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India’s Military Modernization: Plans and Strategic Underpinnings; Conventional to Chemical, Biological, Radiological and Nuclear warfare

ASHOK SHARMA 1 AND SANTOSH AMBFORE 2

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ABSTRACT

India’s chemical industry comprises a major sector of the Indian economy. Within India’s chemical trade are numerous chemicals of potential non-proliferation concern. As a key player in Asia and a large democracy with which the United States shares common interests, India is emerging as an important U.S. strategic partner. In this paper in the following points as: Army Modernization: Enhancing Capabilities without Reducing Manpower, Naval Modernization: Major Fleet Expansion, Air Force Modernization: Air Dominance and Force Projections.

Key Words- Chemical Weapons, NDMA, NA CWC, chemical disasters.

INTRODUCTION

India ratified the Chemical Weapons Convention (CWC) in 1996, and in 1997 declared a stockpile of 1,044 tons of Sulfur Mustard. Destruction was completed in 2009 making it the third state to completely destroy its chemical weapons stockpile. India’s chemical industry is a major sector of the Indian economy that includes trade in dual-use chemicals. India plays an expanding role in global non-proliferation norms by providing extensive support to the Organisation for the Prohibition of Chemical Weapons (OPCW) and seeking greater participation in international export control regimes. While India is unlikely to rebuild a chemical weapons capability, theft or diversion of material by terrorist or criminal organizations remains a concern. History In 1996, India ratified the CWC and in 1997 declared a stockpile of 1,044 tons of sulfur mustard. Statements by the Indian government after the declaration of the stockpile suggest that disarmament was partially intended to encourage Pakistani and Russian disarmament. In particular, Agencies France Pressed reported after India’s ratification that “India urged Pakistan and Russia [in New Delhi] Thursday to follow [India’s] lead in revealing details of its chemical weapon stockpiles as part of an international treaty.” The article went on to quote an Indian Foreign Ministry spokesman stating that, “The government would like to reiterate that all countries, particularly those in our region, should complete their ratification ... at the earliest.” India’s decision to accede to the CWC and declare its chemical weapons stockpile is in contrast to its previous policy of denying the possession of any chemical weapons. This policy was formally established in the 1992 India-Pakistan Agreement on Chemical Weapons under which India and Pakistan agreed to “never under any circumstances... develop, produce, or otherwise acquire chemical weapons.

India has twice been accused of using chemical weapons in the past. In June 1999, military sources within Pakistan alleged that India had launched shells containing chemical weapons at a Pakistani army position on the Line of Control between
the two countries. Additionally, in October 2000, Raja Israr Abbasi, an opposition leader in the Azad Kashmir Assembly, claimed that India’s use of chemical weapons had caused fields to become infertile. These claims were never substantiated and India has denied them. Pakistan never requested a follow-up investigation by the OPCW.

**Domestic Chemical Capabilities of India**

India’s chemical industry comprises a major sector of the Indian economy. Within India’s chemical trade are numerous chemicals of potential non-proliferation concern. For example, the Triveni Chemical Group sells several Schedule 1, 2, and 3 chemicals including Pinacolyl Alcohol (Schedule 2) and Saxitoxin (Schedule 1). India’s chemical trade is promoted by the Chemical and Allied Export Promotion Council of India (CAPEXIL), a non-profit organization created by the Indian Ministry of Commerce in March, 1958 to advocate for chemical exporters to the Indian government.

Although it is highly unlikely that India would use this capacity to rebuild a chemical weapons capability, theft of material by terrorist or criminal organizations remains a serious concern. A 2009 report on the “Management of Chemical (Terrorism) Disasters” by the Indian National Disaster Management Authority (NDMA) highlighted extensive gaps in the ability of India to prevent and respond to chemical terrorism disasters. The most relevant of these gaps are the absence of vulnerability assessments, inadequate ability to track the sale and purchase of hazardous chemicals, inadequate security at “large institutions and isolated storage sites,” and inadequate surveillance of the movement of hazardous chemicals. These problems are further compounded by the facts that NDMA’s guidelines regarding CBR terrorism are not mandatory, and some small- and medium-scale industries have inadequately trained private security forces if any forces are used at all.

The risk of chemical theft or terrorism is likely to increase in the future owing to the extensive expansion of the industry which is promoted through the Indian government. Specifically, the Indian government has developed international collaboration agreements such as the Australia-India Strategic Research Fund, establishing designated Petroleum, Chemicals and Petrochemicals Investment Regions (PCPIRs), and removing industrial licensing requirements for most chemical sub-sectors. Further, the Indian government plans to invest $34 billion (USD) into three PCPIRs. This effort has been driven in part by a perceived threat from China because of China’s lower tariff rates and higher production capability.

Over the past 25 years, India has made extensive advancements in its preparedness for chemical catastrophes (both those caused by industrial accident or by deliberate chemical weapons usage) prompted by the 1984 Bhopal chemical disaster. The disaster occurred in December of 1984 when forty-one metric tons of gaseous methyl isocyanate MIC was released into the atmosphere. The government’s response to the disaster was a catastrophic failure on all levels and led to between 3,000 and 10,000 deaths and over 520,000 were exposed to the gas. This event prompted massive changes within India to develop more effective laws regarding the handling of chemical materials as well as the development of a disaster management framework in the Umbrella Environmental Protection Act of 1986. The Ministry of Environment and Forest serves as the nodal ministry for responding to chemical disasters.
Export Controls

Historically, India has viewed export controls as barriers to the legitimate technological advancement of developing countries by making civilian space technology, civil nuclear power, and other technology more difficult to acquire. These barriers were further seen as reinforcing inequalities between states. This policy shifted after negotiations between the United States and India following India's 1998 nuclear test. Today, India's Directorate General of Foreign Trade is empowered by the Foreign Trade (Development and Regulation) Act No. 22 of 1992 (amended in 2010) to establish licensing mechanisms for Indian exports on the Special Chemicals, Organisms, Materials, Equipment, and Technologies (SCOMET) list. This list includes material related to Weapons of Mass Destruction Technology that is regulated under the Weapons of Mass Destruction and Their Delivery Systems (Prohibition of Unlawful Activities) Act of 2005. However, as of 2011, the SCOMET list was not fully consistent with the Australia Group's Chemical Dual Use List as the SCOMET list did not include toxic gas monitoring systems.

While not currently a member of the Australia Group, India's Foreign Secretary Ranjan Mathai has stated that India views participation in multilateral export control regimes including the Australia Group as an extension of its broader effort to engage with the international community on non-proliferation issues. However, some Indian government sources have stated that India will not join the Australia Group without a roadmap for membership to the Nuclear Suppliers Group and the Missile Technology Control Regime. The Obama administration expressed support for India's membership in these regimes. Despite these recent developments, there were problems in the past. In September 1992, the US protested the sale of dual-use chemicals by India to Iraq, Iran, and Syria after US intelligence discovered that India had shipped trimethyl phosphite, a dual-use chemical that can be converted to nerve gas via chemical synthesis, to Syria. Between September 1998 and February 2001, the Indian trading company NEC Engineers Private Limited shipped $791,343 worth of sensitive and prohibited material to Iraq by routing the material through two firms in Dubai and a Jordanian businessman. This included material and expertise to rebuild a chlorine plant in Fallujah, Iraq that had been cited for potential chemical weapons proliferation. While the 2003 Iraq War revealed that Iraq had not been rebuilding its chemical weapons capacity, this example is nonetheless important as it illustrates how NEC Engineers was able to circumvent the old export controls.

India’s Military Modernization: Plans and Strategic Underpinnings

As a key player in Asia and a large democracy with which the United States shares common interests, India is emerging as an important U.S. strategic partner. There is a broad national consensus in India on the contours of this emerging relationship with Washington, particularly with respect to enhanced defence and civil nuclear energy cooperation. During his visit to New Delhi in June 2012, U.S. defence secretary Leon Panetta identified India as a “linchpin” in Washington’s emerging “rebalancing” strategy in the Asia-Pacific region. While there was no reaction from the Indian government, it is clear that these two large democracies need to work together militarily in order to maintain freedom of the seas in the Indian Ocean region and to ensure peace and stability in the Asia-Pacific more generally. Should China experience political instability or behave irresponsibly in asserting its territorial rights—as it has shown a tendency to do in the South China Sea—both India and the
United States will need strong strategic partners to face worst-case scenarios effectively.

In order to meet future threats and challenges and achieve interoperability with U.S. and other friendly armed forces for joint operations in India’s area of strategic interest, the Indian military needs to modernize and create force structures that are capable of undertaking network-centric warfare on land, at sea, and in the air. Gradually, but perceptibly, the Indian armed forces are upgrading their capabilities, enhancing their kinetic effectiveness and command and control, and improving interoperability. This brief analyzes the threats and challenges that India must address, the measures being adopted to modernize the country’s armed forces, and the strategic underpinnings behind this slow but steady modernization effort.

India; Preparing for a Two-Front War –

South Asia is among the world’s most unstable regions due to the ongoing war against al Qaeda and the Taliban in Afghanistan and on the Afghanistan-Pakistan border. In addition, growing fundamentalist terrorism; creeping “Talibanization” in Pakistan; political instability in Bangladesh, Myanmar, Nepal, and Sri Lanka; unrest in Tibet and Xinjiang; narcotics trafficking; and the proliferation of small arms and light weapons are also destabilizing factors. Unresolved territorial and boundary disputes with China and Pakistan, over which India has fought four wars; internal security challenges in Jammu and Kashmir (J&K) and the north-eastern states; and the rising tide of the Maoist insurgency in the heartland further vitiate India’s strategic environment. Further, many Indian security analysts worry that China is engaged in the strategic encirclement of India through its nuclear and missile nexus with Pakistan; the sale of military hardware to Bangladesh, Nepal, Myanmar, and Sri Lanka; and a “string of pearls” strategy to surround India with naval bases in the northern Indian Ocean region.

Army Modernization: Enhancing Capabilities without Reducing Manpower –

With personnel strength of 1.1 million soldiers regional commands, a training command, 13 corps, and 38 divisions), the Indian Army has kept the nation together through various crises, including four wars since independence, Pakistan’s “proxy war” in J&K since 1989-90, and insurgencies in many of the north-eastern states. Given its large-scale operational commitments on border management and counterinsurgency, the army cannot afford to reduce its manpower numbers until these challenges are overcome. Many of its weapons and equipment are bordering on obsolescence and need to be replaced. The next step would be to move gradually toward acquiring network-centric capabilities for effects-based operations so as to optimize the army’s full combat potential for defensive and offensive operations. The army is also preparing to join the navy and the air force in launching intervention operations in India’s area of strategic interest when called on to do so in the future.

Lieutenant General J.P. Singh (retired), former deputy chief of the army staff (planning and systems), stated in an interview with the CLAWS Journal that “the critical capabilities that are being enhanced to meet challenges across the spectrum include battlefield transparency, battlefield management systems, night-fighting capability, enhanced firepower, including terminally guided munitions, integrated maneuver capability to include self-propelled artillery, quick reaction surface-to-air missiles, the latest assault engineer equipment, tactical control systems, integral combat aviation support and network
centricity.” The army’s mechanized forces are still mostly “night blind.” Its artillery lacks towed and self-propelled 155-mm howitzers for the plains and the mountains and has little capability by way of multi-barrel rocket launchers and surface-to-surface missiles. Infantry battalions urgently need to acquire modern weapons and equipment for counterinsurgency and counterterrorism operations to increase operational effectiveness and lower casualties.

The modernization of India’s infantry battalions is moving forward but at a similarly slow pace. This initiative is aimed at enhancing the battalions’ capability for surveillance and target acquisition at night and boosting their firepower for precise retaliation against infiltrating columns and terrorists hiding in built-up areas. These plans include the acquisition of shoulder-fired missiles, hand-held battlefield surveillance radars, and hand-held thermal imaging devices for observation at night. A system called F-INSAS (future infantry soldier as a system) is also under development. One infantry division has been designated as a rapid reaction force for employment on land or in intervention operations and will have one amphibious brigade and two air assault brigades.

Naval Modernization: Major Fleet Expansion-

The Indian Navy’s ambitious Maritime Capabilities Perspective Plan seeks to dominate the Indian Ocean region by acquiring blue water operational capability while effectively countering current and emerging threats closer to the coastline. There is a perceptible shift in emphasis from an increase in the number of platforms to the enhancement of capabilities. According to a report tabled in the Indian Parliament in the last week of April 2012 by the Standing Committee on Defence, the navy’s modernization plan seeks to achieve the following objectives:

- Augment airborne maritime surveillance, strike, anti-submarine warfare [ASW] and air defence capability through induction of shore-based aircraft, integral hellos, carrier based aircraft, space based [assets] and UAVs [unmanned aerial vehicles], along with suitable weapons and sensors.
- Develop ASW capability through induction of suitable platforms, weapons and sensors.
- Build adequate stand off capability for sea lift and expeditionary operations to achieve desired power projection force levels, influence events ashore and undertake military operations other than war.
- Induct assets and develop suitable infrastructure to augment forces available for low intensity maritime operations (LIMO), protection of off-shore assets and [for] coastal security.
- Induct force multipliers like satellite based global communications, reconnaissance and network enabled platforms to achieve battle-space dominance capability and perform network centric operations.

According to Admiral Arun Prakash (retired), former chief of naval staff, India’s naval modernization plans are designed to meet the following aims:

- Acquiring a capability for maritime domain awareness in the area of responsibility, including space-based surveillance, maritime reconnaissance, airborne early warning and control (AEW&C), and UAVs
- Developing the capability for expeditionary and joint warfare, supported by special operations
- Acquiring reach and sustainability through long endurance, tankers, turnaround facilities in friendly foreign ports, and longer intervals between maintenance cycles
- Acquiring modern capabilities in fields of tactical aviation, ASW, anti-air/anti-missile, land-attack, mine countermeasures, and electronic warfare
Networking ships, submarines, and airborne platforms via satellite

Air Force Modernization: Air Dominance and Force Projection

Until recently, India’s traditional strategic sphere lay between the Gulf of Aden and the Strait of Malacca; but with India’s global footprint expanding, the Indian Air Force should be ready to serve wherever the country’s future strategic interests lie. The air force is gearing up to provide the strategic outreach that India needs as a growing regional power and to project power where necessary in order to defend vital national interests.

According to Kapil Kak, a retired air vice marshal and senior defense analyst, although there is a gap between vision and capability with regard to shaping India’s strategic neighborhood, forward movement is now visible. In his view, the modernization plans of the air force are aimed at achieving the following objectives-

Air dominance and control of the air
Deterrence, by both denial and punishment
Long-range offensive reach—penetration, precision, persistence, and parallelity—in simultaneous operations at the tactical, operational, and strategic levels
Strategic air-lift capability for power projection through both hard and soft power, such as humanitarian assistance and disaster relief operations and diaspora evacuation
Build-up of capability for coercion

India’s Quest for Strategic Outreach-

Given its growing power and responsibilities, India has been steadily enhancing its expeditionary and military intervention capabilities, which have been amply demonstrated in recent times. During the 1991 Gulf War, India airlifted 150,000 civilian workers, who had been forced to leave Iraq, from the airfield at Amman, Jordan, over a period of 30 days. This was the largest airlift since the Berlin airlift at the end of World War II. During the 2004 tsunami, the Indian armed forces were at the forefront of rescue and relief operations. Over 70 Indian Navy ships transported rescue teams and relief material to disaster zones in less than 72 hours, even though the country’s eastern seaboard had itself suffered considerable casualties and damage. Likewise, Indian Navy ships on a goodwill visit to European countries during the Lebanon war in 2006 lifted and brought back 5,000 Indian civilian refugees.

India’s military modernization, however slow it might be, will lead to a qualitative increase in defence cooperation with the United States and other strategic partners by enhancing the capabilities of the Indian armed forces for joint coalition operations, if they are in India’s national interest. Overall, India will gradually acquire the capability to act as a net provider of security in South Asia and the Indian Ocean region. This positive development will allow strategic partners like the United States to reduce their military commitments to the region to a limited extent.

Endnotes:

The India-Pakistan combat ratio is assessed by this author as 1.2 to 1.0 in India’s favor.
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ASSISTIVE PROVISIONS FOR THE EDUCATION OF STUDENTS WITH LEARNING DISABILITIES IN DELHI SCHOOLS

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ABSTRACT

“If I can’t learn the way you teach......Will you teach me the way I can learn?”

The Present Paper discusses the Assistive Provisions for education of students with Learning Disabilities in Delhi Schools, which have been instrumental in using innovative learning strategies to ensure inclusion of children with Learning Disabilities, thus helping them to participate and study at par with their non-disabled peers without any hindrance of discrimination or difficulty in meeting the standards of these elite schools. The various Provisions given by the different Boards of Education in India for students with Learning Disabilities prove to be a silver lining, and some of the innovative educational provisions in practice in some of these Delhi schools if introduced and replicated elsewhere can ensure an inclusive educational environment and promote equity in education by providing a fair platform to the students with this invisible disability to perform together and excel. The assistive provisions can help them in coping up with their educational needs and requirements in a better manner instead of struggling with their studies owing to their disability, to come up to the expectations of their teachers and parents. A collaborative effort in the use of assistive devices, assistive technology; resource room support; acceptance from peers, teachers and the society; innovative educational ideas to promote and sustain inclusion, can support these students to learn at par with their non-disabled peers in inclusive educational settings. While in case of severely Learning Disabled students, it is very essential to recognize their particular skills and start training them in any vocation of their choice from the High school level itself. Many Schools with NIOS Syllabus have in-house vocational training facilities in place. Parents need to accept and understand the need that it is important to make the student self-reliant later on with a vocation learnt earlier at school level, than to force the student to pursue higher education when the interest and abilities of the students do not permit so. Altogether it is also important for the school administration to try hands at newer and better ways to make the School inclusive by collaboration and coordination with the stakeholders involved and to promote such practices to the wider context thereafter, as best practices, to be embraced by other institutions as well. Various initiatives to promote inclusion of children with Learning Disabilities have been taken up by Schools abroad which are being adapted by some of the Schools in India though not all of them are as context-specific in Indian situation owing to the plethora of differences in Indian languages and different socio-cultural settings that the students are part of. The present paper discusses some of the assistive educational provisions in some of the best Schools in Delhi which can be adopted further to promote inclusion of children with Learning Disabilities in schools; under the broader and diverse umbrella of different Educational Provisions offered by the different Education Boards in the country.
INTRODUCTION

Education is the most essential ingredient for the development and empowerment of individuals and the nation. And inclusion in education, irrespective of the varied socio-cultural differences and the differences in abilities and disabilities, undoubtedly makes this foundation much stronger. With the various Policies and Programmes available for Children with Disabilities or the differently-able in India, especially the Persons with Disabilities (Equal Opportunities, Protection of Rights and Full Participation) Act 1995, Learning Disability unfortunately lacks recognition as a Disability under the broader umbrella of disabilities. Though, we find mention of the same in the Sarva Shiksha Abhiyan Programme; still the Scheme ‘Scheme of Assistance to Disabled Persons for Purchase/Fitting of Aids/Appliances’ (ADIP Scheme) recognizes definitions of the various disabilities as stated in the ‘Persons with Disabilities (Equal Opportunities, Protection of Rights and Full Participation) Act, 1995’, therefore, this Scheme as well does not recognize Learning Disability as a disability for extension of the assistive services to the Learning Disabled as is available for persons with other disabilities. This Policy gap leaves Children with Learning Disabilities with little hope for assistance and support. In such a situation, the various efforts being made by the Education Boards across the country, have at least helped these children from dropping out of the education system in struggling to meet the educational level and demands at par with their non disabled peers in the schools.

The Present Paper delves into a discussion of some of the innovative initiatives being taken up by some of the best inclusive schools in Delhi, which can be easily adopted and the practices be replicated by other schools as well to help include Children with Learning Disabilities into the educational setting in accordance with their individual needs and pace of learning and hence ensure their equal participation in education.

RESEARCH STRATEGY AND METHODOLOGY-

The Study was an Exploratory Research aimed at an in-depth understanding of the use of Assistive Devices including the Assistive Educational Provisions of the Education Boards, particularly CBSE Board and the Instructional techniques and the use of educational aids in the education of Children with Learning Disabilities in Delhi Schools. Semi-Structured Interview Schedules were used to interview the respondents and a self- made Information Schedule with a Checklist of Assistive Devices and Educational Programmes, prepared in consultation with Non-Government Organizations working on Learning Disabilities- specifically the Multidisciplinary Clinics of ORKIDS and Educare in Delhi, was administered at the Schools to have a Situational analysis of the presence and use of these Assistive Devices and Programmes in the Schools with inclusive setting. Ten schools were selected through Random Sampling Technique from a List of CBSE Schools provided by the CBSE Board, from which four schools were shortlisted based on the purpose of the study, all of which were Private Schools which had availed the CBSE Board Provisions for Children with Learning Disabilities. Care was taken to include schools having the maximum number of students with Learning Disabilities who took Provisions of the CBSE Board and for this the records of the various Multidisciplinary Clinics of ORKIDS and ‘Educare’ in Delhi were checked and also the CBSE Board’s last ten years’ Board Examination records were analyzed. The School Administrators, Special Educators, School Counselors, Teachers and Children with Learning Disabilities were interviewed and some of the Parents of such children were also interacted with to understand the issue and educational concerns of their children.

INCLUSIVE EDUCATION AND LEARNING DISABILITIES-

According to World Health Organization (WHO) (1980) - “A disability is any restriction or lack (resulting from an impairment) of ability to perform an activity in the manner or within the range considered normal for a human being.”
The term *Learning Disability* was first used in 1963 to describe students having difficulties in school but with no other obvious disability.\(^1\)

> *‘When an idea is wanting, a word can always be found to take its place’.*\(^2\)
> 
> -Goethe

With difference in views on what Learning Disabilities actually implies, the most appropriate definition of Learning Disabilities occurs to be-

> ‘Learning Disabilities’ is a generic term that refers to a heterogeneous group of disorders manifested by significant difficulties in the acquisition and use of listening, speaking, reading, writing, reasoning or mathematical abilities. These disorders are intrinsic to the individual and presumed to be due to Central Nervous System dysfunction. Even though a Learning Disability may occur concomitantly with other handicapping conditions (e.g., sensory impairment, mental retardation, social and emotional disturbance) or environmental influences (e.g., cultural differences, insufficient/inappropriate instruction, psychogenic factors), it is not the direct result of those conditions or influences.’ \(^3\) \(^4\)

As stated in the ‘Action Plan for Inclusive Education of Children and Youth with Disabilities, MHRD, 2005’, Inclusive education, as an approach, seeks to address the learning needs of all children, youth and adults with a specific focus on those who are vulnerable to marginalization and exclusion. It implies all learners, young people - with or without disabilities being able to learn together through access to common pre-school provisions, schools and community educational setting with an appropriate network of support services. Schools with Inclusive setting have a flexible education system, suitting the needs of a diverse range of learners and adapt itself to meet these needs accordingly. It aims at all stakeholders in the system (learners, parents, community, teachers, administrators, policy makers) to be comfortable with diversity and see it as a challenge rather than a problem.

The CBSE Board came up with a Publication entitled “Poor School Performance”\(^5\) in the Year 2002 authored by Dr. Phillip John, a Clinical Psychiatrist, supported by his team; in response to the urgent need of proper identification and mainstreaming of Students with Learning Disabilities in Inclusive Schools. Recognizing Dyslexia and other co-morbid disabilities as a major reason of poor school performance by such children, the document is a useful resource to provide necessary inputs to guide Regular Teachers in understanding the pattern of performance arising out of such disabilities and to facilitate the learners to successfully manage the difficulties. As part of its ongoing exercise to facilitate the schools to meet such challenges, the Board prescribed this Publication to its affiliated schools as a compulsory recourse to help them handle some of these challenges, to address the issue of learning disabilities.

The CBSE Board gives certain assistive provisions to students with Learning Disabilities namely- Provision of Extra Time (depending upon the time allotted for the Paper), Choice of one Compulsory Language against two and Four subjects to opt from a range of Subjects\(^6\) i.e. *Mathematics, Science, Social Science, another language, Music, Painting, Home Science, Introductory Information Technology, Commerce (Elements of Business) & Commerce (Elements of Book Keeping and Accountancy)* and also the Service of an Amanuensis during Examinations to Children with Learning Disabilities as per the need.

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6. This Provision has been introduced in recent years. Over a period of ten years, CBSE Board has been becoming more flexible by introduction of better Provisions as the need be, and through its various Circulars, it has also been enforcing the changes in its Affiliated Schools stringently.
The Central Government has also introduced National Institute of Open Schooling System (NIOS) for Xth and XIIth Grade level exams, the Certificates of which are considered at par with the Board Certificates, based on which the student can get admission into mainstream college later on. The advantage of NIOS system is that the student can choose five or six subjects of his choice from a variety of unconventional subject-combinations. The exams are held once in six months i.e. in April and October; the student is allowed to write exams in as many subjects as he is comfortable with, which he would have studied at his own pace. The student needs to get registered in one of the approved institutions of NIOS syllabus, can attend regular school or schools that offer NIOS syllabus and pass the exams at his own pace. In case of severely learning disabled students, it is very important to recognize their particular skills and start training them in any Vocation of their choice from the High school level itself. Many schools with NIOS syllabus also have in-house Vocational Training facilities.

Parents need to understand that it is important to make the student self-reliant later on with a Vocation learnt earlier, than force the student to pursue Higher Education when the interest and abilities of the student do not permit this. The NIOS (National Institute of Open Schooling) offers more skill based Subjects to choose from and also recognizes Learning Disabilities as of heterogeneous nature and prescribes the Provisions according to the nature of the disability (Dyslexia, Dysgraphia, Dyspraxia, Dyscalculia) besides also permitting the use of Calculators and Computers in the examinations to such students as the need be. So, a student who cannot cope up with the CBSE Syllabus may opt for NIOS Provisions and benefit from it instead of dropping out of the education system struggling to meet the expectations and to perform at par with their non-disabled peers in Inclusive Schools.

SCHOOL A -

In this era of technological revolution, use of Computers is a common and efficient mode of learning but the concept of ‘Smart Classes’ in practice in this School and in various other schools in Delhi, is really beneficial for the students with Learning Disabilities as also for those with other impairment like Visual Impairment, Hearing Impairment etc. Here the lessons taught are prepared in an Audio-Visual format and saved in the Computer Memory. As per the Classes scheduled, these lessons are displayed on the White Boards (meant for this purpose) through Projectors. The Presentations of Poems, Stories, Scientific Experimentations, Discussions, Debates etc helps build up the memory chart and analytical skills of students. The use of Auditory and Visual modalities helps the students with or without impairments to learn together, and easily, making the learning more interesting, participative and comprehendible.

SCHOOL B -

The Special Educators and the School Administration of this school are sensitive enough to start a very easily practicable and efficient initiative to include children with Learning Disabilities. As part of a Compulsory component “Inclusive Education Programme” under the “Community Service” component for Classes XIth and XIIth, the students are subjected to Orientation, Presentations and Training regarding Inclusive Education, inputs regarding the different Disabilities and how to handle cases of Specific Disabilities; to help the students to try hands at Identification of Children with Disabilities, Counseling, trying practicing Remedial Education for such children and Planning out activities for assistance of such kids; thereby, by the time these students pass out of the Education System, they are sensitive enough towards the education of Children with Disabilities and can easily identify such students and help them with the in-hand experience and training they have had at their School level. They can therefore serve as agents of promoting inclusion of
such children, themselves, from a very tender age. In this exercise these Students are marked accordingly in terms of their Attendance and Regularity in these Activities, their Reports (which they prepare Weekly), and the Practical Exercises they do under the guidance of the Special Educators of the School depending upon the type of disabled student they are concerned with. Their peers in Class XIth and XIIth who themselves are Learning Disabled are encouraged to help the students of lower Classes in Sports, Music, Painting, Basketball, Swimming etc depending upon their creative talent and areas they are comfortable with, contributing equally as their non disabled peers of their Class. Teachers and Special Educators there gave certain examples as to how these children have identified and referred many kids in their locality to the Special Educators of their school and inclusion of Children with Learning Disabilities have quite been possible. This practice of including children in the Planning and Management, Identification and Education of Children with Learning Disabilities can help make them sensitive towards their peers with such disabilities and also help them understand their needs as well to assist them in the same. This innovative social initiative is interest driven on part of the children themselves, and quite promising for future endeavors.

SCHOOL C -

For Students who cannot take up CBSE Board Curriculum and Examinations, there is Provision of opting out NIOS (National Institute of Open Schooling) Examinations which provides a wider range of Optional Subjects to choose from, which are not offered by CBSE Board. Students who have opted for NIOS in their Class Xth may shift back to CBSE in their Class XIth depending upon the ease and their desire of doing so if the case turns out to be a minor disability or ADHD very often, which later may be compensated with. For such students, the entire academics go on as the Course for others but with assistance from Special Educators (different for each subject) in the Resource Room or the separate Learning Centers of the School meant for this special assistance. The students are given the liberty to work at their own pace with assistance. Students who can neither take up CBSE Board nor NIOS Provisions due to their impairment being of such a severity (or if coupled with multiple disabling conditions) they have the choice of taking up Vocational Training in areas like Survival Cooking, Baking, Tie and Dye, Candle making, making Key Chains etc as Functional Skills. Besides, these students are also trained with Shopping Skills, Bargaining Skills, etc through use of Functional toys and Models to help them understand the concepts practically. These children are encouraged to sell the Candles prepared by them during Diwali Season through Special Stalls thus making them enjoy the activities in a practical setting. These students also sell the Cakes, Tarts, Patties and Biscuits etc at the school canteen that they bake at the school kitchen, during the school lunch interval, to the children of the school which helps them learn pricing, selling and bargaining skills. For this they plan a recipe each day, learn the ingredients and methods to be used, by their teacher and plan out their tasks. Making up Key Chains out of beads of different colors helps them in learning Color- coordination, Organization and Assembling of the stuff to bring about a fantastic combination. This in-house Vocational Training to the students with Learning Disabilities as also with Multiple Disabilities may help them in the long run where they can use their in hand skills to earn a living if not the ability to read and write. More of such initiatives should be welcomed by helping the parents of such children to understand the need of their children and choosing a vocation for them accordingly despite pushing them into what seems difficult or at times impossible for them to achieve.

SCHOOL D -

Students with Learning Disabilities, besides taking educational assistance at the Resource Rooms or Learning Centers of their Schools (which are established for this purpose) also take assistance at the various Multidisciplinary Clinics of Organizations working for Children with Learning Disabilities, Autism, and ADHD etc very often if the parents find the assistance provided by the schools
unsatisfactory. Such Clinics are really helpful in aiding the students with such disabilities who don’t have facilities of Resource Rooms in their schools to provide them assistance in difficulties faced by them in Regular Classrooms. But for children already getting assistance at the Resource Rooms of their Schools (and coming for part-time assistance at the clinics), there arises question of the similarity and difference of the Pedagogy adopted, the Assistive Devices being used by the two and the IEP (Individualized Education Programmes) devised by the Special Educators of the two Centers. To avoid such mismatch of Pedagogy and Medium, this School has tied up with the Non Government Organization ‘ORKIDS’, which is a multi-disciplinary Clinic and a premier name for working with Children with Learning Disabilities, Autism, ADHD etc, therefore the Resource Room functional at this School is just another of the various Clinics of ORKIDS which is operational here (termed ‘ORKIDS Within School’ or OWS). The advantages of doing so are:

1. It saves the time of the child after school, by the remedial assistance provided here itself.
2. The IEP of the child is uniform with timely and frequent cooperative feedbacks
3. The interaction between the teachers of the child and the Special Educators is more frequent.
4. The child can be given the world class remedial assistance in practice at this Clinic by adaptation of educational assistive devices and Instructional Programmes being used abroad and being adapted to suit the specific needs of the child in the Indian Context (owing to the plethora of diverse Indian languages and different socio-cultural settings that the children are part of).
5. The school can be relieved in terms of extra funds to promote these facilities which are borne by the Organization (ORKID) itself, at the same time the Organization has an access and opportunity to reach wider population of Children with Learning Disabilities needing assistance directly in the school.

This initiative is a practical example of successful partnership and participation of the various stakeholders to promote inclusion.

CONCLUSION -

Inclusive education in India can be said to be still evolving. Successful initiatives therefore, especially the innovative ones being taken in Inclusive Schools (both the Private and the Government Schools and even in Open School System) need to be discussed on a common platform to promote Best Practices. It is also that when the population being covered is not uniform owing to the plethora of socio-cultural differences, individual needs and varying abilities of learners participating in the learning process, the approach also needs to be tailored to suit the diverse learning needs of the students studying in the same class so that all can be benefitted equally. In a right-based society that we live in, we need to hear voices from within the system, and initiatives at the Policy front or the individual ones need not be constrained as such, and the efforts of today may multiply tomorrow to complement the two, through mutual participation and understanding. What actually needs focus and attention is the reality at the implementation level and the level of practice, besides capacity building of the concerned staff and rigorous research to find newer and better ways to address the emerging concerns. Depending upon the degree of disability of the learner, and the context and feasibility of the approach, the available Assistive Educational Provisions can serve as the blueprint and pave a way forward for promoting inclusion in education of Children with Learning Disabilities in the country.

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**BOOKS, JOURNALS AND PERIODICALS -**


Note: The names of the schools discussed in the Paper are not disclosed, to maintain confidentiality.
Ethical Underpinnings of Educational research
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ABSTRACT
Research is a process that presumably attempts to explore truth. It intends to look into any identified phenomena to establish a new principle or reestablish and substantiate a previously existing theory or principle. The process itself requires truthfulness and certain honest and ethical codes of conducts to be adopted and adhered to, in order to have a truthful and honest effort to explore the truth. This paper presents a concept note on ethical issues of educational research and emphasizes the need of adopting and following ethics in research. The paper contends that by following the ethical code of conducts in the research one can maintain and uphold the sanctity of research by providing valid and reliable research output.

INTRODUCTION
Ethics is a social and philosophical construct which deals with the dynamics of decision making concerning what is right and wrong. The most common way of defining "ethics" is ‘norms for conduct that distinguishes between acceptable and unacceptable behavior’.

In fast growing professional world of research, relevance and importance of practicing ethical norms is very critical as it ensures objectivity, promotes truth and knowledge and ensures lesser occurrence of error. Academic, Social and Scientific research work, like all human activities, are governed, regulated and modeled by individual values, community values and societal values. In the broad perspective of research ethics, confidentiality of information collected, confidentiality of the sources of information such as human beings or any other sources – if the situation so demands, and prior permission before publication of the obtained information in the research are the pre-requisites.

Sources of Learning Ethics
Most people learn ethical norms at home, at school, at religious places or through rituals, or in other social settings. Although most people acquire and develop their understanding about right and wrong during their formative phase of life i.e. in their childhood, ethical and moral development keeps shaping up throughout the life. Ethical norms in society are all pervasive. These are the most obvious ingredients of our growing up phenomena that with each step of our movement in life we keep on being prescribed about it. In general, every individual observes or at least try to observe, some common ethical norms that his or her immediate surrounding prescribes or follows as shared understanding among the members of the community which one is a part of. The set of rules or ethical norms of one social circle may be different from that of another circle, depending upon the way a particular social circle or community interprets, believes, and has faith in or shares among its members. The ethical considerations of an individual or a society take shapes and are adopted and observed in the light of their values and experiences.

Almost all the existing societies in the world today have their legal framework, rules and regulations, law of the land, to govern the behavior pattern of their members, but ethical norms and framework are broader. Both – the legal rules and the ethical norms are the means by which people’s behavior are governed and regulated. The difference between these two frameworks is that the ethical norms are informal whereas the legal rules and regulations are formal. Although majority of societies use laws as instrument to enforce widely accepted and agreed
upon moral standards at the same time, moral standards are also used to control and regulate the conduct of the people. However, these two concepts are not the same. A legal action in a society sometimes may be considered as unethical by its own members and an ethical norm may be termed as illegal in some cases. Ethical notions and perceptions are generally used by an individual or a group of people to judge, evaluate, assess, critically examine, or interpret the prevailing laws.

‘Ethics’ is also defined or may be understood in the context of specific discipline or paradigm. In this context, ethics is considered as a set of desired conducts and norms which a particular professional community expects its members to adhere to. For example, there are prescribed code of conducts or ethical conducts for doctors, engineers, chartered accountants, lawyers, teachers and other professionals of different fields that they are expected to follow and adhere to. Similarly, in the field of education and research there are certain ethical parameters and code of conducts, though not universal in nature, which need to be followed.

Importance of ‘Ethics’ in Research
In order to understand the importance of ethics in research, let’s look into what is research. A research is an activity which intends to explore the truth of a process, phenomenon, social dynamics, educational issues or many such issues related to human life and all such things that human beings are related to and interested in knowing about. It makes efforts to verify, re-establish the previously established facts, laws or principles, corroborate or falsify the theories that have been existing in society. Simply putting it, research is an activity intended to explore the truth. If an effort is being made to explore the truth, how can it be done with dishonesty in its base? Therefore, the ethical considerations are of foremost importance for research. An exploration of truth must be based on genuine and correct information, data, appropriate analysis, and correct and truthful representation of facts. If the researcher adopts certain ethical norms, he or she can explore and promote the truth and avoid errors in representing the explanation of any process or phenomena.

Research also requires cooperation and coordination among many sources and people related to the coverage and scope of the research. If the researcher is interacting his subjects in the field to gather information which are very critical in nature, it is his responsibility to keep such information confidential and he must not disclose the source of information if there is a chance that by doing so the person may face problem. Here come the ethical standards and norms of practices. This involves adhering to certain values, accountability, fairness in professional practice, and protection of copyright and patenting, etc. Thus the moral and ethical norms, honesty, integrity and accountability of the researcher is very important in research.

Principles of Research Ethics
The main principles of research ethics, that a researcher or a professional community should follow, are as the following:

Objectivity
Researcher must not have any biases in the design of the research. Choosing correct methodology, data analysis, interpretation of the results, review of literature and peer review, individual and personal decisions, and other aspects of research which require objectivity, most not get influenced by the biases of the researcher. Objectivity of the research must be upheld.

Honesty
The research activity must be an honest effort in its true sense. Research communication, reporting the research data, methods, analysis, synthesis, interpretation, publication status of the research data and result must be based on the foundations of honesty.

Precision and Carefulness
While conducting research, utmost care should be taken to avoid errors. The process of research, its design, methodology, choosing appropriate sample, selecting correct method of analysis, etc. should be taken proper care of. Records should be maintained with clarity and the same should be acknowledged while writing the research report.
Openness
The researcher should not hesitate to give credit where it is due. One should always be willing to share data, ideas, tools, results, etc. He should be open to criticism and new ideas. If the information is being sought from the work of previously carried out work, proper attention should be given to ensure that the patent, copyright, and other forms of intellectual property related issues are taken care of.

Confidentiality of Information
The research ethics also requires the researcher to protect confidential information and communication, personal records, trade secret, etc. If he or she uses some information which has been sent for publication by the sources of the data, the researcher should make it sure that the data is not being processed for research related publications.

Research Competence
The researcher should develop and maintain in them adequate competence to carry out educational research. He should be well versed with the research related formalities, processes, methods and techniques. He should keep himself updated with the new developments in the field of educational research.

Research Related Misconducts
As discussed in the previous section, there may be certain things that may not be illegal but they are unethical in the context of research. These ‘misconducts’ must not be adopted while conducting a research. These include – publishing a paper or report of a research in more than one journal without informing the editors and submitting the same content of a paper to various journals with deliberate intention of misleading the editors. This also includes not acknowledging the work of other collaborators of the research. Sometimes we discuss and share very confidential information with our colleagues and peers related to our or others’ research work. This is wrong and unethical. One should avoid getting into such things. Similarly people use data as per their convenience and report the findings accordingly. In order to do so they trim the data and do not report the complete data. They do not use appropriate statistical techniques to analyze the data. Review of related studies is done without any logical connection with the existing research and the same is reported accordingly. These research related misconducts and unethical practices must not be there in research.

Epilogue
The previous sections have presented the discussion regarding integration of ethics into the research process from selection of research topic or research problem to conducting the research by formulating research questions, objectives, methodologies, sample, analysis and reporting. The overall process of research should be driven by the ethical guidelines, code of conducts and following established convention in order to observe quality in research. Although ethical code of conduct, rules, policies and guidelines are very important in useful, sometimes they do create conflicts and dilemma. Such situations need to be handled carefully and interpretation of the research outcomes should be done intelligently and with a broad knowledge base. Only then research related reliability and validity are maintained.

Reference


Harmful Impact of pesticide Endrin on some selective blood biochemical parameters aspectsof *Notopterusnotopterus* (Pallas, 1769) exposed to 0.1 ppm concentration
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ABSTRACT
During the present experiment, *Notopterusnotopterus* were exposed to lethal concentration (0.1 ppm) of endrin for a period of 60 min. in triplicates. The results on the biochemical parameters aspect of the experiment (5 replicas) revealed that significant (P < 0.05) increase in Bilirubin(mg/dL) (0.2 to 0.39), Creatinine (0.2 to 0.30) Na+ and K+ values as (mEq/L) slightly change (72.0 to 79 and 39.0 to 45.0) and decrease in plasma protein(g/dL), total serum protein(g/dL), Albumin(g/dL), Globulin(g/dL), Glucose(mg/dL), as well as lipid profile Cholesterol(g/dL), TG, reduced respectively.

INTRODUCTION
Fish is one of our most valuable sources of protein; about 25% of animal protein is obtained from fish and shell fish. About 35% of all fish is eaten fresh, chilled or frozen. It is also cured or canned (16%) or made into oil and fish meal (32%). Fishes are used us medicine, ground into vitamins, or processed into cosmetics and perfumes, lubricants, varnishes, soap and margarine. Whales, seals and oysters are valued for many of the above uses. The present report describes toxic effects of biochemical parameter of blood in *Notopterusnotopterus*. Fish kills due to effect of endrin pesticide, so reduced fish productivity or elevated concentration of undesirable chemicals in edible fish tissues it can affect the health of humans eating these fishes (Adedeji *et al.*, 2009) [1]. Fish is very important to humans because it contain protein of very high quality and also has sufficient amount of all the essential amino acids required by the body humans because it contain high quality and also has sufficient amounts of all the essential amino acids required by the body for growth and maintenance of muscles tissues.
Agricultural use of pesticides is a subset of the larger spectrum of industrial chemicals used in modern society. Because the environmental burden of toxic chemicals includes both agriculture and non-agricultural compounds, it is difficult to separate the ecological and human health effects of pesticides from those of industrial compounds that are intentionally or accidentally released into the environment Singh and Khareet *et al.*, (1999)[2]. However, there is overwhelming evidence that agricultural use of pesticides has a major impact on water quality and leads to serious environmental consequences. Water pollution occurs when a body of water is adversely affected due to the addition of large amounts of materials to the water. The sources of water pollution are categorized as being a point source or a non-source point of pollution. The greatest contributors to toxic pollution are herbicides, pesticides and industrial compounds. The many workers investigated other fishes which
were analysed for pesticide contamination and its effect included Clarias gariepinus Adedeji, (2006) [3]; Kori-Siakpere, (2007) [4]; Ogueji (et al., 2007) [5]; Adeleru (et al., 2008) [6]; Inyang (et al., 2010) [7].

According to a report published in 1990 from the Environmental Protection agency (EPA), >50% of the water pollution of stream and rivers occur due to leaching and mixing of chemical from the agricultural practices (Cook et al., 2000) [8]. Water pollution occurs when a body of water is adversely affected due to the addition of large amounts of chemicals to the water. The indiscriminate dumping and release of wastes containing the above mentioned hazardous substances into rivers lead to environmental disturbance which could be considered as potential source of stress to biotic community, particularly to fish. On the worldwide scale, the river water pollution leads hazardous impact on aquatic animals. Some studies show alarming condition of river pollution implications.

Pesticides are various use in agriculture fields and ultimately going on the resources of water bodies through the runoff by rain water and results out put into cause serious aquatic environment problems especially (including fish) in dry season increasing the rich of high concentration of toxic chemicals. Contamination of water by pesticides such as like aldrineendrine, BHC, DDT, Parathion, phorateendosulphan and malathion and other many weedicides herbicides fungicides, various insecticides etc. Either directly or indirectly can lead to bioaccumulation of xenobiotic including these pesticides aqua species and alarming thus posing a threat to aquatic life. Khalaf-Allah (1999). [9] Water pollution may be defined as any impairment in its native characteristics by addition of anthropogenic contaminants to the extent that it either cannot serve to humans for drinking purposes and/or to support of the biotic communities, such as fish. Water pollution is the contamination of water bodies such as lakes, rivers, oceans, and groundwater by human activities. Because, due to rapid industrialization and use of innovation agricultural practices, pollution of water bodies, particularly the estuaries and near shore waters has increased. Pesticides which drain into inland and costal water bodies through run off agricultural fields, sewage disposal and effluents of industries can adversely affect food chain and food webs. Pesticides with run off from agriculture farms into aquaculture systems can potentially trigger the outbreak of discuss, as they cause deterioration of the ecosystem; as well suppress the fish and aquatic animal’s immune system.

Materials and methods:

Original healthy Notopterus notopterus (Pallas) fishes weighing 150 to 170gm with a mean body length of 24 to 26 cm, were collected from the fish hatchery in Bhopal, M.P. Fish were brought to the laboratory and acclimatized for two weeks prior to experimentation. The fishes were fed with balanced diet/pelleted feed with 35% crude protein diet at 2% biomass. Endrin (C_{12}H_{8}Cl_{6}O) is manufactured by Shivalic Agro Chemical Industries India. Endrin is an organochloride that is primarily used as an insecticide. Endrin is a stereoisomer of dieldrin. It is also a rodenticide. Endrin tends to accumulate in fatty tissue of aquatic organisms. It is very toxic to aquatic organisms, invertebrates, fish, and phytoplankton etc. The lethal concentration (0.1 ppm) of the pesticide was prepared by dissolving 1ml of original concentration of pesticide individually in 10 liter of chlorine free water. 30 L of the diluent water was used as control. The fishes (n = 30) were kept in each aquarium in triplicates for each treatment. The stock solution of 0.1 ppm of the solution was introduced separately in each tank. The fishes were observed for 0-60 minutes for any
mortality during the exposure time. The blood samples from the challenged fishes were taken after every 20, 40 and 60 min. Blood samples were collected from the caudal tail vessels with 21 or 23 gauge needles and 1 or 3 cc syringes before ventilator response was noticeably depressed.

**Biochemical analysis**

Blood was collected as described for haematological analysis as firstly blood of healthy (non-toxicated) fish *Notopterus notopterus* were collected directly in dry and sterilized centrifuge by cutting the caudal peduncle of living fish with a sharp sterilized dry knife. Before cutting the caudal peduncle the fish was blotted with blotting paper to avoid the haemolysis. The blood was allowed to clot for 10 minutes and centrifuged at 3000rpm for 20 min. the serum was carefully taken out with the help of pipette and stored at 4°C all the test were performed within 72 hours.

**Plasma Protein Determination:** The total serum protein was determined by Gornall’s biuret method. The solution [Gornall reagent: 1.5 g CuSO₄·5H₂O (Copper sulphate pentahydrate); 6.0 g KNaC₄H₄O₆ (Potassium sodium tartarate); 500 ml of distilled water; 300 ml of 10% NaOH (prepared by diluting 65-70% carbonate-free stock solution)] Plasma protein was determined as per the method described by Keller (1991) by using MERCK autoanalyser kit with the help of microlab 200, MERCK Ltd, Worli, Mumbai and the values were expressed as g/dL.

**Serum Globulin:** Globulin concentration in serum was indirectly determined by subtracting the albumin concentration from the total protein concentration and the results expressed as gm/dL. **Serum Glucose:** Glucose in serum was determined by using MERCK autoanalyzer kit as described by Mayne (1994) with the help of microlab 200 at 546 nm and the value was expressed as mg/dL. **Creatinine:** For the estimation of creatinine, using a photocolorimeter using a green filter (520-540 nm), setting the zero optical density (OD) with the help of blank solution, and the content calculated by the following formula: (NCCLS, 1992).

\[
\frac{\text{OD test}}{\text{OD standard}} \times 0.01 \text{ mg x} = \text{creatinine mg/dL}
\]

**Serum Bilirubin:** Bilirubin concentration was determined by using Malloy and Evelyn method. Calculation Concentration of bilirubin (mg/dL) = \(A_{TT} \times F \times 2\ F = \) calibration factor 2 = dilution

**Serum Sodium:**

\[
\frac{\text{Abs. of unknown}}{\text{Abs. of Standard}} \times \text{Conc. of Standard} = \text{Sodium mEq/L}
\]

**Serum Potassium:**

0.2 ml of serum was taken in 10 ml centrifugation tube. 0.5 ml of silver iodate reagent was mixed. Then 3.3 ml of tungstic-phosphoric acid was mixed. The solution was centrifuged for 5 minutes at 2000 rpm. 1.0 ml of supernatant was transferred into a 25 ml conical flask. Then 1 ml of 2%
Potassium iodide solution was added and titrated against 0.005 N sodium thiosulphate, till the rainbow colour of the iodine nearly disappeared.

**Calculation**

Chloride concentration in serum (mmol/L) = \( \frac{T_t}{T_s} \times 100 \) where, \( T_t \) = Titration value of (specimen) sample \( T_s \) = Titration value of standard 100 = Concentration of standard (mmol/L)

**Results:**

For investigation into the effect of pesticides on the biochemical indices there are eleven (11) parameters were studied. The plasma proteins expressed in (g/dL) was 3.8±0.024, which showed a decrease after 60 min. of exposure, ranging from 2.6-3.0 with a mean±SD of 2.8±0.02. The effect of 0.1 ppm endrin on plasma proteins of *N. notopterus* showed with ‘variance’, ‘regression equation’ and ‘correlation coefficient of 488.3, \( Y= -0.018 X + 3.93 \) and 0.94 respectively. The mean±SD value of total serum proteins expressed in (g/dL) was 3.0±0.020. Which decrease the lowest protein was recorded after 60 min. of exposure, ranging from 1.65-1.95 with a mean±SD of 1.8±0.21. The effect of 0.1 ppm endrin on total proteins of *N. notopterus* showed ‘variance’, ‘regression equation’ and ‘correlation coefficient of 503.07, \( Y= -0.019 X + 3.93 \) and 0.94 respectively. The mean±SD value of total serum albumin expressed in (g/dL) was 1.3±0.012. Which showed a decrease lowest albumin was recorded after 60 min. of exposure, ranging from 0.58-0.82 with a mean±SD of 0.7±0.05 g/dL. The effect of 0.1 ppm endrin on albumin of *N. notopterus* showed ‘variance’, ‘regression equation’ and ‘correlation coefficient of 503.07, \( Y= -0.019 X + 3.01 \) and 0.99 were calculated respectively. The mean±SD value of total serum globulin expressed in (g/dL) was 1.7±0.013. which showed a decrease after 60 min. of exposure, ranging from 0.85-0.95 with a mean±SD of 0.9±0.02, and showing ‘variance’, ‘regression equation’ and ‘correlation coefficient of 520.6, \( Y= -0.013 X + 1.73 \) and 0.99 respectively. The mean±SD value of total creatinine expressed in (g/dL) was 0.2±0.012. The highest creatinine was recorded after 60 min. of exposure, ranging from 0.21-0.39 with a mean±SD of 0.3±0.12 g/dL. The effect of 0.1 ppm endrin on creatinine of *N. notopterus* showed ‘variance’, ‘regression equation’ and ‘correlation coefficient of 538.8, \( Y= 0.001 X + 0.185 \) and 0.94 respectively. The mean±SD value of total serum glucose expressed in (mg/dL) was 108.0±3.20. Which showed lowest glucose was recorded after 60 min. of exposure, ranging from 71-79 with a mean±SD of 75±2.11. The effect of 0.1 ppm endrin on glucose of *N. notopterus* showed ‘variance’, ‘regression equation’ and ‘correlation coefficient of 1385.9, \( Y= -0.55 X + 106 \) and 0.98 respectively. The mean±SD value of total serum bilirubin expressed in (g/dL) was 0.2±0.001 which showed highest bilirubin was recorded after 60 min. of exposure, ranging from 0.36-0.42 with a mean±SD of 0.39±0.04. The effect of 0.1 ppm endrin on total bilirubin of *N. notopterus* showed ‘variance’, ‘regression equation’ and ‘correlation coefficient of 537.4, \( Y= 0.003 X + 0.19 \) and 0.99 respectively. The mean±SD value of total sodium expressed in (mEq/L) was 72.0±2.35.. The lowest sodium was recorded after 60 min. of exposure, ranging from 76-82 with a mean±SD of 79±0.42. The effect of 0.1 ppm endrin on sodium of *N. notopterus* showed ‘variance’, ‘regression equation’ and ‘correlation coefficient of 777.8, \( Y= 0.185 X + 64.2 \) and 0.48 respectively. The mean±SD value of total potassium expressed in (mEq/L) was 39.0±1.33. The highest potassium was recorded after 60 min. of exposure, ranging from 41-49 with a mean±SD of 45±2.11 mEq/L. The effect of 0.1 ppm endrin on potassium of *N. notopterus* showed ‘variance’, ‘regression equation’ and ‘correlation coefficient of 324.7, \( Y= 0.14 X + 35.3 \) and 0.64 respectively.
The mean±SD value of total serum cholesterol expressed in (mg/dL) was 164.0±3.30. The lowest cholesterol was recorded after 60 min. of exposure, ranging from 114-126 with a mean±SD of 120±2.56 mg/dL. The effect of 0.1 ppm endrin on cholesterol of *N. notopterus* showed ‘variance’, ‘regression equation’ and ‘correlation coefficient of 4040.1, Y= -0.735 X + 164.3 and 0.99 respectively. The mean±SD value of total triglyceride expressed in (mg/dL) was 132.2±2.21. The lowest triglyceride was recorded after 60 min. of exposure, ranging from 115.9-116.9 with a mean±SD of 116.4±2.2. The effect of 0.1 ppm endrin on triglyceride of *N. notopterus* showed ‘variance’, ‘regression equation’ and ‘correlation coefficient of 2787.9, Y= -0.254 X + 130.8 and 0.96 respectively. (Table 1 and See table 2 for statistical interpretation)

### Table 1: Mean biochemical parameters of *Notopterus notopterus* (Pallas) exposed to 0.1 ppm Endrin

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Control</th>
<th>20 min</th>
<th>40 min</th>
<th>60 min ‘≠’</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Min.</td>
<td>Max.</td>
<td>Mean±SE</td>
<td>Min.</td>
</tr>
<tr>
<td>Plasma protein (g/dL)</td>
<td>3.8±0.02</td>
<td>4.0</td>
<td>3.80±0.10</td>
<td>2.8</td>
</tr>
<tr>
<td>Total serum protein (g/dL)</td>
<td>3.0±0.02</td>
<td>2.4</td>
<td>2.6±0.25</td>
<td>2.0</td>
</tr>
<tr>
<td>Serum Albumin (g/dL)</td>
<td>1.3±0.01</td>
<td>0.95</td>
<td>1.1±0.12</td>
<td>0.6</td>
</tr>
<tr>
<td>Serum Globulins (g/dL)</td>
<td>1.7±0.01</td>
<td>1.35</td>
<td>1.65</td>
<td>1.0</td>
</tr>
<tr>
<td>Serum Creatinine (mg/dL)</td>
<td>0.2±0.01</td>
<td>0.11</td>
<td>0.2±0.01</td>
<td>0.18</td>
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<tr>
<td>Serum Glucose (mg/dL)</td>
<td>108±3.20</td>
<td>84</td>
<td>93±1.15</td>
<td>78.0</td>
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<tr>
<td>Total serum bilirubin (mg/dL)</td>
<td>0.2±0.00</td>
<td>0.23</td>
<td>0.26±0.10</td>
<td>0.25</td>
</tr>
<tr>
<td>Sodium (mEq/L)</td>
<td>72±2.35</td>
<td>47</td>
<td>56±2.12</td>
<td>66.0</td>
</tr>
<tr>
<td>Potassium (mEq/L)</td>
<td>39±1.33</td>
<td>30</td>
<td>32±2.52</td>
<td>35.0</td>
</tr>
<tr>
<td>Serum cholesterol (mg/dL)</td>
<td>164±3.30</td>
<td>141</td>
<td>150±2.56</td>
<td>128</td>
</tr>
<tr>
<td>Triglycerides (mg/dL)</td>
<td>132.2±2.21</td>
<td>123.6</td>
<td>124.3±2.2</td>
<td>118.0</td>
</tr>
</tbody>
</table>

**Note:** Values are mean±SD of five replications (d.f. 5, 30). Means in the same row having different superscripts are significantly different (P < 0.05) and values in the same row with same superscript are not significantly different (P > 0.05). ‘≠’ Death time * No statistical analysis was possible as determinations were performed on pooled samples.
Table: 2 Statistical interpretation for deriving biochemical parameters in *Notopterus notopterus* (pallas) exposed to 0.1 ppm Endrin

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Groups</th>
<th>N</th>
<th>Means</th>
<th>SD</th>
<th>Variance</th>
<th>Regression equation</th>
<th>‘r’</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plasma protein (g/dL)</td>
<td>Control</td>
<td>10</td>
<td>3.8</td>
<td>2.68</td>
<td>7.22</td>
<td>Y = -0.018x + 3.93</td>
<td>0.94</td>
</tr>
<tr>
<td></td>
<td>Mean</td>
<td>20</td>
<td>3.23</td>
<td>22.09</td>
<td>488.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total serum protein (g/dL)</td>
<td>Control</td>
<td>10</td>
<td>3.0</td>
<td>2.12</td>
<td>4.5</td>
<td>Y = -0.019x + 3.01</td>
<td>0.99</td>
</tr>
<tr>
<td></td>
<td>Mean</td>
<td>20</td>
<td>2.23</td>
<td>22.42</td>
<td>503.07</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Serum Albumin (g/dL)</td>
<td>Control</td>
<td>10</td>
<td>1.3</td>
<td>0.91</td>
<td>0.84</td>
<td>Y = -0.01 x + 1.3</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td>Mean</td>
<td>20</td>
<td>0.9</td>
<td>22.9</td>
<td>526.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Serum Globulins (g/dL)</td>
<td>Control</td>
<td>10</td>
<td>1.7</td>
<td>1.20</td>
<td>1.44</td>
<td>Y = -0.013 x + 1.73</td>
<td>0.99</td>
</tr>
<tr>
<td></td>
<td>Mean</td>
<td>20</td>
<td>1.2</td>
<td>22.8</td>
<td>520.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Serum Creatinine (mg/dL)</td>
<td>Control</td>
<td>10</td>
<td>0.2</td>
<td>0.14</td>
<td>0.02</td>
<td>Y = 0.001 x + 0.185</td>
<td>0.94</td>
</tr>
<tr>
<td></td>
<td>Mean</td>
<td>20</td>
<td>0.25</td>
<td>23.21</td>
<td>538.80</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Serum Glucose (mg/dL)</td>
<td>Control</td>
<td>10</td>
<td>108</td>
<td>76.36</td>
<td>5832</td>
<td>Y = -0.55 x + 106</td>
<td>0.98</td>
</tr>
<tr>
<td></td>
<td>Mean</td>
<td>20</td>
<td>83.33</td>
<td>37.22</td>
<td>1385.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total serum bilirubin (mg/dL)</td>
<td>Control</td>
<td>10</td>
<td>0.2</td>
<td>0.14</td>
<td>0.02</td>
<td>Y = 0.003 x + 0.19</td>
<td>0.99</td>
</tr>
<tr>
<td></td>
<td>Mean</td>
<td>20</td>
<td>0.33</td>
<td>23.18</td>
<td>537.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sodium (mEq/L)</td>
<td>Control</td>
<td>10</td>
<td>72</td>
<td>50.9</td>
<td>2592</td>
<td>Y = 0.185 x + 64.2</td>
<td>0.48</td>
</tr>
<tr>
<td></td>
<td>Mean</td>
<td>20</td>
<td>69</td>
<td>27.8</td>
<td>777.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Potassium (mEq/L)</td>
<td>Control</td>
<td>10</td>
<td>39</td>
<td>27.57</td>
<td>760.5</td>
<td>Y = 0.14 x + 35.3</td>
<td>0.64</td>
</tr>
<tr>
<td></td>
<td>Mean</td>
<td>20</td>
<td>39.6</td>
<td>18.02</td>
<td>324.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Serum Cholesterol (mg/dL)</td>
<td>Control</td>
<td>10</td>
<td>164</td>
<td>115.9</td>
<td>13448</td>
<td>Y = -0.735 x + 164.3</td>
<td>0.99</td>
</tr>
<tr>
<td></td>
<td>Mean</td>
<td>20</td>
<td>135</td>
<td>63.56</td>
<td>4040.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Triglycerides (mg/dL)</td>
<td>Control</td>
<td>10</td>
<td>132</td>
<td>93.3</td>
<td>8712</td>
<td>Y = -0.254 x + 130.8</td>
<td>0.96</td>
</tr>
<tr>
<td></td>
<td>Mean</td>
<td>20</td>
<td>120.2</td>
<td>52.8</td>
<td>2787.9</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Discussion:

The present investigations there are eleven biochemical parameters of blood chemistry of *N. notopterus* due to endrin intoxication after 20 min, 40 min, 60 min respectively. The significant change were noted from the healthy values (P<0.05). The values which showed decrease from normal values include total plasma proteins 3.8±0.024 to 2.8±0.020 (g/dL); total serum proteins from 3.0±0.020 to 1.8±0.21 (g/dL)(hypoprotenemia); serum albumin from 1.3±0.012 to 0.7±0.05 (g/dL)(hypalbuminia); serum globulin from 1.7±0.013 to 0.9±0.02 (g/dL)(hypoglobulinaemia); serum glucose from 108±3.20 to 75.0±2.11 (mg/dL); serum cholesterol from 164±3.30 to 120±2.56 (mg/dL)(chloresterosis); triglycerides from 132.2±2.21 to 116.4±2.2 (mg/dL); While as other parameters showed an increase from the normal value, which include creatinine (mg/dL) from 0.2±0.012 to 0.3±0.12; total bilrubin from 0.2±0.001 to 0.39±0.04 (mg/dL) (hypobilirubinina); sodium from 72±3.35 to 79±0.42 (mEq/L); and potassium (mEq/L) from 39±1.33 to 45±2.11. (Table no 1) Manoj Ahirwar et al., (2012) [13] observed that the total protein, globulin and serum enzymes ALAT; ASAT values were lower in *Tilapia nilotica*, exposed to various pesticides. The study on the toxicity and bioaccumulation of endrin and methoxychlor in aquatic invertebrates and fish was carried out by Richard et al. (2003) [14]; Singh and Shrivastav et al., (1998) [15] reported the decrease in serum proteins in fish on exposure to different pesticides, enumerated the effect of sub lethal endrin exposure on the immune response of rainbow trout, *Salmogairdneri* and reported changes in blood counts along with the plasma biochemistry of trout. Their work revealed significant (P<0.01) increase in sodium and potassium levels of rainbow trout, post exposure to various pesticides.

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The present investigation of blood biochemistry of *N. notopterus* exposed to endrin after the 20 min, 40 min and 60 minutes of intoxication. The drastic changes in the blood profile of the fish were noted. Gluth and Hanke (2004) [16] Hrubec and Robertson, et al., (2011) [17]; Anand Pratapsingh (2010) [18]; Ramesh and Sarvana (2011) [19] investigated the compared the physiological changes and serum chemistry of different fishes due to impact of different pesticides.

The blood chemistry for glucose is must often associated with renal injury. Serum glucose is regulated by complex interaction of hormones such as glycogens and cortisol. The decrease serum glucose can cause hypoglycemic condition. The hypoglycemia in fish may also reflect stress in induced hormone mediated response. These alternations in blood glucose levels have been reported in *H. fossilis* exposed to sub lethal concentration of triazophos intoxication. The serum protein, cholesterol, albumen and globulin were decreased. The toxic stress may be decreased values in disorder of haemopoitic tissue Dasai(2002) [20]. Protein is mainly involved in the architecture of the cell during chronic periods of serum they are sources of energy. These values are depletion during stress condition fish needs more energy to detoxify the toxicant and also to overcome stress. Hilmy et al. (2010) [21] who investigated the physiological mechanism of toxic action of DDT and endrin in two euryhaline freshwater fishes, *Anguilla vulgaris* and *Mugilcephalus*. Sobhana et al. (2006) [22] on the other hand worked on the immunosuppressive action of nuvan (dichlorovos) in the banded pearl spot, *Etroplus suratensis* haematology and humoral immune response, and reported significant (P< 0.05) values. The pesticides have special mechanism of bio-concentration and bioaccumulation, through which the internal organs of the fish are damaged and the fish is stressed. The concept is backed by the work of Alawi et al. (2008) [23] who investigated the levels of organ chlorine pesticides in fish, algae, sediments and sea water samples in the Aqaba Gulf. The study was further strengthened by the work of Marion and James (2010) [24] who investigated vertebrate insecticide resistance in terms of in vivo and in vitro endrin binding to cellular fractions from brain and liver tissues of *Gambusia*. More or less similar results have been observed by Boyd (2011) [25]; David (2011) [26]; Denzel & Bingham (2011) [27]; Gerald et al. (2011) [28]; Jeffrey et al. (2011) [29]; Larry et al. (2011) [30]; Plumb & Richburg (2011) [31] and Ronald & Philip (2011) [32].

Conclusion:

The present investigation revealed that significant (P<0.05) increase in Bilirubin(mg/dL) (0.2 to 0.39), Na⁺ and K⁺ gradually as (72.0 to 79.0 and 39.0 to 45.0) ) and decrease in plasma protein(g/dL), Albumin(g/dL), Globulin(g/dL), Glucose(mg/dL), as well as lipid profile Cholesterol(g/dL), TG, were reduced respectively.

Acknowledgements:

Thanks are due to my guide, Professor Qaiser Jahan Shammi, who supported and guided me through all the odds during my research tenure. I extend my gratitude to my teachers, friends and family.

References:


A STUDY ON STATUS OF GRONDWATER QUALITY IN AND AROUND THE POLOGROUND INDUSTRIAL AREA OF INDORE CITY, M.P.(INDIA)

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ABSTRACT

Safe drinking water is the primary need of time most of the people depends upon groundwater sources that have problems of hardness, calcium, nitrate, phosphate, fluoride, D.O., B.O.D., C.O.D. and Heavy metals copper and zinc and excess of MPN count. Different samples have been collected in pre and past monsoon seasons during 2012-13. different parameters of water has been analysed and evaluated to the suitability of drinking water for human consumption and public hygiene scenario and health impacts. Some of the parameters are observed within the prescribed limits of 15:10500 while others are beyond the limits of WHO and ISI.

INTRODUCTION

Water is the most essential commodity for all living creatures. Organisms cannot survive without water. It is used for many purposes e.g. industrial supply, irrigation, drinking, propagation of fish and other aquatic systems and hydropower. Out of 1.45 billion cubic km world’s water only 13 million cubic km water is available in the form of streams, lakes wells and tube well.

The global environment is changing continuously due to unfavourable alteration of surroundings. These changes may affect man directly or through supplies of water and of agricultural and other biological products. The most common types of pollution and pollutants discharged, encountered in domestic and industrial waste waters, along with their possible effects on the water resources are discussed. Chemicals are a major source of water contamination that introduced during water movement through geological materials, manufactured chemicals may cause problems. Fertilizers and pesticides are major contributors to water pollution. Among the metals, the severe pollutants are lead, cadmium, arsenic, copper, zinc, manganese, iron and calcium. There are a number of pathogenic micro-organisms which cause water born disease in man.

Indore is located geographically between 22°37′29.66″N 75°46′86″E and 22°48′34″N 75°56′32″E at an average altitude of 553 Meters from the Sea Level. It is located 190 KM away from the State Capital, Bhopal on NH - 3. The Indore District is spread in an area of 3898 KM². The Indore city area is 13717 hectare.

Total generation of sewage in Indore city is 200 MLD on the basis of present population. Indore Municipal Corporation is treating only 90 MLD of sewage, the rest is disposed without treatment into Khan River. The Khan River passes from Indore city and travelling a distance of 50 Km., confluences into Shipra River at Ujjain. Following are the important point and drains of Khan river which are important for water quality monitoring.
Khan River near Pologround.
Khan river at Kabitkhedi, before STP
Khan river at Shakkarkhedi, downstream of STP
Vijay Nagar / Sukhia Nala, before 12 MLD STP
Khan river near Sanwer town.

Sanwer road industrial area is the main industrial area of the Indore. Trade and domestic effluent of the Sanwer Road Industrial area is discharged into the Narvar Nala, presently wastewater in the drain is not reaching up to confluence point with Khan river. Pologround industrial area drain is to be monitored before its confluence into the local Nala. Other industrial cluster does not any common outfall.

**Sampling Stations**
Five sampling stations have been chosen for present study during the study year 2013-14 selected sampling stations are as follows:
1. Polo ground industrial area
2. Snehlataganj near Bhandari Bridge
3. Bangada residential area
4. Polo ground residential area
5. Mill area near Patnipura

**Material and method**

Samples for analysis with standard procedure in accordance with standard method of American Public Health Association (APHA, 1986) and National Environmental Engineering Research Institute (NEERI, 1986), Nagpur. The instruments have been used in the limit of precise accuracy and chemical used of G.R. grade. Temperature, pH, TDS were measured. The T-H, Ca-H, Mg-H has measured titrimetrically using EDTA, chlorides by Mohr’s Argentometric titration and $K_2CrO_4$ as indicator, D.O. by Winkler’s method. Total alkalinity was determined by Titrimetric methods using phenolphthalein and methyl orange indicators. Nitrates, sulphates and phosphate were measured by spectrophotometer.

**Observation’s**

The overall results of the study during the year 2013-2014 has summarised here in table-

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Corresponding Author: email:
### Table -
Water Quality of Khan River at polo ground, Indore During 2013-14

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Parameters</th>
<th>Unit</th>
<th>$S^1$</th>
<th>$S^2$</th>
<th>$S^3$</th>
<th>$S^4$</th>
<th>$S^5$</th>
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<td>Temperature</td>
<td>°C</td>
<td>26</td>
<td>26.4</td>
<td>27</td>
<td>26.5</td>
<td>27.6</td>
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<tr>
<td>2</td>
<td>pH</td>
<td></td>
<td>8.2</td>
<td>8.0</td>
<td>7.22</td>
<td>8.0</td>
<td>7.5</td>
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<tr>
<td>3</td>
<td>Chloride</td>
<td>ppm</td>
<td>410</td>
<td>275</td>
<td>325</td>
<td>420</td>
<td>225</td>
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<td>4</td>
<td>D.O.</td>
<td>ppm</td>
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<td>1.80</td>
<td>1.01</td>
<td>1.22</td>
<td>1.30</td>
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<td>B.O.D.</td>
<td>ppm</td>
<td>2.8</td>
<td>2.10</td>
<td>2.74</td>
<td>3.40</td>
<td>3.50</td>
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<td>ppm</td>
<td>64.2</td>
<td>88.4</td>
<td>80.6</td>
<td>70.8</td>
<td>86.4</td>
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<td>Sp. Conductivity</td>
<td>mhos/cm</td>
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<td>1806</td>
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<td>2431</td>
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<td>Nitrate</td>
<td>ppm</td>
<td>5.07</td>
<td>4.31</td>
<td>3.64</td>
<td>6.06</td>
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<td>Phosphate</td>
<td>ppm</td>
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<td>4.81</td>
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<td>ppm</td>
<td>580</td>
<td>584</td>
<td>820</td>
<td>710</td>
<td>740</td>
</tr>
<tr>
<td>11</td>
<td>Total Hardness</td>
<td>ppm</td>
<td>390</td>
<td>392</td>
<td>476</td>
<td>310</td>
<td>400</td>
</tr>
<tr>
<td>12</td>
<td>Ca. Hardness</td>
<td>ppm</td>
<td>220</td>
<td>204</td>
<td>200</td>
<td>240</td>
<td>270</td>
</tr>
<tr>
<td>13</td>
<td>Mg. Hardness</td>
<td>ppm</td>
<td>170</td>
<td>188</td>
<td>70</td>
<td>120</td>
<td>110</td>
</tr>
<tr>
<td>14</td>
<td>Sulphate</td>
<td>ppm</td>
<td>47.52</td>
<td>19.90</td>
<td>34.88</td>
<td>47.95</td>
<td>38.34</td>
</tr>
<tr>
<td>15</td>
<td>Fluoride</td>
<td>ppm</td>
<td>1.02</td>
<td>.6</td>
<td>1.14</td>
<td>1.08</td>
<td>.82</td>
</tr>
<tr>
<td>16</td>
<td>Copper</td>
<td>ppm</td>
<td>.03</td>
<td>.01</td>
<td>.06</td>
<td>.05</td>
<td>.06</td>
</tr>
<tr>
<td>17</td>
<td>Zinc</td>
<td>ppm</td>
<td>.03</td>
<td>.02</td>
<td>.08</td>
<td>1.2</td>
<td>1.4</td>
</tr>
<tr>
<td>18</td>
<td>MPN</td>
<td>No./100ml</td>
<td>46</td>
<td>32</td>
<td>19.4</td>
<td>36.6</td>
<td>54.4</td>
</tr>
</tbody>
</table>

**Discussion:**

Temperature has significant impact on growth and activity of ecological life and affects the solubility of oxygen in water. The temperature of bore well’s water found in the range of 26°-29°C in present study.

pH value is the best indicator of presence of acid and alkali in water samples. pH in the present study varied from 7.22-8.2 at different sampling stations.

Chlorides are common constituents of all natural water. Higher values of it impart a salty taste to water, making it unacceptable for human consumption. As per ISI the desirable limit of chloride for drinking water is 250mg/l and the permissible limit is 1000mg/L. the chloride value in the present study varied from 225-420mg/l.

Total hardness of water is caused by the presence of Ca & Mg salts. Hardness of samples varied from310-476,
Ca-H 200-270 & Mg-H 22.3-48 ppm. Desirable limit of T-H for drinking water is 300 mg/l & permissible limit in the absence of alternate source is 600 mg/l.

Dissolved Oxygen Demand, Biological Oxygen Demand and Chemical Oxygen Demand in the present study ranged from 1.10-1.80, 2.10-3.50 and 64.2-88.4 ppm respectively.

Nitrates, sulphate, phosphate and fluoride have ranged from 3.54-6.06, 19.9-47.95, 3.4-4.81 and 0.6-1.14 ppm respectively. The prescribed limit of nitrate by WHO is 50 mg/l for domestic water. Nitrates are significant for plant growth. The presence of sulphate has less effect on the taste of water than chloride. The desirable limit of sulphate is 200-400 mg/l by ICMR. The high concentration of sulphate may induce diarrhoea and and intestinal disorders.

Phosphate in water occurs in the form of orthophosphate, polyphosphate and organophosphate. Excess amount of phosphate in water has cathartic effect of human health. Concentration of fluoride between 0.6 1.1 mg/l in potable water protects tooth decay and enhances bone development.

Copper and Zinc found in the range of 0.01-.06, 0.020-1.4 ppm respectively, In the present study most of the parameters are found within the prescribed limits of ISI

References-

2. APHA(1986), Standard methods for the examination of water and wastewater, APHA, AWWA, WPCF, 16’n Ed., New York
5. Environmental Protection Agency (1980) Ambient water quality criteria for Heavy Metals as Zn, Mn and Fe ;publication-440/8-80-79 EPA.


SOIL ANALYSIS IN AND AROUND BHOPAL CITY M.P. (INDIA)
Roli Shukla, and Jyoti Tandiya
Department of Chemistry, M.V.M. Bhopal

ABSTRACT
The aim of soil analysis is to develop scientific interest in researchers towards worthy soil science. The present paper receives laboratory studies in order to learn the role of component regarding the functional contribution of soil to all ecological cycles and chasing the needs and developmental demands of an ecosystem. The objective of present study were to (1) to find out the concentration of components present in soil (2) to estimate striking point of similarity among them. Results reveal that the high concentration of acidity (between 3-5 pH) in the samples taken, \( \text{PO}_4^- \), \( \text{NO}_3^- \) are measured in Kg/hectare, ppm respectively. In addition to that a remarkable accumulation of diffusive Ca, Cl, Na, K, and other trace element in the subsoil resulting from different soil horizons.

INTRODUCTION
Soil or pedosphere, are composed of air water and mineral organic materials. The food air water, vegetables needed to survive life, all depends on soil and its life sustaining property. This rich ecosystem is composed of both living and non living matter and the multitude of interaction between them. Soil provides the key link in the ecological C, N, P & S cycle etc. Soil is a store house of mineral, a reservoir of water, conserver of soil fertility or producer of crops, a home of wildlife, microorganism livestock. Soil system is indeed very complex & thus gathered our interest in studying and experimenting on this mysterious resource.

Many investigations have been conducted by a user on its physical and chemical properties. It includes parameter like pH, CONDUCTIVITY, LOD, MEASUREMENT OF acidity and alkalinity, Concentration of Nitrate, AMMONIA, PHOSPHORUS, acidic-basic radical, Mg, Ca++ using basic laboratory instrument and methods.

The main aim of the study is to examine the soil content of various and various locations and comparative study. Although we know ideal soil have 50 % for spec (including air field pores and water field pores both), 45 % mineral material and 5 % living and dead organic matter which help us to carry out an healthy comparative study. The study was carried at Motilal Vigyan Mahavidhyala Bhopal laboratory under supervision of expert supervisor.

MATERIAL AND METHOD
Study sites/Sample location: Three undisturbed top soil from the depth were taken from three prominent location namely Bhel, Kolar, Mirahills area. Usually: there are six types of soils are classified on the basis of major particles (sand, clay, silt) - Sandy, Clayey, Loamy, Sandy Loam, Clayey Loam, Silt Loam soil which mainly differ in %composition of these panicles where as INDIAN soil are divided in 5 broad types- Alluvial, kepi!, Red Desert, Literate soil.

Soil Analysis - Testing of the soil samples are carried out in laboratory as pre:embed by the isolation of these important contents in particular layer of sod on the basis of study we are trying to establish relationship to each other aeration and drainage, physical parameters like texture, specific gravity, weigh of soil, pore space soil porosity, packing of soil particles, size of soil pore, surface area etc have been judged by sensing Houching, however chemical test were tedious and as it includes various parameters-

(A)S011 PII (ACIDITY & ALKALINITY)
The reaction of aqueous solution represent the degree of acidity & basicity depending upon El+ ion & 011 - ion concentration over each other. Acidity is due to excess of H+ ion over OH - ion and alkalinity is reverse of it. Also soil reaction influence crop growth both directly and indirectly, so it has great importance pl 1 is determined by both colonmenc & potentkunerry method using centrifuge technique for better results.

(B) CONDUTIVITY, NITRATE, CHLORIDE ION
Measured by colorimeter provides indirect measurement of soil moisture from the field capacity to the wilting point

(Ca, IC, Na)
Detected by flame photometry by standard solution of K, Na (1000, 100,60,20pprn) & Ca start from 300 ppm because of its high concentration in soil due to sediment. Calcium is determined by EDTA titrated method using Mureoxide indicator.

1. Calculation

RESULTS

The soil we tested was top soil with a high degree of decomposition of sediments. This layer was usually compact and densely populated. Its physic-chemical properties are-

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Sample 1</th>
<th>Sample 2</th>
<th>Sample 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>5.2</td>
<td>9.03</td>
<td>4.04</td>
</tr>
<tr>
<td>Nature</td>
<td>Acidic</td>
<td>Slightly alkaline</td>
<td>Acidic</td>
</tr>
<tr>
<td>Conductivity</td>
<td>74.2 uS</td>
<td>161 uS</td>
<td>114 uS</td>
</tr>
<tr>
<td>Acidity</td>
<td>20 ppm</td>
<td>--</td>
<td>100ppm</td>
</tr>
<tr>
<td>Alkalinity</td>
<td>--</td>
<td>704 ppm</td>
<td>--</td>
</tr>
<tr>
<td>Nitrite</td>
<td>18 ppm</td>
<td>1.5 ppm</td>
<td>2.75 ppm</td>
</tr>
<tr>
<td>Phosphate</td>
<td>400400 kg/Hectare</td>
<td>21,38,400 Kg/Hectare</td>
<td>9,33,600 Kg./Hectare</td>
</tr>
<tr>
<td>Chloride</td>
<td>1.9 mg/L</td>
<td>2.0 mg/L</td>
<td>1.8 Mg/L</td>
</tr>
</tbody>
</table>
DISCUSSION AND CONCLUSION

A healthy soil improves soil aggregate structure, quality and yield of crops in agriculture application also provides healthy roots which produce healthy plants. All these parameters are always used to predict the ideality of soil for various purposes. This study reveals the fact that these soil are not appropriate for crop yield rather they are more acidic which may suit some xerophytes but not as expected.

REFERENCES


MERGER ISSUES AND ANALYSIS OF MERGER EFFECT WITH REFERENCE TO GROWING DEVELOPMENT BANKS OF INDIA
SANDEEP R. SHUKLA
Asst. Professor, Bansal Management Group of Institutes, Bhopal. MP

ABSTRACT
The macroeconomic indicators of banking sector economy of Indian subcontinent has witnessed improvement and growth and one of the major contributing factor in overall growth and development of important Development Banks in India has been strategic alliance and mergers of weaker entities with the stronger counterparts. The present research paper is devoted to analyze the merger effect in important development banks such as Industrial Credit Investment Corporation of India, Industrial Development Bank of India, and Housing Development Financial Corporation Bank and analyze merger issues, their relevance and importance to the selected sampling units in banking sector economy of India.

INTRODUCTION
Till 1990, mergers and acquisitions were not much in vogue in banks of Indian subcontinent. The mergers and acquisitions were in vogue in market based developed economies of the world. With the commercialization of activities pertaining to the financial sector, mergers and acquisitions in banking industry became vogue which can be seen from the merger stories of ICICI, IDBI, HDFC, PNB, Oriental Bank of Commerce, Bank of Punjab etc. with the weaker counterparts. The present research paper throws light on mega mergers of banking sector economy of India and the importance of strategic alliance in the banking industry for improving overall profitability which can be seen from the post mergers performance of selected sampling units.

Hypothesis Testing:
Following generalized hypothesis has been proved with help of data available with the annual reports of selected banks by the process of simple analytical reasoning:

- Mergers and acquisition in the selected banking entities of India have been responsible for creating up thrust in profitability of the banking business.
- There are many advantages of merger of weaker entity with the stronger entities and selected sampling units have similar merger effect which can be seen from the post merger performance of the sampling units.

Research Methods:
In the present research paper, secondary data has been selected for analysis purpose from the Annual Reports of three Development Banks Viz. ICICI Bank, IDBI Bank, and HDFC Bank, for a period from 2001-02 to 2012-13 financial years.

Significance of the present research: The present research will be beneficial to policy makers and planners and it will help them to take initiative in the area of merger and acquisitions in the interest of banking sector economy, it will help management of different banking economies in India and abroad and make them understand the importance of strategic alliance and mergers and acquisitions, it will help investors to know about the performance of a particular sampling unit after the process of mergers.
The major Strategic Reasons for bank mergers in India:

- To capture Market Share through alliance.
- Easy availability of infrastructure, IT infrastructure, ATMs’ and manpower as well as easy availability of already developed branch network.
- Easy availability of value added services with technological up gradation.
- New financial services to demographic segments of economy.
- Incapacity of old banks to withstand competition with technologically equipped modern counterparts.

Major Advantages of Mergers of Banks:

- Increase and expansion of operations and customer base.
- Expansion of branch network in rural, semi urban and urban segments of society.
- Improved and diversified financial products and services.
- Increased intrinsic value of bank and its shares.
- Increased strategic cost advantages.
- Increased utilization of human resources.
- Better financial viability through alliance.
- Better use of risk mitigation and measurement architecture and computer infrastructure.
- Increased value and customer confidence, satisfaction through use of upgraded phone banking, Net banking, Automatic teller machines, cheque truncation systems, pass book printing machines, bank note counting machines etc.
- Better integration though core banking architecture.
- Leveraging through alliance of technological inputs such as hardware, software, modern machines, and upgraded computer architecture systems.

Post merger effect on banking entities:

- Banks unions sometimes prefer status quo and resist bank mergers as many a times the employees and management of merging entities feel that their job is not secured because of post merger effect and because of downsizing of employee costs.
- Impact on the size of Balance Sheet and Income Expenditure Statements and profiteering capacity.
- Many a times the bank mergers have considerable effect on Non Performing Assets; the new entity can control credit risk in a better way because of improved risk mitigation tools with them.
- Massive Branch expansion and association of new customer base and improved retail banking operations of the merged entities.
- Many a times the previous employees are forced to take VRS and new entity has to design certain training modules for up -gradation of manpower in the system.
- The new entity has to design a lending policy which would not affect customers’ interest even after the merger of two entities.
- The effect on IT infrastructure and data processing systems: The IT professionals can be trained in the area of foreign exchange transactional network, sometimes econometric experts may also face difficulty with the changed platforms.
- Many a times there is change in profit per employee, Number of branches, Interest coverage, Credit Deposit Ratio, Non Performing Assets, employee expenses, operational expenses, interest expenses etc.

Merger story of the Sampling Units: Let us discuss the merger stories of Sampling units in the following paragraph:

In the year 2000, Times bank was merged with HDFC Bank then in the year 2001, Bank of Madura was merged with ICICI. In the year 2002, ICICI was merged with ICICI bank, in fiscal year 2005, IDBI Limited was merged with IDBI Bank while in the subsequent year 2006, United Western Bank was merged with IDBI Bank. In 2008, centurion Bank was merged with HDFC Bank.

Now Let us compare the post merger performance of ICICI Bank, IDBI Bank, and HDFC
Bank and let us discuss the post merger effect on profitability as well as financial viability of the above said Development Banks. In the following paragraphs, Net profit, Reserves, and EPS of the sampling units are discussed and compared this will give an idea about the banking entities and their post merger performance on comparative basis.

Table No. 1:
NET PROFIT FOR DIFFERENT DEVELOPMENT BANKS FOR DIFFERENT TIME PERIODS

(Rupees in Crores)

<table>
<thead>
<tr>
<th>Years</th>
<th>ICICI Bank</th>
<th>IDBI Bank</th>
<th>HDFC Bank</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001-02</td>
<td>258.29</td>
<td>424.30</td>
<td>297.04</td>
</tr>
<tr>
<td>2002-03</td>
<td>1206.17</td>
<td>401.40</td>
<td>387.60</td>
</tr>
<tr>
<td>2003-04</td>
<td>1637.10</td>
<td>465.00</td>
<td>509.50</td>
</tr>
<tr>
<td>2004-05</td>
<td>1810.00</td>
<td>307.25</td>
<td>665.56</td>
</tr>
<tr>
<td>2005-06</td>
<td>2540.00</td>
<td>560.88</td>
<td>870.78</td>
</tr>
<tr>
<td>2006-07</td>
<td>3110.00</td>
<td>630.30</td>
<td>1141.45</td>
</tr>
<tr>
<td>2007-08</td>
<td>4158.00</td>
<td>729.45</td>
<td>1590.18</td>
</tr>
<tr>
<td>2008-09</td>
<td>3758.00</td>
<td>858.53</td>
<td>2244.93</td>
</tr>
<tr>
<td>2009-10</td>
<td>4025.00</td>
<td>1031.13</td>
<td>2948.70</td>
</tr>
<tr>
<td>2010-11</td>
<td>5151.37</td>
<td>1650.31</td>
<td>3926.40</td>
</tr>
<tr>
<td>2011-12</td>
<td>6465.25</td>
<td>2031.61</td>
<td>5167.09</td>
</tr>
<tr>
<td>2012-13</td>
<td>8325.47</td>
<td>1882.08</td>
<td>6726.28</td>
</tr>
</tbody>
</table>

Source: Compiled from data obtained from Annual Reports of selected Development Banks for different time horizons.

In the Table No. 1 Net Profit of the selected financial institutions has been shown on comparative basis from 2001-02 to 2012-13 and it can be seen that ICICI Bank has highest net profits and IDBI Bank has lowest net profit during present times. But all the Development Banks have huge profitability which shows that major financial institutions have developed continuous profitability because they have developed innovative financial services and technology after the process of mergers. It is evident that in the year 2000, Times bank was merged with HDFC Bank, in the year 2001, Bank of Madura was merged with ICICI, in the year 2002 ICICI was merged with ICICI bank and in the year 2005, IDBI Limited was merged with IDBI Bank while in the subsequent year 2006, United Western Bank was merged with IDBI Bank. In 2008 centurion Bank was merged with HDFC Bank.

Better Net profits have been possible because of better cost management perspectives and to some extent merger effect has also been contributing factor in overall profitability. But profitability can be improved if establishment expenses and, Interest expenses are controlled for improved interest spread, Credit can be given to credit worthy clients and efforts can be channelized to reduce piling Nonperforming assets.

Table – 2
POSITION OF RESERVES AND SURPLUS OF SELECTED DEVELOPMENT BANKS

(Rupees in Crores)

<table>
<thead>
<tr>
<th>Year</th>
<th>ICICI Bank</th>
<th>IDBI Bank</th>
<th>HDFC Bank</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001-02</td>
<td>5635.54</td>
<td>6042.30</td>
<td>1660.91</td>
</tr>
<tr>
<td>2002-03</td>
<td>6320.65</td>
<td>6978.09</td>
<td>1962.78</td>
</tr>
<tr>
<td>2003-04</td>
<td>7394.15</td>
<td>5182.06</td>
<td>2407.09</td>
</tr>
<tr>
<td>2004-05</td>
<td>11813.19</td>
<td>5204.49</td>
<td>4209.97</td>
</tr>
<tr>
<td>2005-06</td>
<td>21316.15</td>
<td>5647.38</td>
<td>4968.39</td>
</tr>
<tr>
<td>2006-07</td>
<td>23413.92</td>
<td>7575.10</td>
<td>6113.76</td>
</tr>
</tbody>
</table>

Source: Compiled from data obtained from Annual Reports of selected Development Banks for different time horizons.
In the Table No. 2, Reserves and Surplus of selected Development Banks have been shown on comparative basis. It is seen that all the development financial institutions are managing huge reserves accounts such as amalgamation reserves, statutory reserves, benevolent reserves, share translation reserves, revenue reserves, and many other reserve accounts. It can be seen that huge reserves with the banking entities have been possible because of merger effect to some extent. Improved reserve accounts are indicative of better profitability and improved financial status of the concerned Development Banks. More reserves show that a very large quantum of overall profits have been pooled back into the operations after dividend payout, this has been possible to build huge reserve accounts because of more earnings retention of the development banks under consideration. It is also advisable to use saved funds for mammoth expansion in rural, semi urban and urban India besides proliferating into international business operations after careful economy analysis.

**Table – 3**

<table>
<thead>
<tr>
<th>Position of Earning Per Share in Selected Development Banks (रु)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PER SHARE</strong></td>
</tr>
<tr>
<td><strong>Year</strong></td>
</tr>
<tr>
<td>2001-02</td>
</tr>
<tr>
<td>2002-03</td>
</tr>
<tr>
<td>2003-04</td>
</tr>
</tbody>
</table>

Source: Compiled from Annual Reports of Different Development Banks for different time horizons.

In Table No. 2, Reserves and Surplus of selected Development Banks have been shown on comparative basis. It is seen that all the development financial institutions are managing huge reserves accounts such as amalgamation reserves, statutory reserves, benevolent reserves, share translation reserves, revenue reserves, and many other reserve accounts. It can be seen that huge reserves with the banking entities have been possible because of merger effect to some extent. Improved reserve accounts are indicative of better profitability and improved financial status of the concerned Development Banks. More reserves show that a very large quantum of overall profits have been pooled back into the operations after dividend payout, this has been possible to build huge reserve accounts because of more earnings retention of the development banks under consideration. It is also advisable to use saved funds for mammoth expansion in rural, semi urban and urban India besides proliferating into international business operations after careful economy analysis.

**CONCLUSION:**

The selected sampling units have rendered continuous profitability after the process of mergers and acquisitions with the merging entities. In the year 2000, Times bank was merged with HDFC Bank and its profitability, reserves and EPS have improved in post merger periods, similarly in the year 2001, Bank of Madura was merged with ICICI, subsequently its financial viability has improved substantially after post merger era then in the year 2002, ICICI was merged with ICICI bank, similarly in 2005, IDBI Limited was merged with IDBI Bank while in the subsequent year 2006, United Western Bank was merged with IDBI Bank. In 2008, centurion Bank was merged with HDFC Bank and their financial
performance, profitability and viability has improved after the process of mergers and acquisitions. The improved financial viability has been possible because, mergers creates Easy availability of infrastructure, IT infrastructure, ATMs’ and manpower as well as easy availability of already developed branch network, better use of risk mitigation and measurement architecture and computer infrastructure. Many a times, there is change in profit per employee, Number of branches, Interest coverage, Credit Deposit Ratio, Non Performing Assets, employee expenses, operational expenses, interest expenses etc. also because of merger effect.

References:

Books:


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ASSESSMENT OF CERTAIN HEAVY METALS ON THE PAPER MILL EFFLUENT EXPOSED GILLS AND HEPATOPANCREAS OF A FRESHWATER CRAB, PARATELPHUSA SPINIGERA

B. Kalita*, K.C. Bhuyan*, D.Kusre*, P.J.Mahanta**

*Dept. of Zoology, Morigaon College;  
** Dept. of Chemistry, Morigaon College.

ABSTRACT

The concentration of certain heavy metals including Zinc, Copper, Manganese, Cadmium and Lead (Zn, Cu, Cr, Cd and Pb) in the paper mill effluent exposed P. spinigera and their accumulation in gills and hepatopancreas were investigated. Hepatopancreas and Gill tissues from treated crabs showed greater concentrations of most of the studied metals than those from control groups. Maximum accumulation of Zn, Cu, Cr, Cd and Pb recorded in the present investigation was seen in 90 days exposed crabs. It was also recorded that metal concentrations increased by 66.41%, 89.47%, 36.93%, 68.43%, 23.43% in gill tissues and by 61.72%, 72.53%, 44.84%, 48.73% and 24.59% in hepatopancreas with the increase in the exposure period from control to 30, 60, 90 days. Hepatopancreas in P. spinigera contained the highest concentration (Zn->Cu->Pb->Cr->Cd) of most of the detected heavy metals than the gill tissues (Zn->Cu->Pb->Cr->Cd). The edible part of P. spinigera showed higher levels of heavy metal accumulation and the crabs caught from the effluent-fed beel pose health hazards for consumers.

INTRODUCTION

Urbanization and industrialization have resulted in the environment degradation due to chemical and solid industrial wastes. Pollution of the aquatic environment by inorganic and organic chemicals is the major factors posing serious threat to the survival of aquatic organisms including crabs. The aquatic bodies are exposed to high incidence of toxicity due to heavy metal contamination (Ibrahim and Naggar, 2006). The aquatic environment with its water quality is considered the main factor controlling the state of health and disease in both cultured and wild species (Saeed and Shaker, 2008). Metal ions can be incorporated into food chains and concentrated in aquatic organisms to a level that affects their physiological state. Of the effective pollutants are the heavy metals which have drastic environmental impact on all organisms. Trace metals such as Zn, Cu and Fe play a biochemical role in the life processes of all aquatic plants and animals; therefore, they are essential in the aquatic environment in trace amounts (Kalita, 2002). Heavy metal concentrations have been studied in tissues by workers like Abdel-Baky et al. (1998), Elghobashy et al. (2001), Farag, (2002) and Saeed and Shaker (2008). The most anthropogenic sources of metals are industrial wastes, petroleum contamination and sewage disposal (Santos et al., 2005). The present work aimed to investigate the assessment of certain heavy metals (Zn, Cu, Cd, Cr and Pb) on paper mill effluent (PME) exposed gills and hepatopancreas of P. spinigera.

MATERIALS AND METHODS

Collection of specimen:

Healthy specimens of P. spinigera were collected from local unpolluted freshwater sources, having an average weight of 180 g and brought to the laboratory in plastic containers filled with beel water. Crabs were placed in a pre-diluted bath containing 0.1% KMnO₄ solution for a few minutes to avoid infection. Then the crabs were transferred to glass aquaria and acclimatized for 15 days at room temperature.

Collection of PME:
PME was collected from the main outlet of Nagaon Paper Mill in untreated condition and brought to the laboratory for experimental purposes. During the experimental period PME was collected at every alternate 7th day and used in the experiment.

**Determination of LC\textsubscript{50}:**

Acclimatized crabs were divided into nine groups of each consisting of 10 crabs and LC\textsubscript{50} was determined following Reed Muench Method of Ipsen and Feigl (1970). The LC\textsubscript{50} as estimated from this method was found to be 35.2ppm at 96 hours. From the nine groups, the surviving crabs were kept in four aquaria for experimental purposes. Group-1 was used for experiment and kept as control. Another Group-II, III and IV were used for heavy metal determination after 30, 60 and 90 days of treatment.

**Sample collection:**

Samples of gills and hepatopancreas were collected directly from the specimens. Metals in *P. spinigera* tissue were extracted as described by (AOAC, 1990). Atomic Absorption Spectrophotometer was used to detect the heavy metals. The concentrations of heavy metals were expressed as μg/g dry wt. for crab tissues.

**Statistical analysis:**

Mean and Standard Deviation were used to evaluate the significant difference in the concentration of different studied metals with respect to different control/exposed periods (control, 30, 60 and 90 days). A probability level of 0.05 was considered significant. Standard Deviations were also estimated (Bailey, 1981).

**RESULTS AND DISCUSSION:**

The results of the sub-lethal concentration of PME on freshwater crab point out that considerable amount of heavy metals have been accumulated in the gills and hepatopancreas. Long term (90 days) PME exposure to *P. spinigera* demonstrated significant uptake of five heavy metals in the gills and hepatopancreas (Table-I). The bio-accumulation of Zn and Cu was found to be relatively higher in both gills and hepatopancreas. Gills and hepatopancreas showed almost similar level of accumulation ie. Zn->Cu->Pb->Cr->Cd.

<table>
<thead>
<tr>
<th>Tissues</th>
<th>Heavy metals</th>
<th>Control or Normal</th>
<th>35.2ppm Paper Mill Effluent</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>30 Days</td>
</tr>
<tr>
<td>Gill</td>
<td>Pb (μg/g)</td>
<td>7.83±0.95</td>
<td>9.22±1.18</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>17.75%</td>
</tr>
<tr>
<td></td>
<td>Cd (μg/g)</td>
<td>3.99±0.94</td>
<td>4.77±1.49</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>19.54%</td>
</tr>
<tr>
<td></td>
<td>Cu (μg/g)</td>
<td>21.58±1.83</td>
<td>23.43±2.76*</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>8.57%</td>
</tr>
<tr>
<td></td>
<td>Cr (μg/g)</td>
<td>4.34±1.48</td>
<td>4.61±1.45*</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>6.22%</td>
</tr>
<tr>
<td></td>
<td>Zn (μg/g)</td>
<td>29.74±1.94</td>
<td>31.05±2.5</td>
</tr>
<tr>
<td></td>
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<td></td>
<td>4.40%</td>
</tr>
<tr>
<td>Hepatopancreas</td>
<td>Pb (μg/g)</td>
<td>8.83±1.3</td>
<td>11.53±1.75</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>30.57%</td>
</tr>
<tr>
<td></td>
<td>Cd (μg/g)</td>
<td>4.77±1.24</td>
<td>6.03±1.37</td>
</tr>
<tr>
<td></td>
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<td>26.41%</td>
</tr>
<tr>
<td></td>
<td>Cu (μg/g)</td>
<td>21.05±1.78</td>
<td>26.38±2.13</td>
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<td></td>
<td></td>
<td>25.32%</td>
</tr>
<tr>
<td></td>
<td>Cr (μg/g)</td>
<td>8.29±1.65</td>
<td>9.78±2.21</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>17.97%</td>
</tr>
<tr>
<td></td>
<td>Zn (μg/g)</td>
<td>28.7±2.01</td>
<td>30.62±1.46</td>
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<td>6.68%</td>
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Table-1: Mean ± SD of heavy metals concentration (μg/g) in gills and hepatopancreas of *P. spinigera*. Data shown with * or ** are statistically significant at P < 0.05 level.
Cu is an essential micronutrient for living organisms, yet it is toxic at higher concentration. Cu is present in polluted water often together with Zn. Prolonged intake of Cu and Zn are injurious to liver (Kothari et al., 1997; Carvalho et al., 1999). The findings of the study confirm the results of earlier workers (Kannan et al., 1995; Burger, 1997). Pb as a toxicant is known to produce a wide spectrum of toxic effects which includes histopathological changes, deformities, neurotoxicity, haemolytic anaemia associated with decrease in haemoglobin synthesis (Hodson et al., 1984). Many of such investigations have also been directed towards studying the toxic effects of Pb in fishes (Holcombe et al., 1976, Saeed and Shaker, 2008) and in crab (Kalita, 2002).

Cd takes its entry through the alimentary tract, the main route through which the major damages are produced in various organs (Ghosh and Chakraborty, 1993). Earlier workers (Edgren and Notter, 1980; Yamawaki et al., 1986; Kalita, 2002) suggested the toxic effects and damages like shrinkage of lamina propria, damage to basement membrane and mucosal lining on fishes due to Cd. Significant uptake of Cd by P. spinigera could be the best probable reason for the high concentration of Cd in the effluent. Zanders and Rojas (1996) reported that metals like Cd level increased in the gills and hepatopancreas of Fiddler crab and Kalita (2002) also reported the same in crab, P. spinigera.

From the results it is significant in the present study that gills and hepatopancreas showed almost similar level of accumulation. It is clear that, Zn, Cu, Pb, Cr and Cd showed the trends of bioconcentration in gill tissues followed by hepatopancreas (Zn > Cu >Pb >Cr > Cd). This could be explained by the fact that zinc and copper are essential elements in the bodies of living organisms and has an important role in different physiological processes. Gills are always direct contact with the ambient medium and when crabs are exposed to effluent, heavy metals rapidly accumulated in the tissues. As a whole the relative accumulation indices of crab organs were increased due to paper mill effluent.

REFERENCES


Glutathione-S-Transferase activity in liver, gill and kidney tissues of Heteropneustes fossilis exposed to Paper Mill Effluent

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ABSTRACT

Paper mill effluent is toxic and well known for its action in many fishes like H. fossilis, which is an air breathing hard fish; when exposed to paper mill effluent exhibited appreciable alterations in the glutathione-s-transferase levels in all the tissues viz. liver, gills and kidney. Maximum inhibition in the glutathione-s-transferase was noticed in the liver than gill and kidney tissues. There was marked enhancement in glutathione-s-transferase activity in the liver and kidney tissues. The results suggest that the paper mill effluent brings about maximum disturbance in the pathway involving this enzyme in the liver and kidney than gills. The enhancement of glutathione-s-transferase activity in all the tissues may be due to increased metabolic processes or due to damage of tissues or to protect the liver, kidney and gill tissues. Diminished enzyme levels could be due to decrease enzyme activities or decrease synthesis of glutathione-s-transferase in tissues. Liver, gill and kidney tissues when exposed to paper mill effluent exhibited an increase in the glutathione-s-transferase activity though the levels tended to return to the normal when glutathione takes part in protective mechanism and protect the tissue or body from potentially damaging electrophilic compounds after 15 days of recovery.

INTRODUCTION

Fishes are very sensitive to the change of environmental factors and thus they are specific indicators of different environmental pollutants. They accumulate chemicals from water and food and sometimes their levels are toxic to themselves and for human consumers [10, 18]. Alteration in the antioxidant enzyme activities of aquatic organisms in response to contaminants are used to indicate the potential for more severe hazards.

Glutathione-S-transferase (GST) is a family of intracellular enzymes with the main function in detoxification process by catalyzing the conjugation of tripeptide glutathione with some endogenous toxic metabolites and many environmental contaminants [19]. GST takes part in transport of endogenous hydrophilic compounds, including steroids, haeme-pigments, bile acids and their metabolites again they also play an important role in detoxification of lipid peroxidase activity towards reactive oxygen species in the cells in the case of oxidative stress [19]. The increase of GST activity was studied in some fish species and invertebrates collected from environments impacted by complex discharges of contaminants [14]. Though fishes are very sensitive to anthropogenic pollutions and some of them may be tested or bio-monitored for the evaluation of the ecological status of aquatic environment [17]. The resistance of these aquatic organisms to contamination depends on many factors in which phylogenic position, ecological and biological features, physiological status and the presence of efficient detoxification mechanisms [12].

Paper mills are the sixth largest polluting industries in the world [2]. It is reported that the paper mill effluent (PME) alters the histology and physiology of fishes [6, 13, 14, 15, 16], mammals [5] and birds [4]. H. fossilis although regarded as a hard fish, it also affected by PME. Antioxidant enzymes of fishes, that play a deciding role in maintaining
cell homeostasis, have received much attention in eco-toxicology since oxidative damage was considered a mechanism of toxicity in aquatic organisms exposed to environmental contaminants [22]. Therefore, the present study aims to evaluate the potential of GST activity in liver, gill and kidney of *H. fossilis* exposed to PME for 15 days and also aims to study the recovery of the same after 15 days.

**MATERIALS AND METHODS**

An air breathing cat fish *H. fossilis* was selected for the study and were collected (50-70 g weight and 14-24 cm in length) from the uncontaminated beel water of Morigaon District, Assam. Nagaon Paper Mill is situated (Lat. 25°30' N and Long. 92°15' E) at Jagiroad, a small town of Morigaon District of Assam, India. The mill is considered to be the largest paper mill in Asia [20]. To perform the experiment 30 fishes (*H. fossilis*) were collected from the beel and were acclimatized for 15 days. 10 acclimatized fishes were kept in normal beel water as control and 20 fishes were exposed to propose LC₅₀ (30.2 ppm PME). 10 normal and 10 exposed fishes were sacrificed to study the GST levels in liver, gill and kidney tissues. Another 10 exposed fishes were kept again in normal beel water to study the recovery after effect for 15 days. On 15th day after recovery period the fishes were sacrificed and GST levels were studied in liver, gill and kidney tissues.

**Enzyme Assays:** The GST assay kits are used to measure GST activity. GST conjugates toxicants to reduced glutathione. The configuration of 1-chloro-2, 4-dinitro benzene (CDNB) with reduced glutathione increases absorbance at 340 nm. The rate of increase is directly proportional to the activity of GST in the sample. Different tissues were separately taken from exposed and normal medium for estimation of GST activity as follows:

- Measured amount of different tissues of *H. fossilis* were taken from PME containing medium and homogenate is prepared by using homogenizer in a concentration of 10 mg/tissue/ml of phosphate buffer(100 mM; pH= 6.8).
- The homogenate was centrifuged at 5000 rpm for 10 minutes for extraction of liquids from the tissue homogenate.
- 100 µl of supernatant was separated and was further diluted to a ratio of 1:500 to be used as sample for estimation.
- 10 µl of above diluted sample was added to a tube containing 250 µl of buffered substrate and mixed.
- The spectrophotometer was kept ready for measuring changes of absorbance at 340 nm and 25°C with a path length of 1 cm at an interval of 15 sec. as lag time and 30 sec. as active time.
- After adding 50 µl of CDNB solution to the tube containing sample buffered substrate, it was mixed immediately and introduced into the pre-programmed spectrophotometer within 10 sec. Difference in absorbance in 1 minute was recorded and utilized for calculation of GST activity.

\[
\Delta A_{340} \times \text{TVR} \times \text{DF}
\]

\[
\frac{\Delta A_{340} \times 0.31 \times 100 \times 10 \times 5.03}{\text{LP cm} \times \mu \text{ mol Ab} \times \text{Vs ml}} = \frac{\Delta A_{340} \times 6163.0218 \times 1000 \times 10}{1 \times \text{U/ml}} = \text{U/mg}
\]

[Here, \(\Delta A\) = Average change of absorbance per min, TVR= Total reaction volume, DF= Dilution factor, LP cm= light path in cm, 5.03= Molar absorptive of CDNB, Vs ml = Sample volume in ml].

**RESULTS**

Exposed period: The GST activity in experimental fish liver varied from 48.29 IU/mg to 48.61 IU/mg with an average value of 48.41±0.06 IU/mg at normal liver. After 15 days of treatment with PME, GST was recorded from 50.05 IU/mg to 50.57 IU/mg with an average value of 50.29±0.02 IU/mg in liver. The GST value in fish gill ranged between 15.56 IU/mg to 15.76 IU/mg, while 15.63±0.02 IU/mg was the mean value at normal or control. After 15 days of treatment the values were varied from 15.89 IU/mg to 16.55 IU/mg with an average value of...
16.24±0.14 IU/mg. The mean value of GST was recorded as 31.75±0.07 IU/mg and it ranged from 31.58 IU/mg to 31.96 IU/mg in control kidney tissues. After 15 days of treatment the GST value was varied from 32.91 IU/mg to 33.67 IU/mg with an average value of 33.29±0.13 IU/mg.

<table>
<thead>
<tr>
<th>Enzyme</th>
<th>Tissues</th>
<th>Paper Mill Effluent (LC₅₀ 30.2 ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Control/Normal</td>
<td>Treated for 15 days (exposed period)</td>
</tr>
<tr>
<td>GST</td>
<td>Liver (IU/mg)</td>
<td>48.29-48.61 48.41±0.06</td>
</tr>
<tr>
<td></td>
<td>Gill (IU/mg)</td>
<td>15.56-15.76 15.63±0.02</td>
</tr>
<tr>
<td></td>
<td>Kidney (IU/mg)</td>
<td>31.58-31.96 31.75±0.07</td>
</tr>
</tbody>
</table>

Table 1: Effects of PME on the GST activities and its recovery in H. fossilis. Figures in parentheses indicate percent increase (+) or decrease (−). Table shows range, mean, standard error and differences (%).

**Recovery period:** After 15 days of recovery the GST values in liver were ranged from 48.32 IU/mg to 48.97 IU/mg with mean value 48.89±0.03 IU/mg. In gills, after 15 days of recovery, the GST values were varied from 15.68 IU/mg to 15.92 IU/mg with an average value of 15.81±0.03 IU/mg. The mean value of GST in kidney after 15 days of recovery was 31.97±0.17 IU/mg. It was ranged between 31.63 IU/mg to 32.08 IU/mg in kidney tissues. There was no significant difference between the normal and recovery values in different tissues. GST was increased by 1.1% in liver, 1.26% in gills and 0.89% in kidney than that of exposed period.

**DISCUSSION**

In the present investigation in 30.2 ppm PME toxicity test, it is observed that the enzyme levels in liver, gill and kidney are increased due to PME toxicity. The maximum inhibition was noticed in liver after 15 days of treatment, the other tissues like gill and kidney also showed elevation in GST activities under PME treatment. Maximum enhancement was +3.88% in the liver, +3.90% in the gill and +4.85% in kidney after 15 days of treatment with PME. The GST levels after 15 days of treatment with normal beel water were elevated by 1.1% in liver, 1.26% in gills and 0.89% in kidney tissues after 15 days of recovery from that of exposed period.

From the result it is clear that fish living in contaminated water like PME which causes oxidative stress. To combat with these toxic compounds aquatic organisms have to be developed different mechanisms in which antioxidant enzymes like GST is important. Detoxification deals with the series of biochemical reactions occurring in the body to convert the toxic compounds to non-toxic or less toxic and more easily excretable forms. Liver is the major site of detoxification. Kidney and other organs may sometimes be involved. The products formed by detoxification are mostly excreted by the kidney and less frequently excreted via feces. The mechanism of detoxification may be by oxidation, reduction and hydrolysis (phase-I reaction) or by conjugation reaction (phase-II reaction) involving compound like glutathione. GST considered as phase II biotransformation of xenobiotic and carcinogens [25]. GST is thought to contribute by conjugating poisonous compounds.
with reduced glutathione to facilitate dissolution in aqueous cellular and extracellular media. Glutathione conjugation is considered to be an innate protective mechanism, developed to protect the body from potentially damaging electrophilic compounds \[21\]. The conjugation of reduced glutathione with a xenobiotic, either done spontaneously or catalyze by GST and decrease xenobiotic reactivity \[9,19,26\]. In this study, the observed GST-decreasing effects of *H. fossilis* when treated with normal water could be related to the metabolism of xenobiotics or increased excretion of xenobiotics. Several studies reported GST activities to be significantly increase \[23, 24\] but in most cases no significant difference between fish from control and polluted state were observed \[3,7,8,19\]. Organotin compounds inhibited in vitro GST activities in liver of *Signus canaliculatus* and in kidney of *Sparus sarba* \[1\]. The hepatic GST activity in *S.marmoratus* exposed to 1mg TBT/kg for 7 days was significantly elevated by 2.2 fold \[27\]. Present authors also agree with these results when *H. fossilis* was exposed to PME for 15 days.

GST present in cytosol or mitochondria or microsomes where they catalyze a variety of reactions to recover from toxicants present in PME. After the detailed study of GST it could be concluded by present authors that, the differences in GST activities in examined fish tissues probably indicated that maximum GST are involved in detoxification processes. The enhancement of GST activities in liver, gill and kidney tissues which may be due to increased metabolic processes and decreased enzyme activities could be either due to decrease synthesis of GST.

**References:**


