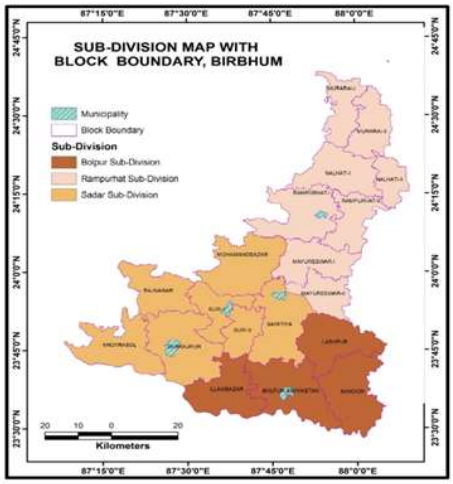


Figure 2 LOCATION MAP OF BIRBHUM DISTRICT (BLOCKWISE BOUNDARY OF BIRBHUM DIST.)

Methodology

The study is based on data from secondary sources. The data required for the study have been collected from 1) Birbhum District Statistical Handbook 2010-2011, 2) Birbhum District Statistical Handbook 2001. To assess the level of human resource development of this particular region, following indicators have been applied -

1. Index of Urbanization = (Urban Population of the Block ÷ Total Population of the block) × 100
2. Index of Workers = (Total Workers of the block ÷ Total Population of the block) × 100
3. Index of Literacy = (Literate Population of the block ÷ Total Population of the block) × 100
4. Index of Female Literacy = (Female Literates of the block ÷ Total Female Population of the block) ×100
5. Index of Schools = (Total Schools of the Block ÷ Total Students of the Block) × 100
6. Human resource development index = (Index of Urbanization + Index of Workers + Index of Literacy + Index of Female Literacy + Index of Schools) $^{1}/_{5}$

The HRDI value is categorised as:

- **HRDI > 30** (Area of high Human Resource Development)
- **HRDI = 25-30** (Area of Moderate Human Resource Development)
- **HRDI < 25** (Area of Low Human Resource Development)

Result and Discussion

1. Index of Urbanization: Urbanization is the process refers to the population shift from rural to urban residency. The index of Urbanisation is one of the important assessments of the human resource development. The urban area is high development of human resource. Communication network, Educational instructions, Infrastructure facility are good from urban area. The urbanization index is thus calculated as:

Index of Urbanization = (Urban Population of the Block ÷ Total Population of the block) × 100.

Table 1: Index of Urbanisation

NAME OF C.D BLOCKS	TOTAL POPULATION	URBAN POPULATION	INDEX OF URBANIZATION
NALHATI I	208642	20824	9.981
NALHATI II	107658	0	NA
MURARIA I	154342	0	NA
MURARIA II	177748	0	NA
MAYURESWAR I	139733	0	NA
MAYURESWAR II	113031	0	NA
RAMPURHAT I	159193	50613	31.793
RAMPURHAT II	158742	0	NA
MOHAMMAD BAZAR	139465	0	NA
SAINTHIA	175645	47556	27.075
DUBRAJPUR	159011	32752	20.597

RAJNAGAR	69692	0	NA
SURI I	96476	61806	64.064
SURI II	77001	0	NA
KHOYRASOLE	135101	0	NA
BOLPUR SANTHINIKATAN	178111	65693	36.883
LABHPUR	176865	0	NA
NANOOR	193775	0	NA
ILLAMBAZAR	145182	0	NA

Source: computed by author (Census data of Birbhum district)

2. Index of Workers: Worker population indicate directly good economic base of the region. Hence high number of workers is associated with higher degree of human resource development. The formula of index is as following-

Index of Workers = (Total Workers of the block ÷ Total Population of the block) × 100.

Table 2: Index of Workers

NAME OF C.D BLOCKS	TOTAL POPULATION	TOTAL WORKERS	INDEX OF WSORKERS
NALHATI I	208642	73357	35.159
NALHATI II	107658	35879	33.327
MURARIA I	154342	50520	32.733
MURARIA II	177748	57581	32.395
MAYURESWAR I	139733	53701	38.431
MAYURESWAR II	113031	43097	38.128
RAMPURHAT I	159193	70571	44.33
RAMPURHAT II	158742	55568	35.005
MOHAMMAD BAZAR	139465	52446	37.605
SAINTHIA	175645	67463	38.409
DUBRAJPUR	159011	63296	39.803
RAJNAGAR	69692	31918	45.799
SURI I	96476	41309	42.818
SURI II	77001	38045	49.408
KHOYRASOLE	135101	47433	35.109
BOLPUR SANTHINIKATAN	178111	77886	43.729
LABHPUR	176865	62601	35.395

NANOOR	193775	71469	36.882
ILLAMBAZAR	145182	53029	36.526

Source: computed by author (census data of Birbhum district)

3. Index of Literacy: Literacy is one of the most important parameter to assess the level of human development of any regions. This is the most important index to measure the level of human resource development. The index has been calculated on the basis of the following formula:

Index of Literacy = (Literate Population of the block ÷ Total Population of the block) × 100

Table 3: Index of Literacy

NAME OF C.D BLOCKS	TOTAL POPULATION	LITERATE POPULATION	INDEX OF LITERACY
NALHATI I	208642	109883	44.25
NALHATI II	107658	54027	42.707
MURARIA I	154342	57156	29.805
MURARIA II	177748	66201	30.277
MAYURESWAR I	139733	77198	46.035
MAYURESWAR II	113031	60089	43.972
RAMPURHAT I	159193	82321	42.807
RAMPURHAT II	158742	84042	44.321
MOHAMMAD BAZAR	139465	63310	36.363
SAINTHIA	175645	96608	46.408
DUBRAJPUR	159011	74837	37.052
RAJNAGAR	69692	34153	38.464
SURI I	96476	50799	43.593
SURI II	77001	41052	44.768
KHOYRASOLE	135101	69513	40.678
BOLPUR SANTHINIKATAN	178111	91199	42.947
LABHPUR	176865	93013	44.618
NANOOR	193775	100541	44.964
ILLAMBAZAR	145182	75847	43.766

Source: computed by author (Census data of Birbhum district)

4. Index of School: Basic education is one of the important parameter of human resource. The frequency or number Schools (primary and high school) are closely related with the level of education and also the development of human resource. The index has been calculated on the basis of the following formula-

Index of Schools = (Total Schools of the Block ÷ Total Students of the Block)×100

Table 4: Index of Literacy

NAME OF C.D BLOCK	TOTAL POPULATION	NO. OF SCHOOLS	TOTAL STUDENTS	INDEX OF SCHOOL
NALHATI I	208642	156	39054	0.399
NALHATI II	107658	82	28189	0.291
MURARIA I	154342	115	35366	0.325
MURARIA II	177748	104	37956	0.274
MAYURESWAR I	139733	137	30212	0.453
MAYURESWAR II	113031	102	22010	0.463
RAMPURHAT I	159193	164	28912	0.567
RAMPURHAT II	158742	136	32920	0.413
MOHAMMAD BAZAR	139465	144	30912	0.466
SAINTHIA	175645	200	31880	0.627
DUBRAJPUR	159011	158	29044	0.544
RAJNAGAR	69692	101	12732	0.793
SURI I	96476	102	19674	0.518
SURI II	77001	90	16709	0.539
KHOYRASOLE	135101	141	26498	0.532
BOLPUR SANTHINIKATAN	178111	174	36438	0.478
LABHPUR	176865	190	38577	0.493
NANOOR	193775	187	39131	0.478
ILLAMBAZAR	145182	156	29803	0.523

5. Index of Female Literacy: Literacy of female can be regarded as important parameter to measure the level of human resource development. The index has been calculated on the basis of the following formula:

Index of Female Literacy = (Female Literates of the block ÷ Total Female Population of the block) × 100

Table 5: Index of Female Literacy

NAME OF C.D BLOCKS	TOTAL POPULATION	FEMALE LITERATRS	INDEX OF FEMALE LITEREACY
NALHATI I	208642	44743	44.00
NALHATI II	107658	22499	42.707
MURARIA I	154342	22392	29.805
MURARIA II	177748	26424	30.277
MAYURESWAR I	139733	31342	46.035
MAYURESWAR II	113031	24117	43.972
RAMPURHAT I	159193	33323	42.807
RAMPURHAT II	158742	34049	44.321
MOHAMMAD BAZAR	139465	24756	36.363
SAINTHIA	175645	39724	46.408
DUBRAJPUR	159011	28768	37.052
RAJNAGAR	69692	13147	38.464
SURI I	96476	20287	43.593
SURI II	77001	16748	44.768
KHOYRASOLE	135101	26569	40.678
BOLPUR SANTHINIKATAN	178111	37462	42.947
LABHPUR	176865	38282	44.618
NANOOR	193775	42448	44.964
ILLAMBAZAR	145182	30835	43.766

Human Resource Development Indexes of Birbhum District:

Human Resource Development Index for 19 blocks of Birbhum District is calculated with the help of the above six indices. The formula is:

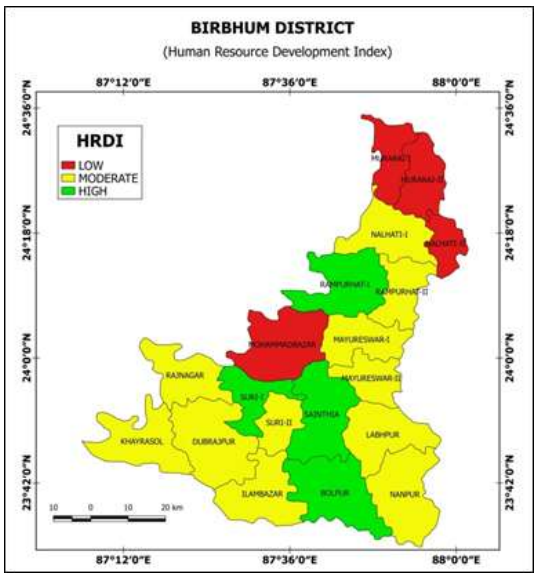
Human Resource Development Index (HRDI) = (Index of Urbanization + Index of Workers + Index of Literacy + Index of Female Literacy + Index of Schools) $_{1/5}$

Table 6: Human Development Index of Birbhum District

NAME OF C.D BLOCKS	INDEX OF URBANIZATION	INDEX OF WSORKERS	INDEX OF LITERACY	INDEX OF SCHOOL	INDEX OF FEMALE LITEREACY	HRDI
NALHATI I	9.981	35.159	44.25	0.399	44.25	26.8078
NALHATI II	NA	33.327	42.707	0.291	42.707	23.8064
MURARIA I	NA	32.733	29.805	0.325	29.805	18.5336

MURARIA II	NA	32.395	30.277	0.274	30.277	18.6446
MAYURESWAR I	NA	38.431	46.035	0.453	46.035	26.1908
MAYURESWAR II	NA	38.128	43.972	0.463	43.972	25.307
RAMPURHAT I	31.793	44.33	42.807	0.567	42.807	32.4608
RAMPURHAT II	NA	35.005	44.321	0.413	44.321	24.812
MOHAMMAD BAZAR	NA	37.605	36.363	0.466	36.363	22.1594
SAINTHIA	27.075	38.409	46.408	0.627	46.408	31.7854
DUBRAJPUR	20.597	39.803	37.052	0.544	37.052	27.0096
RAJNAGAR	NA	45.799	38.464	0.793	38.464	24.704
SURI I	64.064	42.818	43.593	0.518	43.593	38.9172
SURI II	NA	49.408	44.768	0.539	44.768	27.8966
KHOYRASOLE	NA	35.109	40.678	0.532	40.678	23.3994
BOLPUR SANTHINIKATAN	36.883	43.729	42.947	0.478	42.947	33.3968
LABHPUR	NA	35.395	44.618	0.493	44.618	25.0248
NANOOR	NA	36.882	44.964	0.478	44.964	25.4576
ILLAMBAZAR	NA	36.526	43.766	0.523	43.766	24.9162

Figure 3 HUMAN RESOURCE DEVELOPMENT INDEX OF BIRBHUM DISTRICT



Source computed by author

Area of High Human Resource Development:

The blocks with index value above 30.00 have been considered as "area of high human resource development". There are four blocks in this category. These are Suri-I (40.729) (Table 6), Bolpur-Sriniketan (35.05),Sainthia (33.50), Rampur hat-I (34.2356) (Table 6).

Area of Moderate Human Resource Development:

The blocks with index value 30.00 to 25.00 have been considered as "area of moderate human resource development". There are twelve blocks in this category. These are Nalhati –I (28.49), Mayureswar-I (27.633), Mayureswar-II (27.145), Dubrajpur (29.02), Rajnagar, Suri-II, Khoyrasole, Labhpur, Illambazar, Nanoor, Rampurhat-II (Table 6).

Area of Low Human Resource Development:

BLocks with index value below 25.00 have been considered as "area of low human resource development". There are three blocks in this category. These are Nalhati-II (25.00), Murarai-II (20.04), Murarai-I (19.979), Mohammad. (Table 6).

Conclusion

From the above analysis it got revealed that Suri-I block have done well with respect to Human Resource Development Index. Also, it can be remarked that a large part of the district has low and moderate human resource development, a large part of the Birbhum district is still backward with respect to human resource development Index. The situation is appalling. Government policy is necessary for over all development of the region. Planning and thereafter direct intervention is necessary particularly for improvement in education, urban facilities, transport and communication network, health sector, industries and commercial sector etc. Keeping view the block level information of the district, the study revealed that both region and sector specific policies may enhance Human Development, in aggregate for the entire district.

References

Directorate of Census Operations West Bengal (2011): District Census Handbook, Birbhum, Census of India 2011, West Bengal, Series - 20, Part XII-B, Village and Town wise Primary Census Abstract (PCA)

Government of West Bengal (2011): District Statistical Hand Book, Birbhum, Bureau of Applied Economics and Statistics, Department of Statistics & Programme Implementation, Government of West Bengal

Khan, M.N. (1987): "HRD in Modern Technological Structure", Indian Journal of Commerce*, XL No. 150-151, pg. 83*

Nadler, L. (1969): "The variety of Training Roles", American Society of Training and Development*, Miami USA Industrial and commercial training vol.1 Issue: 1 pp.34*

Rao, T.V. and Pereria, D.F. (1986): Recent Experiences in HRD*, Oxford and IBH Publishing Co. Ltd., New Delhi*

Roy D. & Mondal A. (2014): "Status of Human Development in the District of Birbhum at Block Level", International Journal of Sociology and Anthropology*, Vol. 1, No. 2, pp.62*

Sanker, C.S. (1984): "HRD in Banking Industry", Indian Journal of Training and Development*, No. 1, p.88*

Swarajaya L. C. (2005): Human Resource Development in Public Enterprises*, Discovery Publishing House, New Delhi, pg. 38-39*

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REMOTE SENSING AND MAPPING: A SUCCESSFUL APPLICATION IN RESEARCH INQUIRIES

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Abstract

"Remote Sensing (RS) refers to the science of identification of earth surface features and estimation of their geo-biophysical properties using electromagnetic radiation as a medium of interaction…RS data, with its ability for a synoptic view, repetitive coverage with calibrated sensors to detect changes, observations at different resolutions, provides a better alternative for natural resources management as compared to traditional methods" (Navalgund et. al. 2007: 1747). RS has enlarged the scope for inquiries and analysis of the data related to agriculture, forestry, water resources, land use, urban sprawl, geology, environment, coastal zone, marine resources, snow and glacier, disaster monitoring and mitigation, infrastructure development, etc enhancing the scope for specialized research. This paper therefore intends to highlight the various application of remotely sensed data especially targeted for sustainable management of resources.

Keywords:

Remote Sensing, hazard mapping, sustainable management, resource monitoring

Introduction:

Remote Sensing in the present day world is no denying having opened a new horizon to us. It not only facilitates new fields to explore but also helps in higher degrees of research. So far as the classical methods of terrain study are concerned, it was difficult to get into the unreachable areas; Remote Sensing techniques have eased out this problem. Furthermore, accuracy of the remotely sensed data lies beyond question. Besides this, remote sensing has helped in the procurement of the weather and climatic data which is ensured by the satellite-earth observation system. Accurate hazard mapping as a resultant of catastrophes like flood, cloud bursts, Tsunamis, forest fires, vulcanicity etc can be targeted. Monitoring of the behaviour of the rivers especially concerned with the river health by channel shifting, channel migration, river bank erosion can be done meticulously. With regard to resource studies, it has enhanced the scope of resource monitoring, mapping and sustainable management of our natural resources. Remote sensing also has a wide coverage and contribution towards the defense and security of the borders of our country. Remote Sensing therefore has become an indispensible tool for a modern-day world.

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What is Remote Sensing?

"Remote Sensing is the science and art of obtaining information about an object, area or phenomenon through the analysis of data acquired by a device that is not in contact with the object, area or phenomenon under investigation" (Lillesand & Kiefer 1994:1). To understand it very simply, remote sensing may be thought of as a reading process wherein our eyes acting as sensors responds to the light reflected from the pages of the books; the data acquired by our eyes are impulses corresponding to the amount of light reflected from the pages of the books. These data are analyzed and interpreted by our mental computer. Likewise, using various sensors data remotely collected, is analyzed to obtain information about some object, area or phenomena being investigated. Therefore, remote sensing basically involves a two-staged process: data acquisition and data analysis.

How the Remotely Sensed Data is Acquired and Analyzed?

Data acquisition is affected by some factors like propagation of energy through atmosphere, energy interactions with earth surface features, retransmission of energy through the atmosphere, air borne and/ or space borne sensors resulting in the generation of sensor data in either pictorial and /or digital form. In other words, the sensors are used to record variations of the reflectance of electromagnetic energy by the different earth surface features. Data analysis process involves examining the acquired data using various viewing and interpretation devices to analyze pictorial data or a computer to analyze digital sensor data. GIS may be involved here for technical 'layered' analysis and finally the information is presented to the users for applying it in the decision making process.

Remote Sensing and Mapping:

Remote Sensing has become an invaluable source of spatial data on natural resources, which can provide timely information on the present status as well as their dynamic changes. Remote Sensing imageries provide the most authentic information of mapping and monitor land features, natural resources and changing aspects of human activities needed for the preparation of Thematic Resource Maps. Stereoscopic remotely sensed data are now available which are best suited generating Digital Elevation Model (DEM) to extract elevation and slope related information at the desired scale. For example, if continuous rains occur in the catchment area, there lies a probability of flooding in the lower areas; so, with the help of DEM timely precautions may be taken to overcome it. Availability of a number of Remote Sensing Satellites such as IRS-IB, IC, ID; LANDSAT; SPOT etc. are continuously providing data that has greatly helped in the development of modern Cartography facilitating timely mapping and change detection in a variety of application.

Rapid development during the last few decades has led to the formulation and operational procedures for utilizing remote sensing data for various resource management activities. Extensive use of Remote Sensing Satellites particularly in India such as IRS-IB, IC, ID has enabled application in diverse fields for example,

forestry, wasteland mapping, agricultural crop area and yield area estimation, marine resource survey, monitoring and management of flood and drought disasters, land use and land cover mapping, water resource management, ground water targeting and environmental impact assessment.

Forestry

Preparation of Forest Maps on the scale of 1:250,000 for the entire country using remote sensing data of 1972 -'75 and 1985 -'87 clearly brought out the reduction of forest cover from 14% to 11% of the geographical area during the said period. Awareness of depletion of forest cover and execution of different corrective measures including social forestry resulted in 0.5% increase in the forest cover during 1989-91 and afterwards during 1995-97, 1999-2000 and so on. It has been noticed that there has been a major achievement in increasing the forest cover, so at the present times it is about 16%. Selected forest areas have also been thematically mapped for identifying forest type biomass assessment and monitoring of forest plantations etc. at the scale of 1: 50,000. About 80% of the forest areas have been mapped on this scale. The fact that the annual sedimentation load carried by the rivers like the Ganga, the Brahmaputra and the Indus alone is almost 2400 million tonnes i.e 1/3rd of the total sediment carried by all the rivers of the world is a striking evidence of serious soil erosion problem in the hilly areas of our country resulting from extensive deforestation. It is only through repeated and constant monitoring of the forest cover, this colossal loss of the top soil may be arrested in the future.

Wasteland Mapping

A nation-wide wasteland mapping on a scale of 1: 50,000 have been carried out for the National Wasteland Development Board. Actions have been initiated to reclaim the culturable waste lands which approximately amounts to about 25 million hectares through afforestation, fodder development and appropriate agricultural practices. In the context of food security to the growing population, reclamation of the culturable waste lands for productive use assumes a great significance.

Landuse Mapping

A major project at national level for generating district wise landuse and land cover mapping on 1: 250,000 scale using Indian Remote Sensing Data for spatial planning and management has been completed. The district level mapping has been done by NATMO (National Atlas and Thematic Mapping Organization) and SOI (Survey of India). This study has brought about accurate information on agricultural landuse including cropping pattern, fallow land, grazing grounds, water bodies etc. Detection of rapid depletion of pasture land, increase in fallow land, shrinkage of surface water bodies and general degradation of large tracts of once productive lands has firmly established the need for continuous monitoring of land usage.

Soil Mapping

Remote Sensing data has been utilized for preparing small scale soil maps of the country showing details like soil classification and land capability to assist optimum agricultural development in the selected area. Ground water targeted Remote Sensing has been very effectively used in India for optimal utilization of groundwater, by employing hydro-geomorphological maps prepared on a scale of 1: 250,000. Using Remote Sensing data, groundwater potential zones could be delineated to identify problem villages where tube wells could be dug to overcome the acute drinking water problem.

Flood Mapping

Remote Sensing has been successfully used in India for obtaining real time information among the areas affected by flood in the major flood prone river basins namely, Brahmaputra, Ganga, Kosi, Godavari etc. Repetitive monitoring of the flood inundation pattern has helped delineation of the areas prone to perennial flood risk for taking long term measures.

Landform Mapping

This requires elevation information which is generally represented as contours in topographic maps. SPOT satellites with their compatibility to provide digital stereo data (with three dimensional effect) have established the feasibility of obtaining elevation information for deriving Digital Elevation Models (DEM) which can be used for generating contours, slopes, landforms and other terrain related features. SPOT data is being used to generate elevation information at 20 metres interval which is the normal requirement of the Survey of India for topographical mapping on 1: 50,000 scale. However, factors such as base to height ratios of the original stereoscopic images, image quality, terrain /relief, availability of control points etc. affect the elevation accuracy of the DEMs created from the SPOT data. Ortho-images i.e. image equivalence of or the photos has also been generated using geo-coded SPOT images (with proper co-ordinates) and DEMs for extracting planimetric information generating map products and merging of images with GIS data base. Technological development for obtaining high resolution stereo-imageries from satellites will gradually eliminate the dependency on aerial photographs in the near future.

Spatial resolution often termed as the pixel size is the main factor which determines the accuracy of mapping from satellite data. In other words, any object more than 36 square metres can be easily visible. For an instance, the resolution of PAN data is about 5.8-6.0 metres; so it can cover 36 square metres. For mapping of agricultural fields, settlements etc. PAN data is used.

Landuse and Land Cover Mapping

Landuse relate to human activities such as agriculture, pasturing and others associated with a particular piece of land, where as Land Cover relate to the type of feature present on the surface of the land (earth). The information on landuse or land cover can be classified into different levels from I, II to III according to the

specific requirement. Generally, higher the level – higher will be the level of information and vice-versa. An example of level wise information details of Landuse and Land Cover derived from Indian Remote Sensing Satellite data on 1: 250,000 scale is mentioned below.

Table 1: Landuse and Land Cover Classification Scheme using IRS Satellite data:

Level I	Level II	Level III
1. Urban or built up land	11. Residential 12. Commercial & Service 13. Industries 14. Transport & Communication	111. Single Family 112. Multi-storied Apartment 113. Govt. & Group Quarters 114. Hotels & Lodges 115. Others
2. Agricultural Land	21. Crop Land 22. Fallow Land 23. Plantation 24. Orchard	211. Kharif Crop 212. Rabi Crop 213. Mixed Crop
3. Forest Land	31. Evergreen Forest 32. Deciduous Forest 33. Degraded or Scrubland 34. Forest bands 35. Forest plantations 36. Mangroves 37. Social Forestry	
4. Wasteland	41. Salt affected land 42. Waterlogged land 43. Marshy or swampy land 44. Gullied or ravines land 45. Scrub land 46. Sandy areas 47. Barren, rocky or stony waste	
5. Water bodies	51. River or Stream 52. Lake, Reservoir or Tank etc.	
6. Others	61. Shifting Cultivation 62. Grazing land 63. Snow covered or glacial land etc.	

Source: Prepared after the 'Anderson System' (also referred as Land Use Data Analysis) (Giri 2012: 15)

The ground area coverage and minimum mapping unit vary on the map of different levels and scales:

Table 2: Ground Area Coverage & Minimum Mapping Units according to different Levels

Level	Scale	Smallest Mapable Units	Area Covered (in Ha.)
I	1:1000000	3X3	900
II	1: 250000	3X3	56.25
III	1: 50000	3X3	2.25

Source: Prepared after the 'Anderson System'

Wetland Mapping

A wetland is defined as the land where the water table is at or above the land surface long enough to promote the formation of hydric soils or to support the growth of hydrophytes. These areas are one of the most productive eco-systems on the earth, exhibiting a great diversity. The importance of wetlands has increased considerably in the recent years with the growing interest in them for supporting and supplementing human dietary requirements and ecological significance in terms of flood control, water purification, aquatic productivity, micro-climatic regulation and as the habitat of fish, birds and wildlife. Wetlands also provide scientific information for botanical and biological events of the past.

Wetland delineation and mapping has been done using IRS, LISS I and II pre and post monsoonal data using visual analysis techniques. Mapping and monitoring for 21 notified wetlands and their catchments have also been done on 1: 50000 scale. Better resolution imageries from IRS- IC and ID are continuously been used to re-check the changing situation.

Conclusion

Mapping of the remotely sensed data has enabled us to create scientifically and structurally accurate information. This not only enhances the scope of higher studies and advanced researches for the academicians but also extends a helping hand in resource monitoring and sustainability. Landuse and land cover mapping prepared from the aerial photographs and satellite imageries help in terrain studies and slope management as well as urban planning. Sequential analysis of data facilitates to keep a track on the changing situation. The application of remotely sensed data is very much directed to sustainable living.

References

Giri, C.P (Ed.) (2012): *Remote Sensing of Land Use and Land Cover- Principles & Applications*, CRC Press, New York, pp14-16

Heywood I., S. Cornelius and S. Carver (2010): *An Introduction to Geographical Information Systems*, 3rd Edn. Pearson Education, Delhi, pp 2-30

Jensen J.R. (2009): *Remote Sensing of the Environment- An Earth Resource Perspective*, 2nd Edn. Pearson Education, Delhi, pp 1-32, 61-86

Lillesand T.M. & R.W. Kiefer (1994): *Remote Sensing and Image Interpretation*, 3rd Edn. Wiley, Chichester, pp 1-45

Navalgund R. R, V. Jayaraman & P. S. Roy (2007): *Remote sensing applications: An overview* in Current Science, Vol. 93, No.12, p 1747, accessed from http://repository.ias.ac.in/60602/1/13-pub.pdf

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History as Dialogue between Spirits: A Study of Anik Dutta's Film *Bhooter Bhobishyot* (2012)

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Abstract

"The (…) European philosophical tradition is a series of footnotes to Plato"

-A.N. Whitehead

Like the ancient Greek philosopher Plato, literary and social critics across the ages have often interrogated the problematic relation between literary (as well as cultural) artworks and reality based on the presupposition of 'reality' as a knowable, quantifiable background to art. In the post information revolution society of early 21st century, dominated by the apparent endlessness of consumer choices, commodities are rendered hyper-real (Baudrillard) by their getting associated with semiotic characteristics additional to their utility. Proliferation of electronic media and extensive advertisement campaigns obliterate the differences between the real and the imaginary.

In such a globalized postmodern culture, regional identities in developing societies are found at problematic crossroads. Anik Dutta's debut feature film *Bhooter Bhobishyot* (2012) attempts to arise to the difficult task of taking stock of Bengali culture in the early 21st century, by placing an ensemble cast of spirits across social, temporal, religious and caste borders, ironically struggling to survive against the attempt of human real estate agents trying to acquire a dilapidated zamindari mansion, the spirits' present resort.

Using stock postmodern features such as unrealiable narration, faction, play of irony, metafiction, paradox and temporal distortion, Anik Dutta tries to bring several strands of colonial and postcolonial Bengali society into dialogue with each other, unpacking history as traditionally read, to let a polyphony of voices collide, synthesize and co-exist.

Keywords

Idea of History, Bengali Identity, Postmodernism, Narrative.

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The Idea of History: From the Ancient Times to Hegel

The idea of history has assumed a pivotal role in shaping human thought by interweaving the notions of human agency, flux of events and the role of material conditions in bringing about this flux, thus leading to critical analysis of not only *why* things happened, but also *how* they happened and *what* have been their multifold consequences. Students asked to write high school essays often encounter the question: *What* can History teach us?

Such concepts rest on the presupposition that the concept of History refers to the objectively verifiable chain of events that have happened in the past. Closely associated with this is the idea that the events of history unfold with fixed directionality in view. While this concept had several earlier proponents in the form of religious texts, the eighteenth century philosopher G.W.F. Hegel has been one of the major influences on the idea of directionality of history. Hegel propounded history to be the continuous progress of 'spirit' (or 'geist') by resolving the conflicts in human society in particular ages. In other words, history progresses according to the succession of spirits, which refers to the substitution of one set of contradictions by another, as we move from one temporal era to another. The progress of Hegel's 'spirit' implies the attainment of absolute perfection, brought about by the removal of all contradictions.

A product of eighteenth century Western Enlightenment thought, Hegel's philosophy of history has underlain most subsequent theorizations of modernity, focusing on maximizing the fruits off the tree of rationality. However, late 20th and early 21st century thinkers like Jean Baudrillard have critically engaged with this particular feature, enquiring whether or not history has reached its limits in the postmodern era, characterized by our inability to adequately distance ourselves from the uninterrupted flow of information, thus being rendered incapable of differentiating between the real and the fictitious, condemned to seeming abundance of choices in a hyper-real world (Malpas 93-98).

The Postmodern Turn

The 'literariness' of literature has been traditionally maintained by deforming ordinary language, or, going by Baudrillard's dictum, by a complex process featuring intensification, condensation, twisting, telescoping and drawing out of automatized (Eagleton 1) language its suggestive potential. History, on the other hand has been traditionally considered valuable for its objective content. Aristotle preferred literature to history on account of the former's focus on 'universal truths' as against the study of 'particular truths' by history (1965: 43). However, authors in the present world often find it impossible to fit into the traditional grand narratives of universality for their writing and consequently take recourse to the use of metanarrative. Faced with the threat of obliteration of the sense of 'real', postmodern literary and cultural production tends to erase the differences between history and fictional narrative, thereby engendering historiographic metafiction. Such narrativization

is rendered increasingly problematic by the radical conception of textuality by the postmodern practitioners which attempts to destabilize the traditional categorization of literary and non-literary texts.

Introduction to the Film Text

The first two decades of the twentieth century gave to the Western society an innovative medium to engage with, for the purposes of entertainment and enlightenment-the cinema. Built for mass audiences, the cinema has gradually assumed the role of shaping culture through its on-screen depiction of society. Its adaptation in third world cultures involves complex processes that involve questions of modernity and modernization, cultural codification and dissemination, shaping consciousness of history, etc, while being one form of cultural artefact to be consumed as commodity.

Anik Dutta's directorial debut *Bhooter Bhobishyot* (2012) provides a perfect instance for critically engaging with postmodern treatment of the idea of history. The title itself calls for close analysis. The word Bengali word 'bhoot' derives from the Sanskrit 'bhoota' which refers to 'the past' or the idea of 'being'. However, in Bengali as well as a number of other modern Indian languages the term has an added connotation of 'ghost' or 'spirit'. The title of Dutta's film therefore may be translated as either 'the future of the past' or alternatively, 'the future of ghosts'. In fact much of the suggestiveness of the film depends on which way we translate the work. What Dutta does in his narrative is make an attempt to understand the former at a deeper level, while simply playing with the latter on the surface level.

Dutta's handling of the film may be called postmodern on the basis of several strategies adopted by him. One of the most important of these is temporal distortion and re-duplication of events within the narrative. The opening sequence of the film depicts an actress of a periodical Bengali feature film getting ready for her shot in an old zamindar mansion, speaking to various people on the set as well as to people physically absent on the scene (with whom she has telephonic conversations). While she is ready for the shot and sits gazing at her own image front of a mirror she sees something frightening in the mirror and faints. The cause of her bewilderment is kept subtly implied, for the viewer to guess. The next sequence depicts the entertainment and lifestyle section of a television news channel whose anchor claims to be the most accurate and prompt supplier of inside scoops of the world of cinema, in characteristic journalese, toying with the sensationalist idea that the actress might have sighted a ghost in the mirror. The whole sequence is repeated later on in the film, providing the clue to the missing information regarding what she saw in the mirror.

Analysis of Narrative in *Bhooter Bhobishyot* : Postmodernism in Play

The film presents an instance of narrative within narrative, while at the same time making viewers alert about the fictional nature of both strands. The frame narrative acquaints us with director Ayan Sengupta, his assistant

Rinka and production manager Nantu, as they arrive at the location for their next shoot- a dilapidated zamindar mansion (once the seat of power of the Choudhury dynasty) in one corner of Kolkata. Rinka and Nantu leave on business soon. Before leaving, Nantu offers Ayan his bottle of rum to while the time away, to which Ayan replies he has something better for the purpose (showing his packet of cannabis). While awaiting the arrival of the group's director of photography-Sumit Ray, Ayan falls asleep in one of the rooms of the antique-stuffed mansion. His nap is interrupted by the arrival of a man in mid-fifties, who introduces himself as one of the present inhabitants of the property. They get acquainted with each other while discussing films. With time to while in their hands the two like-minded men exchange story-ideas. It is the one voluntarily provided by the stranger that constitutes the core narrative of the film.

In all the stories that we encounter the author makes an effort to place the narrative in an adequate spatio-temporal framework. In other words, authors 'historicize' their narratives. Again, narratives themselves proceed along temporal lines, much in the same way that history unfolds. Following Hegel's idea of the progress of 'history' as the progressive resolution of conflicts, it may be argued that narratives, like history, proceed towards a final resolution at their termination. The unnamed story teller chooses to begin his tale with a question: "Who is the biggest the sufferer as age-old buildings in Kolkata are razed daily to make room for newer architectures?" When Ayan replies that it is the middle class, which is forced to retreat from the heart of the city to settle in the outskirts, his newly made acquaintance rejects; alternatively proposing that it is none but the 'bhoota' of Kolkata that is suffering due to this demolition of old mansions. Ayan interprets this man's use of the term 'bhoot' in a figurative sense, assuming that he is talking about either the spirit of the city or its past, only to be corrected that his interlocutor is referring to none other than 'ghosts' or 'spirits'. As he goes on narrating his tale, he explains how the situation is worsening rapidly, with no voice of protest being raised against such forceful eviction because of the simple reason that they are not consumers or voters. The unnamed narrator is here criticizing modern society through scathing irony. The motive behind social movements, the will to transform, has been replaced by the mere performance of the same. Here and elsewhere the film presents instances of the conjuncture of fictional narrative and criticism, thereby making it possible for us to term it as an instance of theoretical fiction.

As the place of action of his story, the narrator provides the Choudhury mansion itself. Several of its past residents had died unnatural deaths and now they come together to live in the dilapidated Choudhury mansion. Earliest to arrive is the founder-once prosperous zamindar Darpo Narayan Choudhury, who had been killed by bandits during his visit to the country estates. Next to arrive is General Ramsay, a fictitious administrative officer of the British Raj, who had been accidentally killed by a bomb hurled by an Indian nationalist, who mistook Ramsay for the Viceroy on account of the former's mannerisms. As the narrator clarifies to Ayan, the name 'Ramsay' has been inspired by the famous film-makers, the Ramsay brothers, whose low budget sleaze-and-gore horror movies of the 1970s and 1980s won huge popularity. Once again Anik Dutta makes the audience aware of the fact that he is weaving fictional lore. A cheated lover of one of the debased scions of the Choudhury dynasty and former movie actor cum singer Kadalibala Debi also joins the group and so does one

Biplab Dasgupta, another elusive descendant of the once illustrious family who had been killed by the police in a mock encounter for joining the Maoist insurrection in 1970s Kolkata.

As the narrator goes on to elaborate, the rapid urbanization of the surroundings of Kolkata and the space crunch brought about by exploding population led to more old mansions being demolished, thereby leaving more ghosts of the city homeless. As huge numbers of them try to seek shelter in the Choudhury mansion, the once proprietor Darpo Narayan along with General Ramsay decide to arrange for an interview, in order to determine the suitable ghosts. Finally, the spirits of Pablo Patronobis (son of well to do parents, western music enthusiast, died due to excessive intake of addictive drugs), Khaja Khan (cook turned soldier under Nawab Siraj-ud-doulla), Bhootnath Bhaduri (a refugee from East Bengal who had settled in Jadavpur settlers' colony and earned his living by selling digestive lozenges to commuters in local trains), Atmaram Paswan (a migrant from Bihar and a rickshaw puller by profession who had been run over by a drunk driver), late Brigadier Judhajit Sarkar who had been a martyr of war and Koyel Dhar (daughter of a business tycoon and had committed suicide when her parents refused to accept her groom of choice) are allowed admission to Chowdhury mansion.

Listening to the story, Ayan expresses his interest in the tale, passionately describing the wonders that he as film-director can accomplish by working variations on the grey scale to portray each of these characters, separated not only by class and culture, but also by time period. Audiences accustomed to watching various stages of our history in various tones of the grey scale are allowed a revelatory look inside the voluntary, careful processes that underlie artistic production. Dutta, by a subtle move, lays bare the sinews of the film-making process, the glittering end product of which is generally consumed unquestioningly by most viewers. Ayan's wish to portray the sequences featuring Ramsay in sepia, those of Kadalibala in black and white and ones featuring Biplab using handheld camera (to bring in a chaotic element into the narrative) is ample proof of the fact that it is a metanarrative. However, he is corrected by the narrator who insists that research is never mandatory for horror movies, where the protagonists are none other ghosts-insubstantial beings themselves. The self contradictory nature of the narrative (describing those same insubstantial beings in detail before refusing importance to the description in detail) is to be noticed here once again. Besides, in the song and dance sequences, Anik Dutta anticipates audience expectation and frames the sequences in befitting musical modes and picture tones. Besides, characters speak in dialects (Kadalibala as a film actor of the pre-playback days speaks and sings in an affected, nasalized tone, Bhootnath speaks in an East Bengal accent, etc) and mannerisms (Brigadier Judhajit Sarkar begins conversations with accurate historical allusions of war) pertaining to their mortal natures. While the narration returns to present time, so do colours, as well as the dialect and discourses common in the early 21st century. This frequent back and forth movement attendant with the audio-visual shifts makes the constructed nature of supernatural an experience even more self-consciously artful.

As the ensemble of members co-habiting the Choudhury mansion spend their days and nights amidst alternating joy and sorrow, conflict and harmony, they shudder to know of the real estate agent Ganesh Bhutoria who is

itching to demolish the mansion, only to substitute it by a multi-storeyed shopping mall. Even as the ghosts bewail their imminent loss of habitat, Dutta makes Kadalibala pun on the word 'bajaari' (which literally means commercial but when applied to a woman it assumes the derogatory sense of prostitution) as she fears of being reduced into one again after death (the first instance was in her mortal life, when her profession as film actress had attracted stigma from the more traditional, conservative coteries). However, the presence of the brigadier in their ranks solves the issue, as he weaves a full proof plan of luring Ganesh Bhutoria into a business deal, therefore bringing him to the mansion at night, whereafter he may be sufficiently frightened to wash his hands clean off the proposed project at this site.

With the help of the spirit of a lately killed, infamous criminal Kartik and Ganesh Bhutoria's dead wife Lakshmi, the inhabitants of Choudhury mansion successfully drive Bhutoria away. Throughout the narrative Biplab, the Naxalite scion of Choudhury dynasty killed by the state agencies in mock encounter, remains conspicuous by his absence from action. When inquired of by Ayan, the narrator cuts him off by a philosophical question: "Isn't it rare that one has the opportunity of witnessing a revolution?" Playing on the meaning of the Bengali word 'biplab' the narrator defers the meaning until further mention.

As the story comes to a close, the narrator asks for an appraisal of the same, to which Ayan responds in a positive way. He speaks highly of the plot, the narrativization, of the presence of commercial traits in the movie, but concludes by suggesting that it may become somewhat difficult to convince a producer with, on account of its absurd plot where ghosts play the role of protagonists. At this, his narrator shows his benevolent side by supplying him with a bagful of gold coins from the British era. As an incredulous Ayan asks who this narrator is and what he is about, the latter replied that he is none other than the elusive Biplab of the tale he had been narrating. Ayan refuses to believe this when the narrator who claims to be Biplab calls the entire set of characters he had been describing at the twiddle of his fingers. As the audience along with Ayan are left puzzled, it is found that the whole story had been nothing but a dream.

Finally, as his camera person Sumit arrives, Ayan informs him of whatever had happened ever since he had been left alone in the house. Sumit takes a jibe at Ayan's cannabis-addiction, pointing it out as the cause of such vivid, unrealistic dreams. However, Ayan at this point discovers the bag of gold coins (which Biplab had handed him in the dream) in his pocket, as well as case stacked with lakhs of money on the table. As Ayan struggles to comprehend whether whatever he has been experiencing is real or not, the film comes to a close.

On the borders between fact and fiction lies the province of the modern storyteller, as Dutta's film proves. The story featuring ghosts that Biplab narrates to Ayan is realistic in most ways. In fact, ghosts going to fish markets to buy their favourite 'hilsha' fish, when they have traditionally been ascribed powers to fetch anything they desire at any time is countered by Dutta's narrative, due to the simple reason that the ghosts depicted are 'Bengali'. It is the essence of their mortal identities that has been focused on, to lend credence to their ghostly beings. Moreover, certain stereotypes (such as the fearful nature of ghosts, their vindictive qualities, etc) have been replaced by those that would have characterized these characters, had they been flesh and blood human beings.

Anik Dutta utilizes a number of postmodern strategies such as unreliable narratoion, paradox, irony, metanarrative, pastiche and a host of others to unearth the many voices that underlie the history of Bengal. Whereas Darpo Narayan emerges as the sycophant zamindar bent on furthering his stranglehold over wealth and power, Khaja Khan comes to stand for the Muslim population of Bengal. Similarly, Bhootnath, Kadalibala, Biplab, Atmaram, Pablo Patronobis and the others voice the different cultures that underlie the umbrella term 'Bengali', which since the nineteenth century Bengal renaissance has often voiced the concerns of the educated middle class. Following Hayden White, we may say that Anik Dutta's complex narrative generates meanings by the very way in which he narrates his story, simultaneously calling attention to the story-telling devices that are employed in the process. From a broader perspective, Dutta's story participates in the discourse of anti-eviction movements in West Bengal as well as entire India in the last few decades. While the protagonists who muster the energy to stall eviction here are none but ghosts, the success of the apparent non-entities-the spirits, in this endeavour, proves to be no short of 'revolutionary'.

References

Bowers, Maggie Ann (2010): "Delimiting the Terms." *Magic(al) Realism*. London: Routledge 20-22

Eagleton, Terry (2008): "Introduction: What is Literature?" *Literary Theory: An Introducion: Anniversary Edition*. Minneapolis. University of Minnesota Press, 2008. 1-14.

Featherstone, Mike, Scott Lash, and Roland Robertson (1995): *Global Modernities*. London: Sage Publications

Featherstone, Mike (1991): "Theories of Consumer Culture." *Consumer Culture and Postmodernism*, London: Sage Publications, 13-27

Featherstone, Mike (1995): *Undoing Culture: Globalization, Postmoderism and Identity*. London: Sage Publications

Fernandes, Leela (2006): "Framing the Liberalizing Middle Class." *India's New Middle Class: Democratic Politics in an Era of Economic Reform*. Minneapolis: University of Minnesota, 29-87

Little, Daniel (2007): "Philosophy of History." *Stanford Encyclopedia of Philosophy*. Stanford University, 18 February, Web. 23 Feb. 2017,

Malpas, Simon (2005): "History." *The Postmodern*. London. Routledge, 2005. 80-105. The New Critical Idiom

Robertson, Roland (2012): "Globalization as a Problem." *The Globalization Reader*. Frank J. Lechner and John Boli. Chichester, West Sussex: J. Wiley & Sons, 86-93

Storey, John (2009): "What is Popular Culture?" *Cultural Theory and Popular Culture: An Introduction*. Harlow, England: Pearson Longman, 1-16

Whitehead, Alfred North (2010): *Process and Reality*. Free Press White, Hayden (1986): Preface, *Metahistory: The Historical Imagination in Nineteenth-Century Europe*. Baltimore: Johns Hopkins University Press, ix-x

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Fight against the persistent discrimination: Connecting the problem with the issue of psychological well-being of women

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Abstract

There has been an increasing recognition of the fact that women are at the receiving end due to chronic gender inequalities and discriminations which often lead to creation of stress in women that differentially affect them. Though significant changes have started taking place, yet a range of studies indicate that women are disproportionately affected by psychological health problems.The present study tries to find out the causes of this situation that adversely affect the wellbeing of a woman and in a way tries to show how this can be answered positively in the near future with a slight cosmic reference.

Keywords

Gender inequalities, discrimination, psychological health problems, wellbeing

Introduction

Women who are often viewed within the enclosure of relationships and assessed against the yardsticks of tolerance and adjustments, unfortunately in most situations fail to carry the burden of 'sanity' and 'wellbeing', both of which are again judged from an angle of socio-gender bias. The conditions that society accepts to be normal often lead to psychological problems in woman. Though significant changes have taken place in the beliefs and expectations about women's role and identities in the context of work, family and community over the last few decades, still the chronic gender inequalities in terms of discrimination silently contaminates both mind and the health of women.Infact, researches have often revealed the prevalence of certain specific kinds of disorders in women where the nature and severity of many symptoms are pretty gender-sensitive.

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Discussion

The initiation of post liberalization period in 1991 has given rise nation's remarkable success in growth. But the women's position has not attained a satisfactory status in this regard. The women have to envisage a large number of problems which leads to fall them aback as compared to their male counterparts. Reducing the short term and long term stresses in their domestic and professional lives can decline the psychological, physical and societal stigmas like gender discrimination, crimes and brutalities, infanticide and foeticide, domestic violence, etc.

Stress and its physiology and psychology

Several studies have shown that women are likely to be affected by stress and depression than men. At this place, the meaning of stress or depression is likely to be highlighted.
Stress is the body's response physiologically and psychologically to a dangerous situation. Mood of a person when chronically remains down in absence of any external factors such as bad news or continuous illness etc., can be clinically called as stress or depression.
Stress can lead to physical health problems such as ulcers, high blood pressure, muscular tensions, etc. Since, it is an extremely common psychological disorder,it can be characterised by chronic depression of mood, suicidal tendency, overeating, excessive sleep as well as it can also result in mental health problems such as anxiety, insomnia, amnesia, panic attacks, etc.World Health Organisation (WHO) has identified depression as the second largest contributor to disease burden by 2020, especially amongst women. This organisation reported similar findings from 14 countries to show that the ratio is 2:1(Gaier, Gansicke and Gater, 1999).The feelings of worthlessness, hopelessness, helplessness often overcloud the thoughts and perceptions of the sufferers. The feeling of self-worth is mostly challenged by the conflicting demands women encounter at various critical junctures.

Woman: A persona

Today, women strive to prove their efficiency in both domestic chores and professional challenges. Women continue meeting household and family responsibilities, while at the same time working and trying to maintain personal interests. They either view these roles as challenges or perceive them as threats. As demands increase to fulfil these roles, women often feel a sense of losing control which makes them prone to stress and burnout. The contradictory expectations of diversified fields create internal conflicts in women. Proving self-worth in the profession often interferes with establishing oneself as a worthy wife or more as a sacrificial mother. On the other hand, the family crisis or commitments fail to gain any special consideration in the eyes of the employers. Even when they manage to balance the burden of family and profession, the efforts remain unacknowledged.

Women's indoor and outdoor struggle against stress

In some cases, women report of difficulties of sleep, lack of appetite, inability to remember the daily responsibilities, enduring body ache, etc. These complaints though may have individual causes but may have strong connection with depression. Unless the symptoms get worse women do not even seek help or their family members do not bother to take them for clinical assistance. The psychologists have often found that the family members consider the option of treatment only when the depressed women fail to perform their expected duties in daily life. Thus, the decision of treatment is influenced by the utility aspect of the women and not by the enhancement of their subjective wellbeing.

Studies have exposed relevant connection between extensive guilt and feeling of depression, as the presence of the desire to claim personal happiness often lead to a sense of guilt among women. Even if women regain the energy to serve others, they hardly look for attainment of happiness of their own. Sacrifice becomes the epitome of being a good woman.Moreover, they are subjected to innumerable restrictions coming from various corners of the society which frequently interferes with their need to be independent.The unfulfilled desire for freedom stimulates anger in them which they are often unable to express.Thus, internalisation of anger has been identified as a source of depression.The struggle of performing multiple duties, the inability to secure self-dignity often generates severe anger and impatience within women. But, for women, a sense of guilt is inflicted whenever there is any expression of discontent. Thus, anger remains suppressed and this might precipitate several types of psychophysical problems for women. In fact, the presence of any physical ailment in women often creates an unfavourable environment around them as they fail to perform her familial duties because of their illness. Thus, the environment aggravates anger in women which they are forced to suppress which in turn creates severe depression and other physical ailments.

The scenario is categorically worse for women who are working. The daily pressure of work, the stresses induced by the limits imposed and the conflicting demands of office and home front creates tremendous anxieties in women. In many situations, the expected professional norms do not allow them to manifest their grievances at work place. Painfully women fail to even relax when they are back home, for the strict criteria of maintaining the codes of conduct prescribed by the relationships,force women to swallow all negative feelings they have been experiencing so long. The increasing stress without the opportunity of any release deteriorates both the mental and physical wellness of women.

Women are subjected to various levels of physical, sexual and psychological abuse. Uncontested sexual proximity, ranging from harassment till rape, female child molestation, forceful marital coitus, sexual advances at workplace disturbs the psychological alliance of a woman. Sometimes, the absence of alternative support systems leaves these women with no other option than staying with the offender, especially in cases of marital abuse.

Symptoms of depression are also seen in old aged women. Large number of old women lives alone and become widowed often without a network of available family resources. Negative features of elderly women as unattractive, dependent, physically ailing have significant psychological and social repercussions.

Stress management and women empowerment

The darkness of discrimination is gradually creating the need to empower women at one hand and to create an emotionally matured society on the other. Women's physiological and psychological health cannot be considered in isolation from social, political and economic issues. When women's position in society is considered, it is clear that there are sufficient causes in current social arrangement to account for the excessive amount of anxiety experienced by them.

Thus, to bring about a reformation in the condition of women the legal and administrative bodies along with various women commissions are developing guidelines to ensure protection and rights of women so that their physical and emotional health is not stained.

Workshops with women on enhancement of sense of wellbeing, reassurance of social rights, strategies of empowerment are organised. Awareness programmes on identification of psychological disorders, information regarding health care services are also being highlighted. Women are encouraged to take medical support whenever their psychophysical system is under threat. But, what is most effectively required is that women themselves will have to join hands to secure quality life. They need to understand stress, recognise warning signs and develop coping skills to maintain health in all dimensions of their lives.Occupational stress intervention may consist of training in coping strategies, progressive relaxation or other stress management techniques. There is an increasing need for working women to establish or reinforce a network of friends at home and at work. By restructuring priorities and eliminating tasks that are unnecessary, professional women may be able to reduce the stress levels experienced by them. Exercise of any type can be an effective distraction from stressful events. Relaxation techniques such as deep breathingprocedures, muscle relaxation, bio-feedback, musictherapy, etc. may help in relieving stress

At every unaddressed corner of the planet, women need to develop strong sense of self.And oneway to cultivate this power by women is through meditation to enhance the nurturing and calming nature of the home and the hearth which sustain the family, community and society. The feminine principle must be esteemed and protected to allow universal healing at a deeper emotional level. Women must be cheered to uphold the flow of grace; love and devotion in order to sustain this Yoga and meditation bring gratification in our life. To live in content is a work of art. The more competently women leadtheir lives through the odds and shallow of life, the happier they shall be and the greater will be their contribution to the welfare of society. Women need to stand by each other beyond the personal differences.

It is thus a high time to realise that the desire to be psychophysically well is not an auxiliary -it is mandatory for every living being, whether men or women. In this direction, further research is needed on the effects of

multiple role stress on women's health. It is important to make researches that address the physiologic, psychosocial and economic factors that together affect women's health status. The right to live and to live happily must be availed by all even if the stamp of approval is not encrypted by the patriarchy.

Conclusion

Expulsion from paradise was probably the greatest event in human history. Ever since, the human species began, men have surely been asking questions about anything in the Universe and proposing answers as well. Time has perhaps arrived when this opportunity should also be given to the other counterpart of men. All enquiries into the nature are not necessarily scientific for there are other areas of enquiry that may adopt the practice of making observation and asking questions. Science is the most powerful approach to describe how world works, but is silent on the question of how the world 'ought to be'. A response to this quest can perhaps be provided by the diffusion of science with the Mother Nature which can create a magical impact on humanity,but this in a way should be carried out by paying due reverence to the creation of the all-powerful entity-the men and women, being the optimal culminations.

Work cited

Maier, W. and Gansicke M. and Gaer R. (1999): "Gender differences in the prevalence of depression: A survey in primary care", *Journal of Affective Disorders*, 53:241-252

References

Chakraborty, B. (2014): *Women's Studies: Various Aspects*, Kolkata, Urbee Prakashan, pp.169-173

Chaudhuri, Sujit K. (2014): *Concise Medical Physiology,* Kolkata, New Central Book Agency (P) Ltd., pp. 646-647

Chattopadhyay, S. (2017): *Evolution, Adaptation and Ethology*, Kolkata, Books and Allied (P). Ltd., pp.8-9

Menon, L. (2008): *Women Empowerment and Challenge of Change*, New Delhi, Kanishka Publishers, pp.1-2

Yadava, A., Sharma S., Sharma N. R. (2007): *Understanding Women Behaviour,* New Delhi, Global Vision Publishing House, pp.199-200

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বেদে প্রতিফলিত ভাষার ক্রমবিকাশ : একটি সংক্ষিপ্ত আলোচনা

*অরূপ দাস**

সারসংক্ষেপ

প্রাজ্ঞগণ বেদকে বিশ্বের প্রাচীনতম সর্বশ্রেষ্ঠ গ্রন্থ বলে মনে করেন । এটি কেবল একটি গ্রন্থ বা শাস্ত্রই নয়, একটি পূর্ণাঙ্গ সাহিত্য । বেদ বহুবিধ বিষয়ের আকর। সেখানে আলোচিত বিষয়গুলির মধ্যে ধ্বনিতত্ত্ব, বাক্যতত্ত্ব, রূপতত্ত্ব, স্বরসাধন প্রক্রিয়া প্রভৃতি উল্লেখযোগ্য। ভাষা কেবল ভাবের বা চিন্তার বাহকই নয়, চিন্তার উদ্ভাবকও বটে। এই ভাষা কয়েকটি বর্ণসমষ্টি হলেও এর ব্যপ্তি কিন্তু অপরিসীম । ভাষার অন্তহীন ব্যপ্তি প্রসঙ্গে ঐতরেয় ব্রাহ্মণে ভাষাকে সমুদ্রের সাথে তুলনা করা হয়েছে। ঋক্ সংহিতার ১০/৭১ সংখ্যক বৃহস্পতি সূক্তে বলা হয়েছে - শিশু সর্বপ্রথম বস্তুর নাম মাত্র করতে পারে, সেটাই তাদের ভাষাশিক্ষার প্রথম সোপান। ঋগ্বেদে আরও বলা হয়েছে, বাক্-এর চারটি রূপ - সেগুলি পরা, পশ্যন্তি, মধ্যমা ও বৈখরী নামে খ্যাত। এর মধ্যে প্রথম তিনটি রূপ অব্যক্ত এবং চতুর্থ রূপটি ব্যক্ত। শতপথ ব্রাহ্মণ অনুসারে বাক্ দুপ্রকার - ব্যক্তা ও অব্যক্তা। মানুষের বাক্ (শব্দ) ব্যক্তা এবং মানুষ ভিন্ন অপর প্রাণীর বাক্ অব্যক্তা। এই অব্যক্তা বাক্ আবার তিন প্রককার - প্রথম প্রকার সর্প প্রভৃতির হিস্ হিস্ অথবা পতঙ্গ প্রভৃতির গুঞ্জন, দ্বিতীয় প্রকার পাখির কলরব এবং তৃতীয় প্রকার বাক্ হল পশুদের ডাক। অপরপক্ষে মানুষের ব্যক্তা বাক্ দুপ্রকার - শিষ্টা ও অশিষ্টা। ব্যবহারিক জগতে বাক্যপ্রয়োগের প্রভাব এবং মহত্ত্ব সু স্পষ্টকে সুসংস্কৃত আর কে অসভ্য তা বাক্যপ্রয়োগের দ্বারা নির্ধারণ করা যায় । বিদ্বান এবং মূর্খ উভয়েই বাক্-এর অধীন। ঋক্-সংহিতার একটি মন্ত্রে বলা হয়েছে - যেমন চালনীর দ্বারা ছাতু প্রভৃতি দ্রব্য শোধিত হয় তেমনই বুদ্ধিমান বুদ্ধিবলে পরিশোধিত ভাষা প্রস্তুত করেছেন। ভাষা সৃষ্টির মূলে রয়েছে ধ্বনি। শাস্ত্রসমূহে ধ্বনি শব্দের অর্থবিষয়ে ভিন্ন ভিন্ন মতবাদ রয়েছে। সাধারণ মানুষ মনে করে উচ্চারিত ধ্বনিসমষ্টি থেকে তাদের অর্থজ্ঞান হয় । মহাভাষ্যকার পতঞ্জলির মতে স্ফোট হচ্ছে শব্দ এবং ধ্বনি হচ্ছে স্ফোটের গুণ। শাব্দিকগণের মতে, বর্ণমাত্রই অনিত্য । ধ্বনির দ্বারা ব্যঙ্গ্য নিত্য স্ফোটই হচ্ছে শব্দ এবং এই শব্দই অর্থের বোধক । ধ্বনি বা বর্ণসমূহ স্ফোটের ব্যঞ্জকমাত্র এবং এই ধ্বনিই শ্রবণেন্দ্রিয়ের বিষয় হয়। স্ফোট অখণ্ডও নিরবয়ব হওয়ায় একটি বর্ণের দ্বারা স্ফোটের সামগ্রিক অভিব্যক্তি হলেও পরবর্তী বর্ণগুলির দ্বারা ক্রমশঃ স্ফোটের অধিক হতে অধিকতর স্ফুট প্রতীতি হয়ে থাকে।

প্রাচীনতম গ্রন্থ বেদ। এটিকে শুধু একটি গ্রন্থ বা শাস্ত্র বলা চলে না, সমগ্র জ্ঞানরাশির আধার তথা পূর্ণাঙ্গ সাহিত্য বটে। মহার্ণবতুল্য এই সাহিত্যটির পরিব্যপ্তি ও পরিধি অপরিসীম এবং দুরধিগম্য। বেদ শব্দটি বিদ্ ধাতুর উত্তর অচ্ বা ঘঞ্ প্রত্যয়ে নিষ্পন্ন। ভট্টোজি দীক্ষিত তাইর বৈয়াকরণসিদ্ধান্তকৌমুদী গ্রন্থের একটি কারিকায় বিদ্ ধাতু চারটি অর্থে প্রয়োগের

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কথা উল্লেখ করেছেন -

"বেত্তি বেদ বিদ জ্ঞানে বিন্তে বিদ বিচারণে।
বিদ্যতে বিদ সত্তায়াং লাভে বিন্দতি বিন্দতে।।"

ঋগ্বেদভাষ্যভূমিগকায়ও সমুচ্চারিত হয়েছে - **'বিদন্তি জানন্তি, বিদ্যতে ভবন্তি, বিন্তে বিচারয়তি, বিদন্তে লভন্তে সর্বে মনুষ্যাঃ সত্ত্ববিদ্যাং যৈর্যেষু বা তথা বিদ্বাংসশ্চ ভবন্তি তে বেদাঃ'** ইত্যাদি। এই পূর্ণাঙ্গ সাহিত্যটি মূলতঃ চারটি ধারায় বিভক্ত - ঋগ্বেদ,সামবেদ, যজুর্বেদ ও অথর্ববেদ ।। প্রত্যেকটি বেদের মধ্যে আবার যেখানে মন্ত্রসমূহ সঙকলিত হয়েছে, তা সংহিতা। আর মন্ত্রের প্রয়োগবিধি, যজ্ঞপ্রক্রিয়াবিধি প্রভৃতি বিষয় যেখানে আলোচিত হয়েছে, তা ব্রাহ্মণ নামে খ্যাত। ব্রহ্মতত্ত্ব বা আত্মতত্ত্বের বিষয় আলোচিত হয়েছে আরণ্যকও উপনিষদ্ গ্রন্থসমূহে। বেদ নামক এই সাহিত্যটি বহুবিধ বিষয়ের আকর। যেমন ধ্বনিতত্ত্ব, ভাষাততদ্ধত্ত্ব, বাক্যতত্ত্ব, রূপতত্ত্ব প্রর্ভতি তার মধ্যে উল্লেখযোগ্য।

মানুষ একটি সামাজিক প্রাণী। তাই যে সমাজে সে বসবাস করে, সেই সমাজের অপরাপর ব্যক্তির সঙ্গে, পরিবারের সঙ্গে সমন্বয়, সৌভ্রাতৃত্ব বজায় রেখে তাকে চলতে হয়। আর সেজন্যই ভাবের আদান-প্রদানও অপরিহার্য। তাই যার দ্বারা চিন্তা অথবা ভাববিনিময় ঘটে - তা হল ভাষা। সভ্যতার ঊষালগ্নে এই ভাষার সাহায্যে আদিম মানুষের সামাজিক প্রবৃত্তির সূচনা হয়েছিল এবং ধীরে ধীরে চিন্তাশক্তির বিকাশ ঘটেছিল। ভাষা কেবল ভাবের বা চিন্তার বাহকই নয়, চিন্তার জন্মদাত্রীও বটে। এই ভাষা কয়েকটি বর্ণের দ্বারা গঠিত হলেও এর ব্যপ্তি কিন্তু অপরিসীম। ভাষার অন্তহীন ব্যপ্তি প্রসংগে ঐতরেয় ব্রাহ্মণে ভাষাকে সমুদ্রের সাথে তুলনা করে বলা হয়েছে - **'বাক্ বৈ সমুদ্রো ন বাক্ ক্ষীয়তে (ঐ.ব্রা. ১৩/২৩)**। নিরুক্তকার যাস্কও বলেছেন -

"ব্যাপ্তিমত্ত্বাত্তু শব্দস্য। অণীয়স্ত্বাচ্চ শব্দেন সংজ্ঞাকরণং ব্যবহারার্থং লোকে"।

বক্তার যখন বিবক্ষা জন্মে, তখন সেই ইচ্ছার পূর্বে বক্তার বুদ্ধিতে শব্দ ও অর্থের জ্ঞান বর্তমান থাকে। সেসই শব্দজ্ঞান এ অর্থজ্ঞানকে অবলম্বন করে শব্দোচ্চারণে প্রবৃত্ত বক্তার উদর হতে প্রাণ বায়ু (দেহস্থিত পঞ্চ বায়ুর একটি বায়ু) উদগত হয়ে বাগিন্দ্রিয়ে অভিহত হয়। পরে বাইরে তা নির্গত হয়ে শ্রোতার বুদ্ধিকে ব্যাপ্ত করে অর্থাত্ শ্রোতারও বুদ্ধিতে একইভাবে শব্দের জ্ঞান ও অর্থের জ্ঞান হয়। শব্দব্যক্তিগুলি অনিত্য হলেও শব্দজাতি নিত্য হওয়ায় সেই শব্দ বক্তার ও শ্রোতার বুদ্ধিতে থেকে বুদ্ধির দ্বারা ব্যাপ্তিমান হয়। ফলে বক্তার বুদ্ধিস্থ শব্দ শ্রোতার বুদ্ধ্যবস্থ অর্থকে ব্যাপ্ত করে। সুতরাং ব্যপনস্বভাব শব্দ বা ভাষা বিশ্বপরিব্যাপ্ত।

ভাষাতাত্ত্বিক আলোচনার প্রথম সূত্রপাত ঘটে ঋগ্বেদে। ঋগ্বেদের বিভিন্ন সূক্তে এবিষয়ে যথেষ্ঠ ইঙ্গিত রয়েছে। যেমন ঋগ্বেদের ১০/৭১, ১০/১২৫, ১/১৬৪, ১/৩৯ সংখ্যক সুক্তগুলি উল্লেখযোগ্য। ঋক্ সংহিতার ১০/৭১ সংখ্যক বৃহস্পতি সূক্তে বলা হয়েছে —

বৃহস্পতে প্রথমং বাচো অগ্রং যত্প্রৈরত নামধেয়ং দধানাঃ।
যদেষাং শ্রেষ্ঠং যদরিপ্রমাসীত্প্রেণা তদেষাং নিহিতং গুহাবিঃ।।[1]

মন্ত্রার্থ — হে বৃহস্পতি! শিশু সর্বপ্রথম বস্তুর নাম মাত্র করতে পারে, সেটাই তাদের ভাষাশিক্ষার প্রথম সোপান । তাদের যা কিছু উত্কৃষ্ট ও নির্দোষ জ্ঞান হৃদয়ের নিগূঢ় স্থানে সঞ্চিত ছিল, তা বাগ্দেবীর করুণায় প্রকাশ পায়।[2] বৈদিক যুগে বাক্-সূক্তে

বাক্-তত্ত্বের আলোচনা যা আমাদেরকে বিস্মিত করে। ঋগ্বেদে আরও বলা হয়েছে, বাক্-এর চারটি রূপ - সেগুলি পরা, পশ্যন্তি, মধ্যমা ও বৈখরী নামে খ্যাত। আচার্য্যগণের আরাধ্য পরা বাক্ ব্রহ্মস্বরূপা, যা মূলাধারচক্রে অবস্থিত এবং শব্দসমূহের আধারভূত। নাভিচক্রে স্থিত পশ্যন্তী বাক্ পরারূপশব্দব্রহ্মের উন্মেষস্বরূপা। মধ্যমা বাক্ হৃদয়ে স্থিত। মুখগহ্বরে অবস্থিত বৈখরী বাক্ অভিব্যক্তিপ্রকাশক স্পষ্টবাণীস্বরূপা। সুতরাং প্রথম তিনটি রূপ অব্যক্ত এবং চতুর্থ রূপটি ব্যক্ত। সাধারণ মানুষ বাক্ -এর এই ব্যক্তরূপটিকেই বুঝতে পারে এবং বলতে পারে।[3] বাক্-এর উপর্যুক্ত প্রথম তিনটি অব্যক্তরূপকে পরবর্তী কালে শব্দাচার্যগণ যথাক্রমে সূক্ষ্মতম, সূক্ষ্মতর ও সূক্ষ্ম ভেদে তিনভাগে বিভক্ত করেছেন। জৈমিনীয় ব্রাহ্মণ,ঐতরেয় ব্রাহ্মণ ও আরণ্যক, কৌষীতকি ব্রাহ্মণ, শতপথ ব্রাহ্মণ প্রভৃতিতে বাক্ (শব্দ)-এর মহত্ত্ব প্রস্ফুট হয়েছে। শতপথ ব্রাহ্মণ অনুসারে বাক্ দু'প্রকার - ব্যক্তা ও অব্যক্তা। মানুষের বাক্ (শব্দ) ব্যক্তা এবং মানুষ ভিন্ন অপর প্রাণীর বাক্ অব্যক্তা। এই অব্যক্তা বাক্ আবার তিন প্রকার - প্রথম প্রকার সর্প প্রভৃতির হিস্‌হিস্ অথবা পতঙ্গ প্রভৃতির গুঞ্জন, দ্বিতীয় প্রকার পাখির কলরব এবং তৃতীয় প্রকার বাক্ হল পশুদের ডাক। (শ.ব্রা. ৪.১.৩.১৬)।

মানুষের ব্যক্তা বাক্ আবার দুপ্রকার - সাধু বা শিষ্টা ও অসাধু বা অশিষ্টা। ব্যবহারিক জগতে বাক্যপ্রয়োগের প্রভাব এবং মহত্ত্ব সুস্পষ্ট। মানুষের মধ্যে প্রেম, প্রীতি, ভালোবাসা, ঘৃণা, শত্রুতা প্রভৃতি বাক্যপ্রয়োগের মাধ্যমেই ফুটেওঠে। কে সুসংস্কৃত আর কে অসভ্য তা বাক্যপ্রয়োগের দ্বারা নির্ধারণ করা যায়। বিদ্বান এবং মূর্খ উভয়েই বাক্-এর অধীন। ঋক-সঙহিতার বৃহস্পতি সূক্তের একটি মন্ত্রে বলা হয়েছে - যেমন চালনীর দ্বারা ছাতু প্রভৃতি দ্রব্যকে পরিষ্কার করা হয় সেরূপ বুইদ্ধমান বুদ্ধিবলে পরিষ্কৃত ভাষা প্রস্তুত করেছেন।[4] আবার এও বলা হয়েছে - কেউ কেউ বাক্-কে (কথা) দেখেও কথার ভাবার্থ গ্রহণ করতে পারে না, কেউ শুনেও শোনে না। যেমন প্রেম পরিপূর্ণা সুন্দরভাবে সজ্জিতা স্ত্রী নিজ স্বামীর নিকটে নিজ দেহ প্রকাশ করেন সেরূপ বাগ্‌দেবী বিদ্বান ব্যক্তির নিকট প্রকাশিত হন।[5]

ভাষা সৃষ্টির মূলে রয়েছে ধ্বনি। ধ্বনিসমষ্টির মধ্য দিয়েই ভাষা বিষয়কে ব্যক্ত ও ভাবকেপরিস্ফুট করে তোলে। ঐ ধ্বনি সমূহের লিখিত রূপ বর্ণমালা। ভাষার মূল প্রেরণা হল বিবক্ষা বা বলার ইচ্ছা। আর এর মূল উপাদান হল স্রেফ হাওয়া বা বায়ু। আমাদের দেহের মধ্যে পাঁচটি বায়ু নানাবিধ কর্ম সাধন করে চলেছে। এর পাঁচটি বায়ু হচ্ছে - প্রাণ, অপান, ব্যান, উদান এবয় সমান। নাভির উপর থেকে শুরু করে মুখ পর্যন্ত ক্রিয়াশীল বায়ুকে বলা হয় প্রাণ। নাভির নীচে মূত্রদ্বারে ও মলদ্বারে ক্রিয়াশীল বায়ু অপান। ব্যানের কাজ আকুঞ্চন, প্রসারণ, উর্ধ্বগতি, অধোগতি ঘটানো। উদান বায়ু আমাদের কর্মের প্রবৃত্তিতে শক্তি দান করে। সমস্ত ক্রিয়ার বিশ্রাম ঘটানোই হচ্ছে সমান বায়ুর কাজ। শব্দের উচ্চারণে প্রাণ বায়ুই প্রকৃত কার্য নির্বাহ করে বলে শৌনক প্রভৃতি বেদাচার্য মনে করেন। বলার ইচ্ছা যখন মনের মধ্যে জাগে তখন সেটি ইন্ধনের মত প্রাণ বায়ুকে উদ্দীপ্ত করে। সেই বায়ু-ই বুক থেকে উঠে গরা থেকে ঠোঁট পর্যন্ত মুখমণ্ডরের বিভিন্ন জায়গায় ধাক্কা খেয়ে বা নিয়ন্ত্রিত হয়ে বিভিন্ন বর্ণ বা ধ্বনি হয়ে বেরিয়ে আসে। পাণিনীয় শিক্ষায় ধ্বনির উৎপত্তি বিষয়ে বলা হয়েছে —

"আত্ম্যা বুদ্ধ্যা সমেত্যার্থান্ মনো যুঙ্ ক্তে বিবক্ষয়া।
মনঃ কায়াগ্নিমাহন্তি স প্রেরয়তি মারুতম্।।
মারুতস্তুরসি চরন্ ..... কণ্ঠে .....
স-উদীর্ণো মূর্ধ্নি-অভিহতো বক্ত্রম্ আপদ্যং মারুতঃ। বর্ণান্ জনয়তে ....।"[6]

শাস্ত্রসমূহে ধ্বনি শব্দের অর্থবিষয়ে ভিন্ন ভিন্ন মতবাদ রয়েছে। ধ্বনি শব্দের সাধারণ অর্থ যে কোন প্রাকার আওয়াজ। কিন্তু শব্দশাস্ত্রে বা ভাষাদর্শনে পরিভাষিক অর্থে ধ্বনি বলতে বোঝায় মানুষের বাগ্-যন্ত্রের সাহায্যে উৎপন্ন আওয়াজ অর্থাৎ বাগ্-ধ্বনি। এক কিংবা একাধিক ধ্বনির সমন্বয়ে উৎপন্ন হয় শব্দ। লোকব্যবহারে সাধারণভাবে ধ্বনিকে শব্দ বলা হলেও ব্যাকরণশাস্ত্রে অর্থযুক্ত ধ্বনিকেই শব্দ বলা হয়। ন্যায়মতে আবার শঙ্খ, ঘন্টা, মৃদঙ্গ প্রভৃতি হতে উৎপন্ন শব্দবিশেষই ধ্বনি,

আর কণ্ঠ, তালু প্রভৃতি বাগ্-যন্ত্রে অভিহিত হয়ে যে শব্দবিশেষ উৎপন্ন হয়, তা বর্ণ। আলঙ্কারিকগণ আবার শব্দার্থশরীরযুক্ত কাব্যকে, কোথাও বা ব্যঙ্গ্যার্থকে ধ্বনি নামে অভিহিত করেছেন।

সাধারণ লোক মনে করে উচ্চারিত ধ্বনিসমষ্টি থেকে তাদের অর্থজ্ঞান হয় ।শব্দ-শ্রবণ ও অর্থবোধের মধ্যে তারা ধ্বনিসমূহের অতিরিক্ত স্ফোটনামক কোন বস্তুর সন্ধান পায় না।। পতঞ্জলি বলেছেন, স্ফোট[7] হচ্ছে শব্দ এবং ধ্বনি হচ্ছে স্ফোটের গুণ।[8] প্রকৃতপক্ষে স্ফোটাত্মক শব্দের অবিব্যক্তি ঘটে ধ্বনির মাধ্যমে। বক্তার পূর্বনিশ্চিত সংস্কারকে ধ্বনিসমূহই প্রকট করে। ধ্বনির অতিরিক্ত শব্দের অন্য একটি তাত্ত্বিক স্বরূপ আছে। যা উচ্চারিত (অভিব্যক্ত) হলে সাস্না, লাঙ্গূল, ককুদ, খুর এবং বিষাণযুক্ত প্রাণীর বোধ হয়, তা শব্দ - **"যেনোচ্চারিতেন সাস্নালাঙ্গূলককুদখুরবিষাণিনাং সম্প্রত্যয়ো ভবতি, স শব্দঃ "** (মহাভাষ্য, পস্পশাহ্নিক)। স্ফোট উচ্চারিত হয় না, উচ্চারিত হয় ধ্বনি। কিন্তু এই ধ্বনি সাস্নাদিযুক্ত বস্তুর বোধক না হওয়ায় ধ্বনির অতিরিক্ত অথচ ধ্বনির দ্বারা অভিব্যক্ত স্ফোটাত্মক শব্দকেই সাস্নাদিযুক্ত বস্তুর বোধক না হওয়ায় ধ্বনির অতিরিক্ত অথচ ধ্বনির দ্বারা অভিব্যক্ত স্ফোটাত্মক শব্দকেই সাস্নাদিযুক্ত বস্তুর বোধক বলে বুঝতে হবে। এটিই শব্দের ভাষাতাত্ত্বিক স্বরূপ।

শাব্দিকগণের মতে, বর্ণমাত্রই অনিত্য, যেহেতু উচ্চারণের পরেই ধ্বংসপ্রাপ্ত হয়। ধ্বনির দ্বারা ব্যঙ্গ্য নিত্য স্ফোটই হচ্ছে শব্দ এবং এই শব্দই অর্থের বোধক। ধ্বনি বা বর্ণসমূহ স্ফোটের ব্যঞ্জকমাত্র, এবং এই ধ্বনিই শ্রবণেন্দ্রিয়ের বিষয় হয়। স্ফোট অখণ্ডও নিরবয়ব হওয়ায় একটি বর্ণের দ্বারা স্ফোটের সামগ্রিক অভিব্যক্তি হলেও পরবর্তী বর্ণগুলির দ্বারা ক্রমশঃ স্ফোটের অধিক হতে অধিকতর স্ফুট প্রতীতি হয়ে থাকে।

শব্দ সম্পর্কে আদিম মানুষের স্পষ্ট ধারণা ছিল না। শব্দকে একটা অলৌকিক রহস্যময় ব্যাপার বলে মনে করা হত। শব্দের যাদুশক্তি আছে, শব্দের সঙ্গে আমাদের মঙ্গল অমঙ্গল জড়িত, কোন শব্দ উচ্চারণ (নামসঙ্কীর্তন) করলে ভগবৎপ্রাপ্তি হয় — এরূপ বিশ্বাস আদিম মানুষের কুসংস্কার বলে মনে হয়। তবে সে যাইহোক না কেন শব্দের অসাধারণ মহত্ত্ব মহাকবি দণ্ডীর ভাষায় প্রাণবন্ত হয়ে উঠেছে —

"ইদমন্ধং তমঃ কৃৎস্নং জায়েত ভুবনত্রয়ম্।
যদি শব্দাহ্বয়ং জ্যোতিরাসংসারং ন দীপ্য।।"

প্রান্তটীকা

1 ঋগ্বেদ সংহিতা ১০/৭১/১

2 'ময়া সো অন্নমত্তি যো বিপশ্যতি যঃ প্রাণিতি য ঈং শৃণোত্যুক্তম্'।
'অহমেব ... যং কাময়ে তন্তমুগ্রং কৃণোমি তং ব্রহ্মাণং তমৃষিং তং সুমেধাম্'। ঋ. সং. ১০/১২৫

3 চত্বারি বাক্ পরিমিতা পদানি, তানি বিদুর্ব্রাহ্মণা যে মনীষিণঃ।
গুহা ত্রাণিনিহিততা নেঙ্গয়ান্ত, তুরায়ং বাচো মনুষ্যা বদান্ত।। ঋ.সং. ১/১৬৪/৪৫।

4 সক্তুমিব তিতউনা পুনন্তো যত্র ধীরা মনসা বাচমক্রত। ঋ. সং. ১০/৭১/২

5. উত ত্বঃ পশ্যন্ন দদর্শ বাচমুত ত্বঃ শৃণ্বন্ন শৃণোত্যেনাম্।
উতো ত্বস্মৈ তন্বংবি সস্রে জায়েব পত্য উশতী সুবাসাঃ।। ঋ.সং. ১০/৭১/৪

6. অথর্ববেদ-সংহিতায়ও বাক্-এর আবির্ভাব প্রসঙ্গে বলা হয়েছে —
"ধীতী বা যে অনয়ন্ বাচো অগ্রং মনসা বা যেহবদন্নৃতানি।
তৃতীয়েন ব্রহ্মণা বাবৃধানাস্তুরীয়েনামন্বত নাম ধেনোঃ।।" অ. সং. ৭/১/১

7. স্ফোট শব্দের ব্যুৎপত্তি বাচস্পত্যম্-এ করা হয়েছে - **স্ফুটত্যর্থোঽনেন স্ফুট (করণে) ঘঞ্ প্রত্যয়**
নিষ্পন্ন অর্থাৎ যার দ্বারা অর্থ প্রকটিত হয়, তা স্ফোট। স্ফোট শব্দের প্রথম প্রয়োগ দেখা যায় মহাভারতে —
বায়ুস্ফোটাঃ সনির্ঘাতাঃ (৩/৪৩/৫)।

8. স্ফোটঃ শব্দঃ, ধ্বনিঃ শব্দগুণঃ। অষ্টাধ্যায়ী ১/১/৭০ মহাভাষ্য।

তথ্যসূত্র

খণ্ডুডী, সত্যনারায়ণণ (২০১৪): বাক্যপদীয়ম্ (ব্রহ্মকাণ্ডম্), চৌখম্বা কৃষ্ণদাস একাডেমি, বারাণসী
দাস, রমাপ্রসাদ (১৯৯৫): (১ম সংস্করণ) ২০১৮ (৫ম পুনর্মুদ্রণ)
ঋগ্বেদ সংহিতা (১ম এ ২য় খণ্ড) (১৯৭৬): হরফ প্রকাশনী, কলিকাতা
শব্দ ও অর্থ (শব্দার্থের দর্শন), আনন্দ পাবলিশার্স, কলিকাতা
মহতো, বিদ্যাসাগর দামোদর (১৯৯০): (১ম সংস্করণ), ২০১৪(৫ম মুদ্রণ) পাণিনীয় শিক্ষা, মোতীলাল বণারসী দাস, দিল্লী
Verma, Siddheshwar (1961): *Critical Studies in the Phonetic Observations of Indian Grammarians,* 1st Edition, Munshi Ram Manohar Lal, Delhi

Mishra, Vidhata (1972): *A Critical Study of Sanskrit Phonetics*, Chowkhamba Sanskrit Series Office , Varanasi

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REPRESENTATION OF MARRIED WOMEN IN SANSKRIT LITERATURE

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Abstract

In ancient India, women occupied a very important position, in fact a superior position to, men. It is a culture whose only words for strength and power are feminine - "Shakti" means "power" and "strength." All male power comes from the feminine. Literary evidence suggests that kings and towns were destroyed because a single woman was wronged by the state.For example, Valmiki's Ramayana teaches us that Ravana and his entire clan was wiped out because he abducted Sita. Veda Vyasa's Mahabharata teaches us that all the Kauravas were killed because they humiliated Draupadi in public.

Scholars believe that in ancient India, the women enjoyed equal status with men in all fields of life.In ancient India the wife is not only an ornament of the house, she was verily the home. Manu says that the husband and the wife are identical with each other. In the famous marriage hymn of the Rgveda, the bride is welcome with the blessing that she would have command over all the members of the family- father-in-law, mother-in –law, sister-in-law and others- like an empress over her subjects.

Keywords

Ancient India,Vedic literature, Married Women,Sanskrit literature, Manusamhita

Introduction

In the early literature show that a bride on her arrival at the father-in-law's house was welcomed with great affection. In the famous marriage hymn of the Rgveda she is requested to acquire mastery, like an empress over the member of the family like the father-in-law, mother-in-law, sister-in-law, and brother-in-law etc.She is also expected to stay in the house ever united with her husband and enjoy all kinds of pleasure. Her presence in the house should be auspicious for everybody- the servants, maids and also the beasts and others.

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She must have a mind full of joy and free form all anxieties. Her beauty should grow brighter and brighter everyday.
In the Atharvaveda also it is said that in the household of her husband the bride should act like an empress.

Content:

The Vedic word for a married couple is dampati. The term literally means the master of the house. But it is interesting to note that the term is generally used in the dual number, signifying both the husband and the wife. According to a statement in the Rgveda, the wife is not only an ornament of the house, but she was verily the home. This statement particularly is expressed later also a home and wife are identical, a home without a wife is not a home at all. In a passage of the Satapath Brahmana it is said that a man is only one half, he is not complete till he is united with a wife and gives birth to children. Later author of Dharmasastra like Manu and Apastamba also emphasize that the wife and the husband should be united in all their activities. After the husband has accepted the wife's hands in marriage he must do everything as united with her. Even the fruits of virtue should be shared. Manu also says that, according to the wise, the husband and the wife are identical with each other.

We shall refer a verse of the Raghuvamsa in the eighth canto. The context is king Ajas lamentation over the death of his beloved wife Indumati. In this verse, through a number of simple but expressive adjectives, the poet has shown what invaluable role a wife plays in the life of the husband. First of all, she is the master of the house, the house actually belongs to her. The term used is very significant, grhini, and the poet has not used any other synonym of a wife. She is also a minister (saciva), she always advises him to what is wrong and what is right, so that he is never led astray.Thus whatever is good for him is attained through her advice. Again, she is his partner (sakhi) in all his enjoyment. She is his most intimate friend and he can enjoy all the pleasures of life in her company alone. In the matter of the delicate arts like singing and playing musical instruments etc. She is like a dear and devoted student. In fact, every joy of life is dependent on her.

Bhavabhuti also mentions the excellences of conjugal life in glorious terms. First of all, there is absolute identity between husband and wife in both happiness and misery. When husband and wife truly love one another, the happiness or sorrow of the one becomes the happiness or sorrow of the other also. When there is a happy union of hearts the heart of the one that is afflicted finds solace in the love of the other. They follow each other through the whole life in all circumstances. Even in old age this love never diminishes in intensity. As time passes all reserve between the two passes away and nothing remains except love and affection.

Varaha Mihira a famous astronomer of the sixth century strongly denounces those who speak ill of women and on the contrary, heaps praises upon them. He says that every man should strive to attain at least the first three ends of human life, namely dharma, artha, and kama. But without the help of a wife it is impossible. One can obviously enjoy the pleasures of life through a wife. It is one of the duties of a man to produce progeny. Without a wife is it possible? The wife is like the goddess of prosperity (Laksmi) residing in the house. Therefore, she should be treated with due honour.

Varaha Mihira says that there are indeed persons who practice detachment and without taking into account the vartues of a woman rather speaks about her faults. Buthe considers them to be very bad persons.He quotes Manu and says that one's mother is a woman. Every man owns his birth and wellbeing to a woman. If one speaks against woman, he only shows that he is an ungrateful wretch. According to scripture, both husband and wife would be equally guilty if they prove faithless to the marriage vow. But the fact is a man hardly cares for the dictates of the scripture, but a woman actually does so. This shows that a woman is superior to a man.

In Sanskrit literature in general we find a lot of information about the duties of a wife. All authorities agree that the first and for most duty of a wife is to obey her husband absolutely. In fact,it has been repeatedly asserted that she should consider her husband as God incarnate. Some even say that if the husband is guilty of some mortal sin she should wait till he is purified. It is said in the Mahaabharata that to a woman the father, the brother and the son give only what is limited, but what the husband gives her is unlimited. Not only the authors of smrtis, puranas etc.are of the view, but even the great poet Kalidasa expresses the same sentiment through the words of one of Kanva's disciples who says to Dusyanta that Sakuntala was his wife, whether he should accept or reject her he alone decides, because a husband has total mastery over the wife.

Manu says that a woman who never proves faithless to her husband in body, mind and word secures the heavenly worlds together with her husband and acquires the status of a virtuous (sadhvi) woman.On the other hand, if she is faithless she is born as a female jackal in the next life and suffers from verybad diseases. Yajnavalkya declares that a devoted wife not only attains glory in this world but also plays with Uma, the wife of Siva. In heaven. In fact, we find a number of instances in literature which show that a really devoted wife can acquire extraordinary powers. For example, in the Vanaparva of the Mahabharata it is recorded that Damayanti because of the power of her faithfulness to her husband killed by her curse a young hunter who had evil designs on her. The story of Savitri is too well-known. She could even rescue her husband from the clutch of dreadful death and being him to life.

In Vatsyayana's Kamasutra we find a detailed account of the ideal conduct of a wife in her new family. First of all, the author classific wives as one who is a single wife and another, having co-wives. Polygamy was

prevalent in the society and therefore the possibility of the second kind of wife was a reality.It is clear that the duty of running the husband's household was wholly entrusted to the wife. Of course,it is also prescribed that she should take care of the whole family in accordance with the wish and instruction of the husband. She should maintain the house properly, all the corners of the house should be kept clean and will decorated. Flowers should be placed in proper spots and the ground should be made smooth. Offerings to the household deities should be made daily. The garden also should be carefully maintained.

A wife should take personal care of her husband. For example, she must be careful about the food, to be taken by the husband. She must be aware of what are liked by him and he disliked, what are good for his health and what are not etc. When the husband comes back home from outside she should immediately be attentive and come forward to the compound to welcome him. The maid who has come to wash his feet should be sent away and she should herself do the work.

She had responsibility in financial matters also. If a husband is extravagant in spending money or gives away money to unfit persons, the wife should try to argue with him and prevent him. But this should be done in secret and not publicly so that there is no embarrassment for the husband. All the necessary items for daily consumption, such as salt, oil. different kinds of vegetable, rice, pulse etc. should be procured at the proper time and stored in the proper way. The maids and servants of the house also should be under her supervision.The domestic animals should be carefully looked after. The utensils for cooking are to be cleaned by the servants.If necessary, she should herself guide the servants in their work. A daily account of income and expenditure also should be prepared.If short, it may be said that truly the wife is the lord of the house.

Manu clearly states that due honour must be given to women. Thus, for example, he says that in a household where the women are honoured, the Gods are much pleased, but in the women are dishonoured all the rites and performances fail to produce any result. If the women are properly honoured, the God's become pleased and therefore eagerly grants whatever is prayed for worshipper. the wife, daughter, daughter-in-law etc. live in misery and are unhappy due to tack of food, clothing, ornaments etc. is destroyed very soon. But if a family keeps the women pleased and happy it goes on prospering. If the women in the family are not cared for they become unhappy and curse the family.

Manu says that women deserve specially honour, because they are fortunate and blessed due to the fact that, they can give birth to children and bring up them. Like a bright lamp they till the house with light and glory. In fact, they adorn the house and there is no difference between a women and the goddess of fortune. The daily life of the household cannot be carried on without the direct help of the wife. She gives birth to children brings them up and performs the essential duties of a householder, such as looking after the guest, giving alms to the beggars etc.She is also responsible for taking care of the wellbeing of the members of the

family-not only the husband but also everybody young and old. By producing progeny, they also benefit the departed forefathers. Thus thereis no doubt that Manu also accepted the indispensable and honourable role of the wife in the family.

We have already seen that Manu specially recognizes the most important role of a wife in the family. Practically she has total control on everything that is necessary for the successful running of the household.There is no doubt that she was allowed freedom in all important matters. Like Manu, Narada also was of the opinion that a woman should never be allowed freedom. But he also prescribed that at the death of the father, the mother should be chosen as a guardian of the minor children and not any other male relation.That she was supposed to be always dependent could prevent her from assuming important duties in preference to a male. In fact, it has been pointed out that this dependence of women at least in some cases was more of a theory than actual practice. It was prescribed that in the old age a woman should be under the control of her sons, but in actual practice it might have been the opposite.

In the *Mahabharata*, we find Kunti taking a very important role in deciding the policy to be adopted by her sons.Gandhari also was outspoken about what was proper and what was improper.In the *Raghuvamsa* we find that on the death of the last king of the Raghu dynasty, Agnivarna, theduty of governing the kingdom was taken up by the widowed queen who was then pregnant.

Conclusion

We may make some brief remarks on women's role and participation in rituals. It is generally believed that women enjoyed a better position in the Vedic times, but in the classical period their importance generally declined. So far as early Vedic literatureis concerned, women played an important part both in sacrificial (srauta) rituals and in ritual practices in general.But afterwards their importance generally diminished.

According to the various scholars in ancient India, the women acquired equal status with men in all spheres of life. In the Vedic tradition, all religious activities had to be performed along with the wife. The tradition was that in a religious ceremony the wife was an equal partner and generally the husband along was not considered competent enough to performed sacrifices etc. on his own. At least, this was the theoretical position. This also demanded that the wife should have a position of respect.

In Puranic literature and some great digests of Hindu law and custom we find mentioned some votive rites (vrata) which were observed by women only. The purpose of performing these rites is that they are the best means for attaining the world beyond as well as for attaining enjoyment in this world.It is through vratas that one attains success. Therefore, everyone should perform them. It may be asked in this connection whether

the performance of these rites lead to ordinary enjoyable fruits or alsoto the attainment of liberation which is supposed to be the ultimate goal of human existence.

REFERENCES

Altekar, A.S. (1956). The Position of Women in Hindu Civilisation. Delhi,
Motilal Banarasidass. Bandyopadhyay, Dhirendranath. (2000). Sanskrita Sahityer Itihas, Kolkata, West Bengal State Book Board.
Bandyopadhyay, Shanti. (1993). Vaidik Sahityer Ruparekha. Kolkata, Sanskrit Pustak Bhandar.
Bandyopadhyay,Manabendu, (1410 Bangabda). Manusamhita.Kolkata, Sanskrit Pustak Bhandar
Benjamin, J. (1991). Socio-Religious Status of Girl Child in Hindu Society. New Delhi, Ashish Publishing.
Bhattacharya, Sukumari. (1408 Bangabda). Pracin Bharat: Samaja o Sahitya. Kolkata, Ananda.
Bhattacharji ,Sukumari (1990).Motherhood in AncientIndia, Economic and Political Weekly, Vol. 25, No. 42/43 (Oct. 20-27, 1990), pp. WS50-WS57.
Bhattacharya. Pradip, (1991), Women in Ancient India, Economic and Political Weekly, Vol. 26, No. 24 (Jun. 15, 1991), p. 1426.
Dak, T.M. (1988). Women and Work in Hindu Civilization. Delhi, Discovery.
Dasgupta, S.N., & De, S.K. (1962). A History of Sanskrit Literature. Kolkata, Calcutta University Publication.
Jha, Usha Kiran and Jha Ushak Kiran (2002). Some Aspects of Women and Their Work in Ancient India, Proceedings of the Indian History Congress, Vol. 63 (2002), p. 1333,
Kane.Pandurang Vaman, (1930). History of Dharmasastrs: Ancient and Mediaval Religious and Civil law, Vol.4, Poona, Bhandarkar Oriental Research Institute.
Macdonell, A.A. (1962). A History of Sanskrit Literature. Delhi, Motilal Banarasidass.

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In Search of Ethnic Identity Movement: Koch-Rajbanshis of North Bengal

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Abstract

Ethnic identity movements have now occupied an important place in the domain of social science. We observed the ethnic identity movement of Rajbanshis from North-East part of India especially in North Bengal. The Koch- Rajbanshis constitutes the most predominant section of the local Hindu population in the northern district of Bengal. Social reformer Panchanan Barma of that time realized accurately that Identity of the community. Therefore, in search of the identity of Rajbanshis, then Panchana Barma too traced the social roots of the community in the past though his claim to kshatriyahood in the name of Rajbanshis. In order to secure only a positional improvement for them, they tacitly endorsed the caste based system of social differentiation, thus missing an important opportunity to bring about some fundamental structural change in the society. The Kshatriya Movement lost its significance in the later phase while with the initiative of Panchanan Barma, and the Rajbanshis were offered scheduled caste status. The Hindu refugees, who came from East Pakistan and others to Cooch Behar and various part of North Bengal after independence, had good economic background. They had a strong cultural awareness with a good knowledge of cultivation. In front of the migrant Bengali, the indigenous Rajbanshis could not stand anywhere and they gradually lost identity. Above all, they became minority due to the flow of this immigrant and ultimately they lost their last asset, which was their identity.

Keywords
Ethnic identity, movements, colonial Bengal, Rajbanshi, Kshatriya

Introduction

The Rajbanshis are the indigenous people of the greater part of North Bengal and lower Assam in the pre-colonial and colonial period. They are the majority among the people of North Bengal, particularly in the

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northern districts of Bengal. Actually they are the third largest Hindu caste in Bengal as a whole. The origin of this case is shrouded in mystery & the basic debate is around the question of their association with the Koches. Whatever might have been their actual origin; there is no dispute about the fact that the Rajbanshis were the early settlers in North Bengal. They were a socially homogenous community, in the sense that there was no sub-caste among them (Basu 2003). Dr. Charu Chandra Sanyal stated that the above observations point to the fact that the Koches are non-Aryan in origin. Some of them adopted Hinduism and became Rajbanshis. These Rajbanshis later on claimed to be Kshatriya (C.C Sanyal). According to Swaraj Basu, the local situation also provided a sufficient ground for the Rajbanshis'assertion of a Kshatriya identity and their endeavor to build up caste solidarity (Swaraj Basu 2003).

It is stated that among the Koches who were converted into Hindu religion were called the Rajbanshis and who were converted into Islam were called Muslim or Mahameddan. Hunter here pointed out that the name of Koch was abandoned by the converts who assumed that of Rajbanshis literally of the Royal Kind. The Koch or the Rajbanshis form by far the majority of the Hindu population of Jalpaiguri district (W.W.Hunter). Whatever is the identity of the Rajbanshis they were the people like semi-tribes, simple in habit. Swaraj Basu again writes, as they were guided by the traditional Brahmonical cultural values, the Rajbanshis, with a tradition and culture of their own, failed to get a respectable position in the status estimation of these immigrant upper caste gentry (Swaraj Basu 2003). It is true that the people of higher caste Hindus coming from East Bengal and South Bengal treated the Rajbanshis as inferior caste, many times called them 'Bahe' or 'Banku'; on the contrary the Rajbanshi people called the Bengali people coming from East Bengal or South Bengal as 'Bhatia' (Kartik Chandra Sutradhar2013). On the other hand H.H. Risley says that there was no historical foundation for the claim of the Rajbanshis to be a provincial variety of the kshatriyas (H.H.Risley 2011). Edward Tuite Dalton has pointed out that since the Koch king Viswa Singha having been Hinduised took the title "Rajbanshi", therefore, it could be a clue afterwards for all the Koches to take for themselves the name Rajbanshi. But it has to be stated here that the Koch kings of Koch Behar till the end of their dynastic rule consistently introduced themselves as Koch and not Rajbanshi (Edward Tuite Dalton 1896).

In the early social setting of North Bengal region, the social status of the Rajbanshi's was not challenged until the influx of a large number of caste-Hindu immigrants into this clime from other parts of the country. These people with a strong awareness to castes started interacting with the indigenous Rajbanshis in differential terms (Sujata D. Hazarika 2004). Swaraj Basu observes, with the gradual settlement of an upper caste Hindu gentry in what were traditionally the Rajbanshi dominated areas of North Bengal, the existing balance in local power structure had changed. The immigrant's upper caste gentry in course of time had become the most dominant group in the local society, economy and politics. They manned the local administration and by virtue of their closeness to the administrative power and their shrewdness, emerged as the dominant landholding class. As they were guided by the traditional Brahmanical cultural values, the Rajbanshis with a tradition and

culture of their own failed to get a respectable position in the status estimation of these immigrant upper caste gentry (Swaraj Basu 2003).

The narrow mentality of the upper caste Bengali Hindus were reflected in the work of renowned scholars of that time.

Mora chahina artha, chahina man,
Chahina bidya, chahina jnan
Mora chahi shudhu jatir pratistha,
Mora chahi shudhu jatir pran.

We do not want money, nor do we want prestige,
We do not want education, nor do we want knowledge,
We only want the recognition of our caste,
We only want our caste to be alive. ……..(G. C. Roy)

Through this song, the Rajbanshi poet Gobinda Chandra Roy tried to whip up caste sentiments among the members of his caste. The leaders later used this song in most of the mass gatherings to awaken caste consciousness within the community. How far this appeal for caste solidarity was successful in mobilizing the entire community is something that needs to be verified. The existing historical evidence suggests that the Kshatriyaisation movement had evoked varied responses from the Rajbanshi community. A line of distinction was very much in existence between the economically well-off and the culturally advanced sections on the one hand and the rest of the community on the other. The majority of the Rajbanshis who were at the bottom of the local agrarian structure and lived mostly in village had significant differences in the social values with the better-off section of the community. No doubt they were also conscious of their Rajbanshi identity.

Soumen Nag observes that Nagendranath Basu in the early 20th century while writing his Vishwakosh (Encyclopedia) mentioned the Koch Rajbanshis as barbarians or (Mlechha). Bankim Chandra Chattopadhyay, the renowned Bengali scholar says in 'Bongo Darshan' that the Koch identity cannot be synonymous with Bengali Hindu identity (Soumen Nag 2003). He writes in 'Bongo Darshan', lot of Koches live inside Bengal. Koches are found in the district of Dinajpur, Malda, and some other part of Bengal (now Bangladesh). There are almost one lakh Koches, who live in Bengal. Few people say they should be counted as Bengalis who live in Bengal. Few people say they should be counted as Bengalis (Soumen Nag 2003).

In the social hierarchy of Bengal, the Rajbanshis were placed at the bottom of the structure along with the Namasudras (Swaraj Basu 2003). It was mainly from the early twentieth century onwards that colonial policy was given a new direction in order to safeguard the interests of certain underprivileged groups. Without getting into the debate whether this policy was desirable or not, it may be submitted that this policy definitely reinforced the caste identities and indirectly encouraged mobilization along caste lines. It all started with education as the government had made it clear that it was going to assist those who belonged to the very lowest classes of the Hindu social system, or were outside the pale of caste altogether the government took special care to motivate

the boys of these classes to go to schools. Special schools were opened in the backward areas and education for them was made highly subsidized (GB General, (Education), File no.-11C, 1931).

The sense of alienation among the Rajbanshis was further strengthened by the insults and humiliation they faced due to the domination of Brahminical culture. In the Rajbanshi caste literature, as also in some other contemporary accounts, there are number of references regarding the humiliation of the Rajbanshis by the upper caste Hindus. The latter regarded the Rajbanshis as antyaja who had no right to enter the places of worship on the occasion of any public celebration of pujas or to enter the kitchen in the upper caste household. Even water was not accepted from their hands by the upper caste Hindus (D.N. Sarkar). Charu Chandra Sanyal, while he was writing on the history of Jalpaiguri district, mentioned that casteism was strictly maintained in this district and the people of higher and lower castes used to sit in different rows on the occasion of any public lunch or dinner. Initially although the Rajbanshis were also regarded as ajalchal and they were not allowed to touch the wells of the upper castes, with the beginning of the Kshatriyaization movement these prejudices gradually disappeared (C.C. Sanyal 2002).

It is not only in the literature where Koch Rajbanshis were humiliated; they also faced social oppression in their social life in Bengal and Assam. According to one scholar, in the early 20th century the Koch Rajbanshis were even denied entry into the temple of Jagannath in Puri by an Act of the Government in the year 1911 (Sujata D. Hazarika 2004). There were similar practices in Assam. Once Koch Rajbanshis were denied entry in the famous Barpeta Kirtan Ghar, a prayer place for the Vaishnavite sect of Assam, situated in Barpeta town of lower Assam (A.C.Choudhury1993). In such a situation of social oppression, the Koch Rajbanshis had two options. Firstly, the Koch Rajbanshis could live with their 'Koch Rajbanshi' identity without caring about the rest of the world, secondly Koch Rajbanshis could once again try hard to enter the fold of caste Hindu society. Unfortunately, the Rajbanshi leadership went for the second option. Still the dream world of 'Kshatriya' was in their mind (Arup Jyoti Das 2009).

Panchanan Barma was the person who tried to elevate the status of the Rajbanshis by claiming 'Kshatriya' status for them through the famous 'Kshatriya Movement' of the early 20th century. He had a reason for this, as he himself was a victim of racial discrimination by upper caste Hindu. About his humiliation Ranjit kumar Mandal writes in his book 'Ray Saheb Panchanan - Life and Time' that Panchanan Barma experienced caste hatred right in his childhood. Once in early childhood, he touched the Gita of their family Priest while the later was on his visit to their house. He was shocked that even the conduct of the innocent child was grossly condemned through an alarm of hue and cry. He was cautioned that being a non Brahmin he had no privilege to touch a holy book that too written in Sanskrit. The Deva-Bhasha. Mandal continues, "even after the brilliant Panchanan established himself as a highly qualified lawyer, he could not escape the fate of caste hatred. Once in Rangpur court, Panchanan unconsciously, in hurry, put the hat of his colleague Mr. Maitra to attend a court proceeding. Mr. Maitra subsequently refused to use the same hat and retaliated, "I hate to use a toga used by a Rajbanshi" (Ranjit Kumar Mandal 2002).

This brief sketch of the early phase of Panchanan Barma's life is important to understand his mind-set. This in effect shaped his leadership which ultimately was to determine the future course of the Rajbanshi cast movement itself. Panchanan belonged to a rural society dominated by traditional outlook and values which had an important bearing on the formative phase of his life. Later when he came to Calcutta for higher education he became aware of the 19th century spirit of reform, regeneration, and nationalism. But all these liberal ideas and influences were overshadowed by the humiliations, that he had to face because of his caste identity. The woes of his community arising out of its backwardness and perpetuated by the domination of the upper castes made him very worried. His personal experience of frustration for not getting suitable job in Cooch Behar further strengthened his ideas about the magnitude of domination by the upper caste. But as his mind had been conditioned in a traditional social milieu, he looked for a solution to this problem in the socio-religious reform of his own community. Instead of challenging the caste hierarchy itself, he looked for a higher status for the Rajbanshis within that same structure, hoping that would remove the social stigma of degraded ritual rank. For the same reason he felt the need to secure the support of the British government and could not think of making a common front with the nationalists against colonial rule. What he failed to realize is without some basic economic reforms, his movement was unlikely to succeed. It was his lack of any long-term perspective on mass mobilization programme that circumscribed the scope of success of the Kshitriya Samitis. There was no much difference in attitudes among Panchanan Barma's successors in this regard. So beyond Kshtriyaization the politics of the Rajbanshi caste movement was mainly confined to the articulation of the demand for being enlisted as a scheduled caste so that they could enjoy special protection in education, employment and in matters of representation in the legislative council and the other local bodies (Swaraj Basu 2003).

It is through Kshatriya Movement that we find the Rajbanshis challenging the lower status assigned to them. While in 1891 the Rajbanshi's described themselves as Vratya Kshatriya from 1911 they began to claim pure Kshatriya Status legitimized by priest, genealogists and pundits. In order to gratify their ritual rank aspiration they began to imitate the values, practices and cultural styles of 'twice born' castes that formed a part of Hindu Great tradition. Since 1912, a number of mass thread wearing ceremonies (Milan Kshetra) were organized in different districts by the 'Kshatriya Samiti' where lakhs of Rajbanshis donned the sacred thread as a mark of 'Kshatriya' status. The immediate objective of the 'Kshatriya Samiti' was to regain the lost social status of the Rajbanshi community in the Hindu social system (Sujata D. Hazarika 2004).

Interestingly one of the main thrusts of the movement was to disassociate the Rajbanshis from the Koch identity, as the leaders felt by doing so they could establish the superior social rank for the Rajbanshis. The tragedy of the Kshatriya movement was that through this movement they (Rajbanshis) tried to elevate their social rank, though they were against similar efforts of the other indigenous communities of North Bengal. (Swaraj Basu 2003). Instead of developing a common platform with other victims of Brahmanical hierarchy, writes Basu, the Rajbanshi leaders remained preoccupied with their own exclusive community centric interests. In order to secure only a positional improvement for them, they tacitly endorsed the caste based system of social differentiation, thus missing an important opportunity to bring about some fundamental structural change

in the society (Swaraj Basu 2003). The Kshatriya Movement lost its significance in the later phase while with the initiative of Panchanan Barma, the Rajbanshis were offered scheduled caste status. (Swaraj Basu 2003) With gradual settlement of the Upper caste gentry in North Bengal, the indigenous Koch Rajbanshis faced a great loss regarding economic power and land holding. They also experienced a great deal of social discrimination. But more than social discrimination, loss of land and power, they went through a bigger threat of cultural politics. Soumen Nag offers a good example of cultural politics in Siliguri town of North Bengal. Nag writes, before independence Siliguri was not a full town. The educated Bengalis who came from East Pakistan (now Bangladesh) and settled in these areas after purchasing lands from local Rajbanshis first replaced the indigenous Rajbanshi name from the places with their names. The new names not only pushed back the old names into the past, this also resulted in the loss of old Rajbanshi identity (Soumen Nag-2003). Soumen Nag further informs that in a Government report of 1930, the old name of the present Desbandhu Para was recorded as Rajrajeswari Jot. Same way Hakim Para was Brajasingh Jot, Bharat Nagar was Jogen Jot, Mahananda Para was Lambodas Mohan Jot and the present Babu Para was recorded as Sabur Jot (Soumen Nag 2003).
When it comes to cultural politics, name plays a very important part, at least in the context of North Bengal and Kamtapur movement. Nabyendu says, they don't want to see the name Cooch Behar (Koch Bihar) anywhere. Any name that makes us feel about our past history, they will change it. They have changed the name of 'Cooch Behar State Library' to North Bengal State Library', 'Cooch Behar State Transport' to 'North Bengal State Transport' and 'Moti Mahal' to 'Kalyan Bhavan'. We have lost everything, land, language, culture and even the names of places (Nabyendu Roy Pramanik 2004).
Soumen Nag says the Hindu refugees, who came from East Pakistan and others to Cooch Behar after independence, had good economic background. They had a strong cultural awareness with a good knowledge of cultivation. In front of their developed culture, modernity of language, education and efficiency, the indigenous Rajbanshis could not stand anywhere and they gradually lost their culture, language and land. About all they became minority due to the flow of these immigrants and ultimately they lost their last asset, which was their identity (Nag 2003).

According to Sujata D. Hazarika ('Unrest and Displacement: Rajbanshis in North Bengal' - South Asia Forum for Human Rights) - Jogendra Nath Mondal who was leading the movement for upliftment of backward classes mooted the idea and pressed for a separate state for Rajbanshis called 'Rajar-Sthan' meaning abode of king. He had an apprehension that if Bengal were divided, a section of backward class would be dominated by the upper caste Hindu Bengalis and the other will be dominated by majority Muslims. In 1969, an organisation named Uttar Khanda Dal (UKD) demanded a separate state for Rajbanshis in the name of either Kamtapur or Uttar Khanda. In the same year, 'Uttar Banga Sanskritik Parishad' raised the issue for recognition of Kamta language and measures for its development. Main factors that are responsible for demanding a separate state is have an identity of their own, safeguard their socio-economic interests, development of their cultural heritage and language and have some say in economic-political fields. From practical point of view, geographically and demographically South and North Bengal separated by the river Ganga, are already two

separate identities, whereas from the same point of view, entire North Bengal barring its hilly areas, Purnia and Kishanganj districts of Northern Bihar, districts of lower Assam and northern districts of Bangladesh are more contiguous. Therefore, of late, the demand for a separate state for Koch-Rajbanshis has picked up that has been creating problems for the political establishments both at the Centre and respective State capitals (Roy, Nalini Ranjan 2007).

Conclusion

Still now the problem of ethnicity is going on, and the Rajbanshi peoples are demanding for separate land for them. The Rajbanshis are of the local people of north Bengal have not only economically suffered but have also faced social humiliation. After long and silent suffering the Koch-Rajbanshi peoples of this areas started movement and get a chance to express their resentment against exploitation. From the early phase, till now, the leadership of local indigenous people to assert their voices against immigrants. Bengali gentry has been a historical phenomenon. This movement could be seen as a protest against assimilation or integration of local indigenous people by dominant socio-cultural groups of this region.

References

Swaraj Basu (2003): The Rajbansis of North Bengal 1910-1947, New Delhi
Dr. C.C Sanyal,(2002) The Rajbansis of North Bengal, 1910-1947, Asiatic Society, New Delhi
W.W. Hunter, (2016) Statistical Account of Bengal, Vol,10, Forgotten Books
H.H. Risley- (2011 re print) The tribes and Caste of Bengal, Vol.-I , Kolkata,1981
Edward Tuite Dulton, (1896) Descriptive Ethnology of Bengal, Kolkata
Sujata D. Hazarika (2004): "Unrest and Displacement: Rajbanshis in North Bengal" , South Asia Forum for Human Rights,[accessed March 05,2004]
Soumen Nag,(2003) Bichintar Utsa Sandhane Kamtapur Theke Uttarpurba Bharat(Bengali),Kolkata
GB, General (Education), File no.-11C – 9- 1. April1931,progs. No – 67.
D.N. Sarkar, Rai Saheb Panchanan (Bengali), Rangpur, 1984

Sujata D. Hazarika, (2004) Unrest and Displacement: Rajbanshis in North Bengal, South Asia Forum for Human Rights, Guahati
A.C. Choudhury, (1993), Koch Rajbanshi Sanmilanir Samikshatmak Itihas,(Assamese) ,Bongaigaon
Arup Jyoti Das (2009), Kamatapur and the Koch Rajbanshi Imagination, Guwahati
Ranjit Kumar Mandal, (2002) Ray Saheb Panchanan- Life and Time, Delhi
Banshi Badan Barman (ed) Dangar Koch Bihar Basir Koyta Kotha(Rajbanshi) Received on March 30, 2004 from Nabyendu Roy Pramanik
Nalini Ranjan Roy (2007), Koch Rajbanshi and Kamtapuri – The Truth unveiled,, Guwhati.

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Below are the main elements of the formatting style that the authors are requested to follow while preparing their research paper. That will help faster and error-free processing for publication.

1. General guidelines

- The entire text should in *Arial* font with font size *11* and line spacing 1.5.
- The length of the original articles and review articles should not exceed 4000 words and 6000 words, respectively.
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- Title of the paper should use title-case, with 14 font size, bold and centred.
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4 Economic Development (Level 1)
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- Kindly restrict yourself to two levels of headings; it is advisable to avoid the third level if not absolutely necessary.

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The production of paddy was 52 million tonnes in 2001 compared to 41 tonnes in 1993 (Table 3).

Production rose from 6800 light and medium vehicles in 1978-88 to more than 10,000 a year by 1998-99 (Figure 1).

4. In-text citations

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- Please do not use ibid. or op.cit. In case of repeated citations, all such citations must follow the author-date citation approach.

The studies revealed that advanced medicinal knowledge rarely reached the community. (Barua, 1993).

Barua (1993) revealed that advanced medicinal knowledge rarely reached the community.

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The author and date should be provided, followed by a colon and the specific page number.

According to Basu's analysis, self-development is related to education. (1986: 74).

Theories on sustainability should consider environmental aspects. (Banerjee 1998: 19–27).

4. Citations and References

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Chatterjee, A. (1993): "From Hegemony to Counter Hegemony: A Journey in a Non-imaginary Unreal space", *Economic & Political Weekly*, Vol 23, No 5, pp 41–50.

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- The ministry, committee, agency or any subdivision that served as the author needs to be cited first.
- Next should be the date, title, place, and publisher.

Committee on Irrigation and Water Resources (1981): "Debate on the Water Policy," Monsoon session, 1981, Lok Sabha, New Delhi: Government Press.

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For a book citation, the style should be - Last name, First name (Year of publication): Title of book, Place of publication: Publisher.

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Beck, George (1974): *Society: A New Perspective*, New York: Penguin.

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- First author name will be written with last name/ surname first;
- Subsequent author names will be written with the first name first and then the last name/surname.

Fisher, Henry and Adams Joe (1995): *Sustainable Development*, Boston: Academic Corp.

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Bhowmick, Bikash K. (1941): *Struggle for Independence: A Social Narration*, Good Earth: Southern London University Press.

— (1947) *New Independent India*, Denver: Academic Press

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