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on

"POLLUTION AND ITS IMPACT ON UNIVERSAL HEALTH"

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About the KLE Society

The **Karnatak Lingayat Education Society**, Belagavi, since its inception 1916 by a group of seven young and dedicated graduates respectfully called "Saptarshis", has been a role model in imparting quality education and upliftment of socio-economic status. The KLE Society disseminates the knowledge in all spheres of education from KG to PG, for overall personality development of the students. It promotes and encourages the student's community to opt for programmes like Medicine, Dentistry, Pharmacy, Nursing, Agriculture, Law, Business Management, Hotel Management, Engineering & Technology, Arts, Science, Commerce and Education. Under the leadership of visionary chairman Dr. Prabhakar B. Kore, Ex-M.P., the number of institutions has elevated up to 270 in various fields of education including research in India & abroad quality concept.

About the KLE College

K.L.E Society's S. Nijalingappa College, established in the year 1963, is one of the premier institutions under KLE Society and has been included under 2(f) and 12(b) of UGC. The college has seen phenomenal growth in terms of courses offered, quality enhancement, student and staff strength besides development in infrastructure. Over its glorious service of more than a half century to the community, the college has earned many significant laurels. The crowning ones of these are: the rare distinction of having been re-accredited at 'A^{+}' grade with CGPA 3.53 on a 4 point scale in 2016. College has received the status of 'College with Potential for Excellence' Phase II and UGC STRIDE component-I by UGC in 2019. The college conducts a range of UG courses in B.A, B.Sc, B.Com, BCA, BBA, BHM and PG Courses in M.Sc, M.Com, MCA, MTTM and Ph.D in commerce to cater to the diverse needs of the evolving higher education scenario at the national as well as Global level.

Over all development of the student is ensured by necessary support facilities like advanced library, counselling placement, internet centre and multi speciality gymnasium. The health centre caters to the health care for wards. Hostels with transport facilities are provided. The college takes pride in its distinguished alumni in all walks of life.

About department

The Department of Zoology came into existence in the year 1967, currently affiliated to Bengaluru City University offering CBZ and CZBt undergraduate programmes. Department has state of art museum and well equipped laboratories and research centre. The faculty have contributed continuously for growth of the department.

The department has been constantly involved in diverse kinds of activities by conducting seminars, workshop, lectures series, faculty development programs and conferences for students, research scholars and faculties. The faculties of department are involved in various student research activities.

Gmail ID: zoologydept@klesnc.org

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About the Conference

Pollution can be caused by natural events such as forest fires and active volcanoes; use of the word pollution generally implies that the contaminants have an anthropogenic source created by human activities. Pollution has accompanied humankind ever since groups of people first congregated and remained for a long time in any one place. Pollution was not a serious problem as long as there was enough space available for each individual or group. The use of coal for fuel caused considerable air pollution and the conversion of coal to coke for iron smelting beginning in the 17th century. Water & air pollution and the accumulation of solid wastes were largely problems of congested urban areas. But, with the rapid spread of industrialization and the growth of the human population to unprecedented levels, pollution became a universal problem. By the middle of the 20th century, an awareness of the need to protect air, water and land environments from pollution had developed among the general public, environmental damage caused by improper use of pesticides such as DDT and other persistent chemicals that accumulate in the food chain and disrupt the natural balance of ecosystems on a wide scale. The problem of plastic pollution on land and in the oceans has only grown as the use of single-use plastics has burgeoned worldwide. In addition, greenhouse gas emissions, such as methane and carbon-di-oxide, continue to drive global warming and pose a great threat to biodiversity and public health.

The Department of Zoology invites you all to be a part of one day national webinar under UGC STRIDE component – 1. All respected research scholars, authors and students are encouraged to contribute & support the shape of the webinar through submissions of their academic experience and research findings.

THEME: "National e-conference on Pollution and its Impact on Universal Health"

SUBTHEMES:

01. Global environmental issues
02. Toxicology
03. Eco-technology
04. Bio energy and bio fuels
05. Climate change

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SCHEDULE			
01	**Inaugural function and Keynote address 29th October 2020 @ 10:00 AM to 10:15 AM**		
02	10:15 AM to 11:15 AM	**Health Cost of Environmental Pollution**	**Dr. Vijaykumar B. Malashetty**, M.Sc, Ph.D Professor and Chairman Department of Zoology Vijayanagara Sri Krishnadevaraya University, Ballari
03	11:15 AM to 12:15 PM	**Effectiveness of Environmental Laws for the Effective Environmental Management**	**Dr. S. Ganapathy Venkatasubramanian,** M.Sc, Ph.D Professor, Department of Environmental studies Anna University, Chennai
04	12:15 PM to 01:30 PM	**Oral Presentation- I**	**Session Chair:** **Dr. Shobha Ananda Reddy** M.Sc, M.A, M.Phil, Ph.D Founding Trustee & Director Trust for Rejuvenation of Enviornment & Nature Development (TREND), Bengaluru
LUNCH BREAK			
05	02:00 PM to 03:00 PM	**Environment Management System (EMS)**	**Dr. Anil R. Kulkarni** M.Sc, Ph.D, MMEA Principal College of Non-Conventional Vocational courses For women, Kolhapur
06	03:00 PM to 04:30 PM	**Oral Presentation- II**	**Session Chair:** **Dr. Sagarika K.** M.Sc, Ph.D HOD of Zoology, S J R College, Bengaluru
07	**Valedictory function: 29th October 2020 @ 04:30 PM to 05:00 PM** Presided by **Dr. Arunkumar B. Sonappanavar, Principal**		

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Message by

Dr. Prabhakar B. Kore, **Ex- MP**
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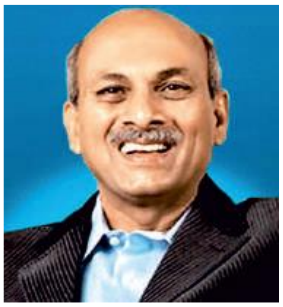

I am delighted to know that IQAC of KLE Society's S Nijalingappa College, Bengaluru is organising UGC STRIDE sponsored one day National e-Conference on "Pollution and its Impact on Universal Health" on 29th October 2020 and has invited eminent resource personalities. I am confident that the conference will enrich the knowledge of academicians and administrators of higher education institutions across the Nation. Congratulations to the organisers and I wish the National e-Conference an epic magnificent success.

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Message by

Shri. Mahantesh M. Kavatagimath
Chief Whip, Government of Karnataka
Member,
Board of Management
KLE Society Belagavi
KLE Society's S Nijalingappa College
Rajajinagar, Bengaluru-560010

Greetings!

Being in the framework of this National e-Conference, I take immense pleasure to welcome all the attendees of the conference on "Pollution and its Impact on Universal Health". This is a timely arranged National level platform organised to offer novel scientific thoughts and research findings of academicians, administrators, industrialists and students. I hearty congratulate the principal and his team for their timely organisation of this National e-Conference and providing an easy and safe platform.

I wish the e-Conference a huge hit and thought provoking informative proceedings that disseminate knowledge to all the stakeholders of this organisation.

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Message by

Shri. Shankaranna I. Munavalli

Member,

Board of Management
KLE Society Belagavi
KLE Society's S Nijalingappa College
Rajajinagar, Bengaluru-560010

This is my privilege and I am so enthusiastic to welcome you all for UGC STRIDE sponsored one day National e-Conference on "Pollution and its Impact on Universal Health" 29th October 2020 organised by KLE Society's S Nijalingappa College, Bengaluru. The conference will help in understanding the concept of pollution and its impact on environment. I am very sure that this National e-Conference including keynote address, special talk and academic / research work presentations will be helpful for the participants across the globe.

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Message by

Dr. Arunkumar B. Sonappanavar

Principal
KLE Society's S Nijalingappa College
Rajajinagar, Bengaluru-560010

It gives me immense pleasure to welcome all the eminent speakers and delegates to the IQAC initiated UGC STRIDE sponsored One-day National e-Conference on "Pollution and its Impact on Universal Health" organised by Department of Zoology, KLE Society's S. Nijalingappa College, Bengaluru.

The conference covers a keynote address followed by three technical sessions by eminent speakers and paper presentation by research scholars and students across the globe. I hope the one-day academic deliberations in the conference will enlighten the faculty, researchers and students on recent strides in Environment, Pollution and its applications for the benefit of humanity & encourage them to take up further research in these crucial fields of study.

On this occasion, I extend a heartfelt welcome to all the delegates to KLE Society's S. Nijalingappa College, Bengaluru. The college will bring out proceedings of the conference. I congratulate the organising committee members of conference in conducting such an event to boost the knowledge of faculty, research scholars and students.

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Report by

Dr. Tejaswini V. Nandi

Convener
HOD & Assistant Professor of Zoology
KLE Society's S. Nijalingappa College
Rajajinagar, Bengaluru

I take this opportunity to thank UGC for funding this conference under STRIDE Component-I. I thank honourable Dr. Prabhakar B. Kore, Ex-MP, Chairman, Board of Management, KLE Society's Belagavi, all the members of board of management, the Secretary, Life members, Principal for extending their support and valuable guidance in successfully organizing this academic event. I extend my gratitude to my colleagues who extended their support in making this e-conference successful. I also thank the students, research scholars and faculties for submitting their research work in this e-Conference.

As a result, the information about the e-Conference was largely spread through the Internet. A record number of more than 200 participants and more than 35 research abstracts were received from research scholars, faculties and scientists from India.

The guest speaker for inaugural function and session-I speaker was **Dr. Vijaykumar B Malashetty** Professor and Chairman Department of Zoology, Vijayanagara Sri Krishnadevaraya University, Ballari. Session-II speaker was **Dr. S. Ganapathy Venkatasubramanian** Professor, Department of Environmental Studies; Anna University, Chennai and session-III speaker was **Dr. Anil Kulkarni** Principal, College of Non-Conventional Vocational Courses for Women, Kolhapur.

Out of these, 26 best papers were selected for the oral presentation. The first oral presentation session was chaired by **Dr. Shobha Ananda Reddy** Founding Trustee & Director Trust for Rejuvenation of Environment & Nature Development (TREND), Bengaluru and second session oral presentation was chaired by **Dr. Sagarika K.** HOD of Zoology, S J R College, Bengaluru.

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RESOURCE PERSON

Dr. Vijaykumar B Malashetty, Ph.D.
Professor and Chairman,
Department of Zoology
Vijayanagara Sri Krishnadevaraya University, Ballari

Dr. Anil R. Kulkarni M.Sc., Ph.D. MMEA
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For women, Kolhapur

Dr. S. Ganapathy Venkatasubramanian, M.Sc., Ph.D.
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Anna University, Chennai

SESSION CHAIR

Dr. Shobha Ananda Reddy M.Sc, M.A, M.Phil, Ph.D
Founding Trustee & Director Trust for Rejuvenation of Enviornment & Nature Development (TREND),
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Dr. Sagarika K. M.Sc, Ph.D
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AUTHOR INDEX

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PIUH - 01

Effect of Climate Change on Flowering and Fruiting Patterns of *Prosopis Cineraria* in Barmer Area of the Thar Desert

Hemu Choudhary,
Department of Zoology, Government Girls College, Magra Punjala, Jodhpur
Corresponding author Email ID: hchemuchaudhary06@gmail.com

ABSTRACT

The present study was conducted with the objective of accessing the effect of climate change on flowering and fruiting pattern in *Prosopis cineraria*, at Dharasar ka Tala in Barmer district during the year 2018-2019. As *Prosopis cineraria* (L.) (Khejri) is the state tree of Rajasthan state. It is a native tree of the Thar Desert in the Western Rajasthan. It is a multipurpose tree for the people inhabiting in the harsh climatic conditions. The pods, leaves and bark are very useful in medicine as well as in food for animals and human being. As it has good nutrients, good fuel, improve soil fertility and provides shadow and shelter to many animals. It plays important role in religious aspects. It plays an important role in increasing economy of farmers. The present paper shows that due to climate change and shifting in weather cycle, flowering and fruiting time in *Prosopis cineraria* has been shifted earlier, which may leads to decline in production of fruits (pods) in the plant, causes nutritional as well as economic loss to the villagers.

Keywords: *Prosopis cineraria*, Multipurpose tree, Medicinal use, Nutrional value, Religious status, Flowering and fruiting pattern.

INTRODUCTION AND OBJECTIVE

Prosopis cineraria (L.) (Khejri) belongs to family Leguminosae is native to arid portions of western Asia and the Indian sub continent including Afghanistan, Bahrain, Iran, India, Oman, Pakistan, Saudi Arabia, The United Arab Emirates and Yemen[1]. It is a desert tree having height of nearly 10-25 Ft. Leaves are scattered and stripy along its branches. Flowers are produced in the month of March-April and having racemose inflorescence. This tree is also known as the wonder tree or "King of Desert"[2] or "the Golden tree of Indian Desert"[3]. Flowering and fruiting: Plant flowers during February - March, the 'fruits during April-May. In Rajasthan there is a common practice to harvest the greenpods[8].

Its flowers are known as anti diabetic agent[4][5]. Leaves of *Prosopis cineraria* as a pasteused to apply on boils and blisters (mouth ulcers) in livestock[6]. Dry pods helps in preventing protein calorie malnutrition and Iron Calcium deficiency in blood[3]. Its bark used in treatment of asthma, bronchitis, dysentery, leucoderma, leprosy and piles[7].

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The Inter-Governmental Panel on Climate Change [9] in its first report in 1990, projected for an increase in global average temperature between 0.15 - 0.3°C /decade for 1990 to 2005. The Inter Governmental Panel on Climate Change [10] projected for hotter days and warm nights and a reduction in rainfall in Thar region by 21st century, such global climate change will influence the Thar Desert ecosystem. Thar Desert region is more sensitive to changing global climate than other climate regions. Development of strategies, adaptation of traditional knowledge and practices related to biodiversity conservation and sustainable use along with modern scientific interventions will lead to mitigation of adverse effects of anticipated climate change on biodiversity in Thar Desert region.

The purpose of the present study was to access the effect of climate change on flowering and fruiting pattern in *Prosopis cineraria.*

METHODOLOGY

Study site: Dharasar ka Tala is 50 Km away from the Barmer district headquarter (Figure 1 and 2). It is situated on state highway No. 40, was chosen for study.

The study site is located in Baitu panchayat samiti of Barmer district, between 25°51'N to 71°41'E having total geographical area of 5.94 Km^2 . Human populations according to 2011 Indian census are 879.

Figure-1 Rajasthan map showing location of Barmer district.

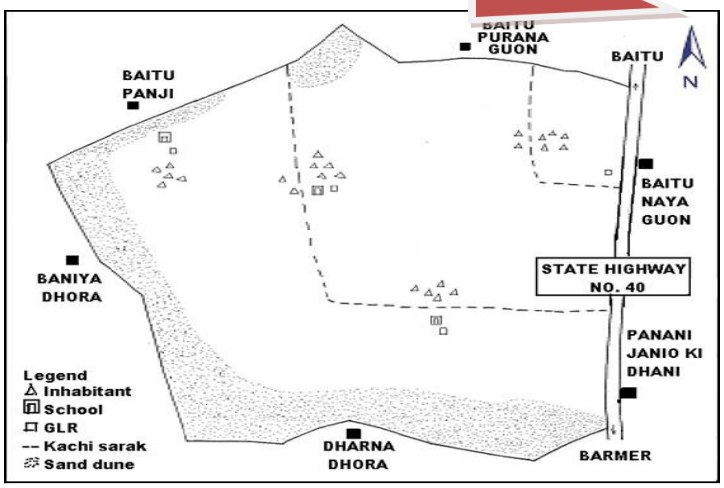

Figure-2 Barmer District map showing Dharasar ka Tala, intensive study site. Dharasar ka ala and nearby villages. [NOT TO BE SCALE]

(Drawn with the help of Patwari, Dharasar ka Tala, Baitu.)

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The present study was conducted during the year 2018-2019 with the objective of accessing the effect of climate change on flowering and fruiting pattern in *Prosopis cineraria.* With direct observations during survey, 50 farmers from the study site were randomly selected for personal interview and group discussion. The impact assessment was done by using qualitative as well as quantitative techniques. All the information was collected through open ended questionnaire and extensive use of probing technique and funnel technique for data collection. The data were quantified by using frequency and percentage analysis.

OBSERVATIONS AND RESULT

Table 1. Perceived impacts on climatic parameters and change in flowering and fruiting patterns and effect on fruit production in *Prosopis cineraria.* (n=50)

Area of change	Kind of change	Percentage
Temperature	Increase in temperature and duration	70
Heat wave	Intensity increased significantly	82
Sandstorm	Low frequency storms	76
Rainfall	Delayed rainfall	86
Drought	Frequency and duration increased	52
Cold	Winter delayed and days also reduced	78
Change in flowering time in *Prosopis cineraria*	Shifted to nearly 15 days earlier	62
Change in fruiting time in *Prosopis cineraria*	Shifted to nearly 15 days earlier	62
Effect on production on fruits in *Prosopis cineraria*	Less production	36
Effect on economy	Due to less production	32

Perceived impacts on climatic parameters and change in flowering and fruiting patterns and effect on fruit production in *Prosopis cineraria* (Table 1). Majority of farmers agreed that temperature was increasing in the area (70%), Heat wave frequency and intensity increased significantly (82%), low frequency storms (76%), delayed rainfall (86%), winter delayed and days also reduced (78%). The results favor IPCC report 2001 and 2007.

Selected farmers were also agreeing with change in flowering and fruiting time in *Prosopis cineraria* shifted to nearly 15 days earlier (62%). Although its effect on production of fruits in *Prosopis cineraria* (36%) and effect on economy due to less production (32%) was lesser noted till date.

Religious Aspects: All communities residing in the Thar Desert worships *Prosopis cineraria* (L.) (Khejri) as holy tree. Nearly 250 years ago 363 Bishnoi people sacrifice for saving this tree in Jodhpur district of the western Rajasthan. Today too Bishnoi villages in Barmer district can be easily identified by presence of numerous Khejri tree in their fields.

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Plate 1 *Prosopis cineraria* tree in the field.

Benefits of the tree: As *Prosopis cineraria* tree is capable to stand heat and tolerate drought, salt and alkalinity make its cultivation and distribution easy. It has significant contribution in economy and rural area development. As the mostly population (nearly 80%) have main occupation of agriculture in western Rajasthan. It is the only tree which is the most beneficial for the farmers. As the crops plough under this tree have much more growth while other trees found here like *Telomella undulata* (Rohira) and *Acacia Senegal* (Kumat) prohibit the growth of crops as well as nearby vegetation. Farmers use its dry leaves as fodder for their animals and also sell for commercial purpose. Its pods (Sangri) are well known for making "Panchkoota" in the international market. It is also useful in sand dune stabilization as its roots penetrate deeper in the soil. Its dry branches and bark are used as fuel; it provides shadow and shelter to many animals (Plate 1).

Uses of different parts: Leaves of *Prosopis cineraria* are widely used as fodder for domestic and wild ungulates. Due to high calorific values of leaves and pods animals in the early morning can be seen in herds under this tree for getting their food.

Pods of the tree are the most valuable source of protein, fiber, Fe and Ca in arid and semi arid regions. Pods due to having high nutritional value collected by local people in unripe stage. They consume it as traditional diet. They use the pods either in fresh form or boil and dry in sunlight and then use it for making vegetable "Panchkoota" or keep it for selling purpose. Dry pods on the tree are also collected and consumed directly as "Khokha". Its bark and twigs are used for holy purpose "Hawan" for making the environment pure. Its bark was found useful in making chapattis during drought periods, consumed by poor people to keep them alive. So the tree is worship as a holy tree in Rajasthan and attach with many folk songs and stories.

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Plate 2 *Prosopis cineraria* flowering and fruiting.

CONCLUSION

Prosopis cineraria is a multipurpose tree in the Thar Desert of Rajasthan. Due to climatic changes and shifting in weather cycle, earlier flowering and fruiting has been noted in *Prosopis cineraria*. This leads to lesser production in fruits (sangria) in it. Although result not showing significant changes in production and economy from fruits of this plant. But this effect may be noted much more clearly in the forthcoming periods and needs more study in this respect.

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PIUH- 02

Cytotoxic Effects of Different Detergents on Gills and Liver of *Labeo Rohita*

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ABSTRACT

Detergents are the parts of a large group of chemical compounds, collectively referred as surface-active agents or surfactants because they act upon surfaces. Studies indicated that detergents have toxic effects on all types of aquatic life. Fish being highest at tropic level of aquatic food chain is maximally affected with dyes, detergents this in turn poses a threat to humans on consumption. In the present study, short term (96 hrs) toxicity of different detergent solutions to fresh water teleost fish *Labeo rohita* has been investigated using static bioassay. Data on mortality (%) were analysed using Grafpad software method. Concentration dependent percent mortality was observed at different concentration of detergent solutions with respect to control. The histopathological studies of sectioned gills and liver of rohu fish species showed marked histological alterations. The observed gill pathological observations revealed clumping of cells, destruction of mucosal cells, proliferations, shortening and fusion of gill lamellae. The liver showed changes and damage to the hepatic cells due to detergent solutions toxicity. All the fishes held in the control stock showed inappreciable or no histological degradation. The degree of all recorded and anomalies in liver and gill tissues were concentration and time dependent. There is a need of developing "eco-friendly" detergents and soaps to conserve our aquatic environment from the consequences of pollution. If the present rate at which they are introduced into water bodies is not monitored, existences of aquatic organisms in water bodies are in serious threat.

Keywords*:* *Labeo rohita*, Percent mortality, Liver, Gills, Histopathology.

INTRODUCTION

The various freshwater pollutants, detergents have attracted special attention. They are widely used in both industrial and domestic purposes. Detergents are xenobiotic compounds which are usually washed into water bodies and are made up of several compounds of which the active components are the surface active agents or surfactants[5]. The 'after wash' of the detergents are either drained into the aquatic environments by natural sewage. Detergent surfactant increases microbial populations especially those that are able to use the surfactant as their basic source of carbon orphosphate or both, stands as an ectoparasites or endoparasites that causes histological degradation in fish species[1][2]. Xenobiotics compounds concentrate in the tissues of aquatic biotas and are known to produce cumulative deleterious effects[4][8][17]. Indiscriminate discharge of these compounds that contains mixtures of heavy metals such as herbicide, pesticides, detergent into natural waterways have harmful effects on the fish population and other forms of aquatic life and may contribute long term effects in the environment[16]. Toxic

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chemicals cause tissues damage and histophathological degradations as the fish show haematological responses toxicants and such degradation of histological origin occurs in the intestine and epidermis of animals.

Studies indicated that detergents have toxic effects on all types of aquatic life. The demand for fish consumption is increasing world over, as it is healthy alternative to animal protein. The synthetic detergents can alter pH and salinity of receiving freshwater bodies, which affect oxygen consumption by aquatic organisms including fishes[5].

During pathological studies the variations in the histology are exploited for evaluation of physiological state of the animal[3]. Fish is good indicator of aquatic contamination because its biochemical stress responses are quite similar to those found in mammals[22]. An important consideration for studying the toxicity of detergents on the fingerlings of rohu was the paucity of information on the younger developmental stages which are considered to be more susceptible and vulnerable to toxicants than those of adult stages. Histological changes provide a rapid method to detect effects of irritants, especially chronic ones, in various tissues and organs[4]. The present study was undertaken on the histopathological effects of different detergents solution on fingerlings of *Labeo rohita*.

MATERIALS AND METHODS

Collection and maintenance of animals

The Indian Major carp, *L. rohita* were procured from Government fish farm, Pune, India. The test organisms were transferred to the laboratory in the plastic bags and were washed with 0.1% $KMNO_4$ solution to get rid of dermal infection. Healthy fingerlings were selected and acclimated in dechlorinated tap water for 15 days; during this period they were fed with oilcake (1g), thrice a day by dissolving in 10 ml of dechlorinated tap water. Water was replenished 75% on daily basis with routine cleaning of aquaria leaving no faecal matter and unconsumed food. In the present study chlorine free tap water was used which had the following physiochemical characteristics; temperature 25 ± 1.0℃, pH 7.4 ± 0.07, salinity 0.25 ± 0.1 ppm, dissolved oxygen 6.5 ± 0.4 mg/L, total hardness 17 ± 0.5 mg/L and alkalinity 36 ± 0.5 mg/L.

Toxicant used

Detergents like Foram, Sasa and Ujiyara were locally purchased and used for the experiment. Stock solution of these detergents prepared by dissolving in appropriate amount of normal tap water.

Acute toxicity test

Into 5L plastic tubs containing 1L of test solution, twenty test animals were introduced in a static bioassay system. Experiments were carried out in replicates and a separate control was maintained. The fingerlings were not fed during the period of exposure.

After conducting range finding tests, five different concentrations namely 0, 1, 10, 25 and 100 PPM were selected to determine the LC50 values. Mortality and behaviour were observed everyday in each concentration.

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Measurement of cytotoxic marker enzyme

After removal of organs (Gills and liver), blotted dry with Whatman filter paper. Then 100 mg of each tissue were homogenates (100 mg/2.5 ml, w/v) with 0.25 M sucrose solution in ice cold condition[11]. The homogenates were centrifuged for 20 min at 6000 rpm (ice cold condition) and the clear supernatant fluid was removed and used to determine the level of GOT, GPT and LDH activities. GOT and GPT activities were measured according to *Galina et.al*, (1992) at 505 nm against distilled water. LDH was measured using standard protocol[20] 340 nm against distilled water. Optical density was measured with the help of a UV-spectrophotometer. Activity of all enzymes was expressed in IU/L.

Microscopy Examination

At the end of exposure period, 5 fish were taken from each replicate tank. The gill arches of the fish were excised from both sides. Fish were dissected, the abdominal cavity was operated and the liver was excised quickly and was fixed in Bouin's solution as a histological fixative for 24 hours [25]. According to Tao (1999), the specimens were processed as usual in the recognized method of dehydration, cleared in xylene and finally embedded in paraffin wax before being sectioned at 5 μm using a rotary microtome (Leica RM 2235 Germany). The specimens were stained with hematoxylin and eosin. Finally, the prepared sections were examined and photographically enlarged using light microscopy (Hamilton compound photomicroscope).

Statistical analysis

The mortality (%) data obtained were used to calculate the 24, 48, 72 and 96 hrs LC50 values, using a statistical package (Grafpad software). ANOVA was used to compare the LC50 values of detergent powder to test organisms after 96 hrs. All experiments were repeated at least five times and data presented is average of these replicates. One-way analysis of variance (ANOVA) test associated with the Tukey's test was used to determine the statistical significance of the differences among experimental groups. All the statistical analyses were done using SPSS 17.0 software.

RESULTS

Morphometric measurements and behavioural changes

During the study the morphometric measurements of fingerlings of Rohu were also taken. A Morphometric measurement of fingerlings varies in weight (13.8 gm ± 1.6), Length (4.5 cm ± 0.8), Breadth (2.1 cm ± 0.6) and height (0.8 cm ± 0.1). No significant variations were observed on Morphometric measurements in terms of weight, length, breadth and height (Table 1).

When experimental fishes were introduced into water containing, at higher concentrations, they started showing discomfort within few minutes and began to move rapidly. Rohu fingerlings exhibited a variety of behavioural responses like opercular movement was 20-25 times more faster than controlled, loss of nervous control; try to jump out of media. Body was slimy due to mucus secretion from epithelium of gills. The fishes were surfacing frequently. Affected fishes were swimming on lateral side of the body; nervous control and equilibrium were lost. During tests, the test fish exhibited several behavioural

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changes before death such as restlessness, rapid swimming and respiratory distress. Opercula ventilationrate as well as visual examination of dead fish indicates lethal effects of the on the fish.

Table 1: Morphometric measurements of fishes

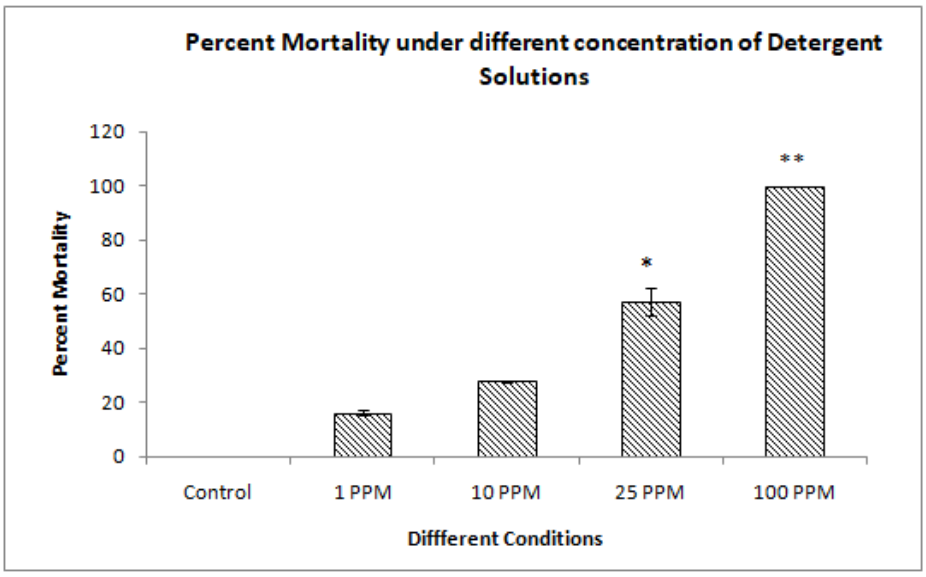
Different concentration	Weight of fingerlings (gms)	Length (cm)	Breadth (cm)	Height (cm)
Control	14 ± 0.8	4.1±0.3	2.4±0.4	1.1±0.5
1 PPM	15.2 ±1.2	4.6±0.5	2.1±0.3	0.6±0.5
10 PPM	13.5±1.7	5.2±0.6	1.2±0.9	0.9±0.3
25 PPM	14.7±1.2	3.9±1.4	2.5±1.3	0.8±0.2
100 PPM	11.8±2.9	4.9±1.1	2.3±0.2	0.5±0.6

Values are means ± SE of five individual observations

To measure and evaluate the median lethal concentration (LC50)

In the following experiment the rohu fingerling was treated with different concentrations s ranging from 0 to 100 PPM. At the different concentrations of s viz 0, 1, 10, 25 and 100 PPM, the mortality were 0, 16, 28, 57 and 100 percent respectively. Figure 1 shows the mortality rates and LC50's for combined effect of solution was 24 PPM.

Figure 1 Percent mortality of *Labeo rohita* fingerlings exposed to different concentrations of detergent solutions



** Statistically significant ($p<0.001$) compared to control group.
* Statistically significant ($p<0.05$) compared to control group.

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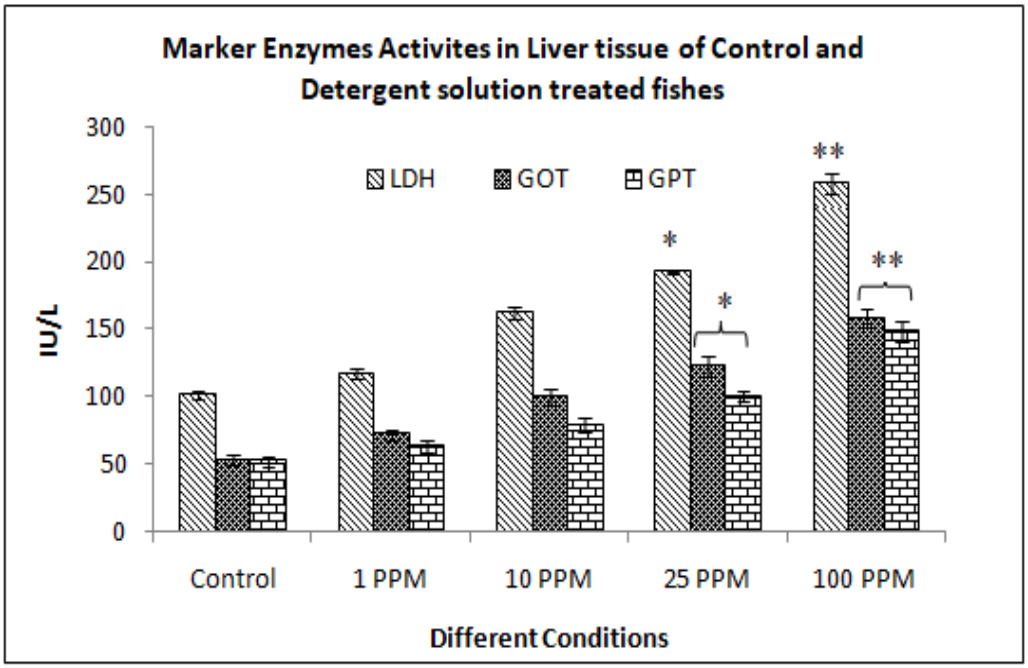
Quantitation of cytotoxic marker enzyme (LDH, GPT and GOT) under different conditions

On addition of the detergent powder as a toxicant at different concentrations (0, 1, 10, 25, and 100 PPM), the specific activity of LDH was significantly increased with respect to the control in a concentration dependent manner. At the concentration of 100 ppm solution the activity of LDH (Figure 1 and 2) was significantly increased in liver (258 ± 7.5 IU/L, $p<0.001$) and gills (196 ± 2.3 IU/L, $p<0.001$) as compared to controls (Liver: 101 ± 3.2 IU/L; Gills: 65 ± 1.2 IU/L). The activities of GOT was also significantly increased at 100 PPM (Liver: 158 ± 1.2 IU/L, $p<0.001$; gills: 98 ± 1.5 IU/L, $p<0.001$) compared to controls (Liver: 53 ± 1.8 IU/L; gills: 26 ± 1.6 IU/L) respectively. Similarly the activities of GPT were also significantly increased in liver and gills tissues at 100 PPM respective controls (Liver: 148 ± 2.8 IU/L, $p<0.001$; gills: 102 ± 2.4 IU/L, $p<0.001$) compared to controls (Liver: 52 ± 1.0 IU/L; gills: 22 ± 0.5 IU/L).

Figure 2 Effect of detergents solution on biomarker enzyme activities in the liver tissues under different conditions



** Statistically significant ($p<0.001$) compared to control group.
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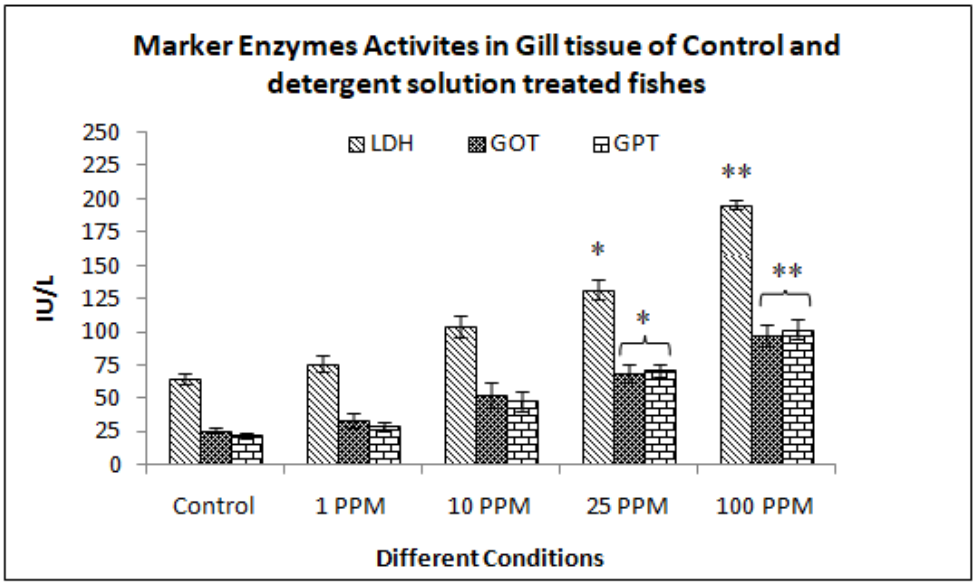
Figure 3 Effect of detergents solution on biomarker enzyme activities in the Gill tissues under different conditions



** Statistically significant ($p<0.001$) compared to control group.
* Statistically significant ($p<0.05$) compared to control group.

Histopathology of Gills and Liver tissue

The cellular damage observed in the gills in terms of epithelial proliferation, separation of the epithelial layer from supportive tissues and necrosis can adversely affect the gas exchange and ionic regulation.

Histopathology of Liver

The changes observed in the liver tissue on exposure to different concentration of s included swelling and rounding off of hepatocytes, detachment of cells from each other. Control group showed normal architecture and well defined histological structures without any sign of vascular changes. Intact hepatocytes plates were observed in fairly radial position in relation to the centrolobular vein with reticular fibres present on both sides. Rohu fingerlings treated with 1 PPM solution exhibited mild vascular congestion and sinusoidal dilation compared to liver tissue. Histological examination of the liver tissues from 10 PPM treated rohu fingerlings showed vacuolisation in cytoplasm followed by mild changes in terms of sinusoidal changes and necrosis. At 25 PPM concentration treated fingerlings showed more pronounced hepatocellular degeneration, characterized by cloudy swelling and necrosis with inflammatory infiltration, dilated central vein and sinusoidal congestion. Severe damage to hepatocytes was observed in 100 PPM solution treated rohu fingerlings. Most of the hepatocytes showed degenerative properties.

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Histopathology of Gills

In the present study histological alterations were documented for gill tissues, solution infected *Labeo rohita* fingerlings. Control gill tissue, represents numerous gill arches. Primary lamella project from posterior edge of gill arch (Plate 1). Secondary lamella originates on superior and inferior surface of primary lamella. Epithelial cell covering of secondary lamella on basement membrane was supported by pillar cells. Arches are supported by mixed bone (a cellular and spongy) and cartilage with associated striated abductor and adductor muscles, facilitating movement of gills. The changes observed in the liver tissue on exposure to different concentration of s included swelling and rounding off of hepatocytes, detachment of cells from each other. At 1 PPM the normal architecture of gill filaments such as primary lamellae, secondary lamellae with mucus cells lying scattered on both sides as observed in control fingerlings (Plate 1). Whereas at 10 PPM, proliferation of filamentary epithelium, lamellar fusions, loss of secondary lamellae, swelling of inter lamellae and excessive secretion of mucus on the surface of filaments compared to gills of control fingerlings (Plate 2). At the concentration of 25 PPM detachment of epithelial surface in primary gill lamella was observed. Increased progressive degeneration occurred in supportive structure of primary gill lamella. At the highest concentration of 100 PPM, the sinus in the primary gill lamella was dilated leading to damage at various places. Basal cell layer was reduced. Destruction of mucus cells on the top of gill lamella was observed.

DISCUSSION

The use of s has been responsible for the increase in the phosphorous in sewage effluents[7]. Phosphate pollution of rivers and lakes causes extensive growth of algae which depletes the dissolved oxygen content of water and disrupts the natural food chains. On treating the fishes with different concentrations of solution they exhibited a state of inactive nature with an in increase in the rate of breathing with the secretion of mucous. From the above, it is apparent that the test animal of the present study has revealed that the vital organs were damaged at cellular level due to the synergetic effect of pathogenic microbes and disease causing dyes.

Fish health reflects and gives a good indication of the health status of a specific aquatic ecosystem. Aquatic vertebrates particularly fish appear to have similar enzyme and receptor systems as in mammalian system[12]. By changing and adapting metabolic functions, fish react to environmental toxicants. Changes in the enzymatic activities of aquatic organisms are widely used to demonstrate tissue damage and also diagnosis of fish diseases[18]. The accumulation or binding of toxicants in these cells lead to damage and disintegration of cells, releasing these enzymes into blood circulation, results in increase in blood serum transaminases during stress conditions[14]. Increase in GOT and GPT activity in monocrotophos treated fish *Channa punctatus* indicates liver damage[24].

In the present study, the significant increase in LDH, GOT and GPT activity in gill and liver during acute treatment indicates that the damage of the organs due to s toxicity or the organism tries to mitigate the toxicant induced stress by increased rate of metabolism. LDH enzyme activity can be used as a good indicator of the anaerobic capacity of a tissue, chemical exposure and stress in fish[23]. Elevated LDH

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activity in gills suggests that the aerobic catabolism of glycogen and glucose has shifted towards the formation of lactate, which may have adverse long-term effects on the organisms[20]. In the present study (Figure 1 and 2) the elevation of LDH activity in gill and liver has occurred may be due to the metabolic changes caused by the detergent powder. Further disruption of respiratory epithelium might have caused tissue hypoxia resulting in a decrease in oxidative metabolism which may be responsible for increase in LDH activity in toxicant stressed animals[15].

Histological analysis appears to be a very sensitive parameter and is crucial in determining cellular changes that may occur in target organs, such as the gills, liver and kidney[21] [6].
The molecules can penetrate and solubilize the lipid content of cell membrane and may reduce its permeability. Gills are osmoregulatory organs in fishes and are primary site of uptake for water borne pollutants. Therefore, gills are the first sites where the effect of pollutants would be observed, because of the swelling of gill epithelium it leads to decreased efficiency for gases exchange and oxygen consumption. Gill hyperplasia has been regarded as a common sign of chronic toxicity caused by various chemical pollutants [19] [10].

The observed alterations like proliferation of the epithelial cells, partial fusion of some secondary lamellae and epithelial lifting are defence mechanisms, since, in general, these result in the increase of the distance between the external environment and the blood and thus serve as a barrier to the entrance of contaminants. Similar results were observed[13] wherein gills and liver tissues showed damage due to metal contaminated sediments exposure.

The parenchymatous hepatic tissue in teleosts, has many important physiological functions and also detoxification of endogenous waste products as well as externally derived toxins, drugs, heavy metals and pesticides[22]. Due to these reasons, the hepatic cells are damaged severely, on chronic exposure to copper. The liver exhibited several pathological changes including hyperplasia, degeneration of blood vessels, vacuolisation, hypertrophy; pyknotic nuclei, necrosis, and accumulation of blood vessels (Plate 1). Significant changes were observed in the liver tissue at lethal and sublethal concentrations of detergent powder with marked swelling of the hepatocytes in places with areas of diffuse necrosis. Similar results were also observed by Jabeen *et al*., 2018. Several histopathological symptoms that appeared in fish organs would serve as biomarker responses in s toxicity of fresh water ecology.

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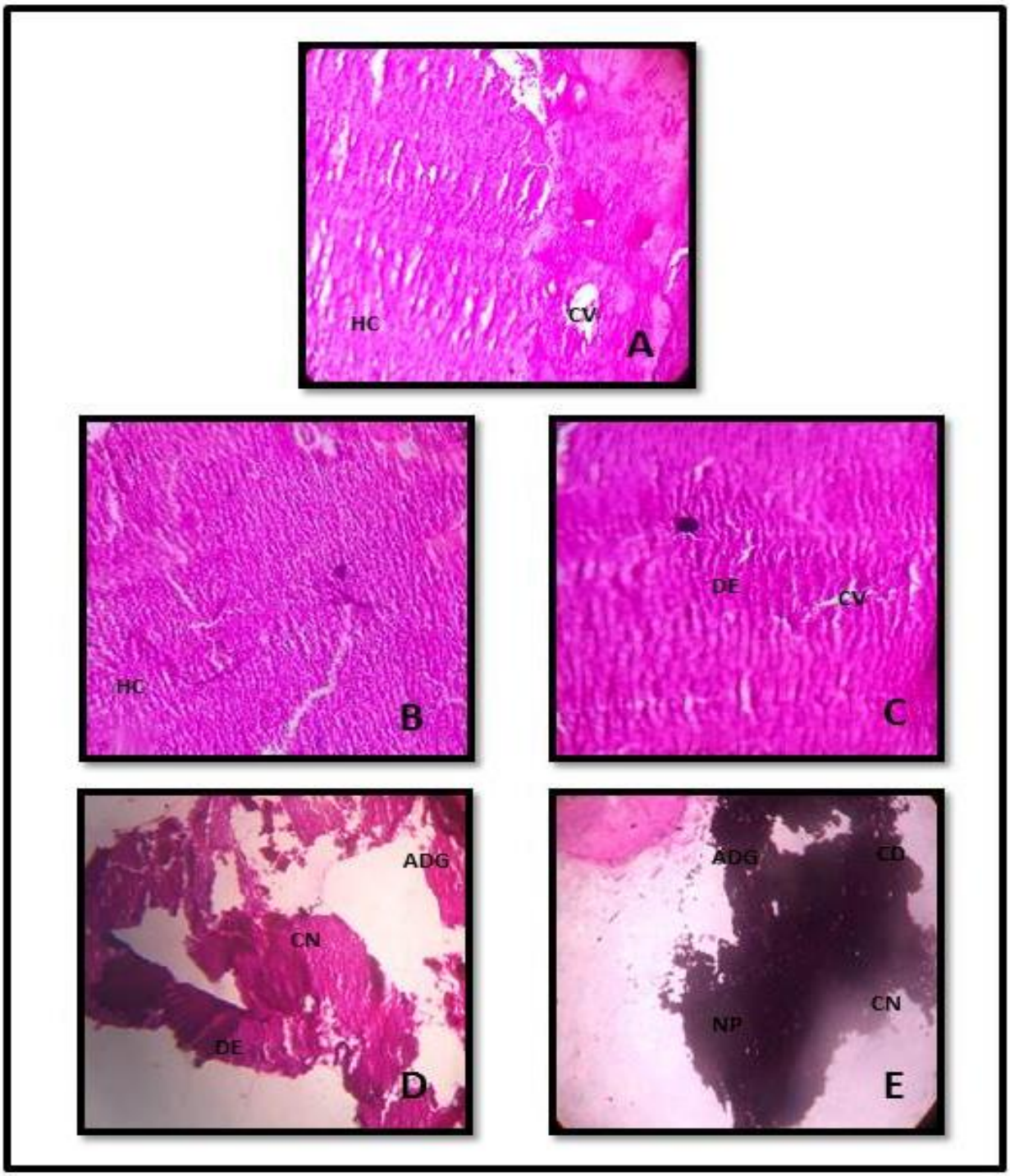

Plate 1 Histological changes of liver in rohu fingerlings under different conditions.
Light micrographs of a paraffin section stained with Hematoxylin and Eosin (40 X).
(A) Control (B) 1 ppm (C) 10 ppm (D) 25 ppm (E) 100 ppm

[Abbreviations: CV- Central Vein; HC – hepatocyte; CD – cytoplasmic degeneration; DE – damaged epithelium; NP – nuclear pyknosis; CV – cytoplasmic vacuolation; ND – nuclear degeneration; ADG – accumulation of dark granules; CN – cellular necrosis]

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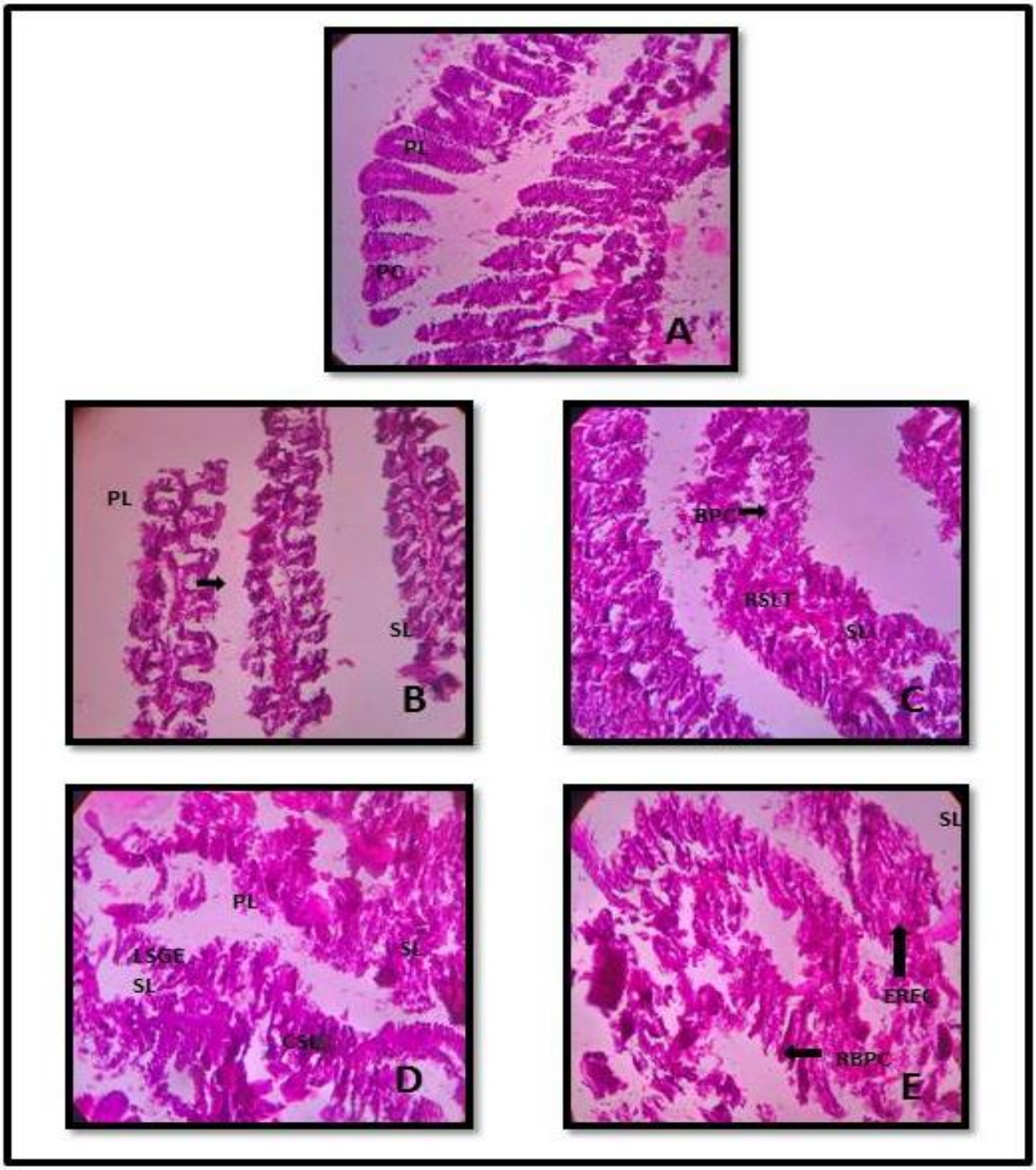

Plate 2 Histological changes of gills in rohu fingerlings under different conditions.
Light micrographs of a paraffin section stained with Hematoxylin and Eosin (40 X).
(A) Control; (B) 1 ppm (C) 10 ppm (D) 25 ppm (E) 100 ppm
[Abbreviations: PL – primary lamellae; SL – secondary lamellae; PC – pillar cells; BPC– breakdown of pillar cells; LSGE – lifting of secondary gill lamella epithelium; CSL – curling of secondary lamellae;RSLT – rupture of secondary lamellae tip; RBPC – rupture and breakdown of pillar cell system; EREC – oedema and rupture of epithelial cells]

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CONCLUSION

The present study indicates that induced alterations in the marker enzymes activities of the freshwater fish at acute concentration. These alterations can be considered as a tool for biomonitoring of pharmaceutical drug substances in the aquatic environment. However, further studies are needed to understand the risk of s using different end points.

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CONFLICT OF INTEREST

Authors declare no conflict of interest.

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PIUH - 03

Homology Modelling, Insilico-Virtual Screening and Docking of Bifunctional Protein in *Microcystis Aeruginosa*

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ABSTRACT

The objective of the study was to identify a potential inhibitor for Bifunctional protein in *Microcystis aeruginosa*. The insilico modeling of the protein was performed using the TBM module of galaxy seok lab and the methodology was extended the execution of virtual screening using MTi open screen and finally the interaction between the protein-ligand interaction was studied using LIGPLOT software for Bifunctional protein in *Microcystis aeruginosa*. Virtual screening revealed 7176 compounds from the drug library and the best fit of 1500 compounds were screened. Among the 1500 compounds, the molecule MK-3207 sowed a better affinity towards the bifunctional protein with the binding energy of -11.3Kcal/mol.

Keywords: Microcystis aeruginosa, Bifunctional protein, TBM Module, Ligplot, MTiopen screen, Molecular docking**.**

INTRODUCTION

Water quality issues are a major challenge that humanity is facing in the twenty-first century. Emphasis is placed on chemical pollution, particularly on inorganic and organic micro pollutants including toxic metals and metalloids as well as a large variety of synthetic organic chemical[1]. *Microcystis aeruginosa* is a photosynthetic cyanobacterium that plays an important role in global oxygenation[2]. Some cyanobacteria form toxic water blooms in nutrient rich waters, causing water contamination and public health threats and impacting the world economy[3][4]. Water blooms formed by phytoplankton species are often observed in eutrophic bodies of water. Among blooming phytoplankton, *Microcystis aeruginosa* is the most common and widespread cyanobacterial species found in freshwater environments extending from tropical to sub frigid zones. *M. aeruginosa* blooms cause several environmental problems, including bad odor and bottom-layer hypoxia; however, the problem of greatest concern is the production of hepatotoxic cyanotoxins called microcystins[5]. Bifunctional protein GlmU in *Microcystis aeruginosa* catalyzes the last two sequential reactions in the de novo biosynthetic pathway for UDP-N-acetylglucosamine (UDP-GlcNAc). The C-terminal domain catalyzes the transfer of acetyl group from acetyl coenzyme A to glucosamine-1-phosphate (GlcN-1-P) to produce Nacetylglucosamine-1-phosphate (GlcNAc-1-P), which is converted into UDP-GlcNAc by the transfer of uridine 5-monophosphate (from uridine 5-triphosphate), a reaction catalyzed by the N-terminal domain. This protein is also involved in LPS lipid A biosynthesis, which is part of Bacterial outer membrane

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biogenesis. This protein is involved in step 1 of the sub pathway that synthesizes UDP-N-acetyl-alpha-D-glucosamine from N-acetyl-alpha-D-glucosamine 1-phosphate. This sub pathway is part of the pathway UDP-N-acetyl-alpha-D-glucosamine biosynthesis, which is itself part of Nucleotide-sugar biosynthesis. The goal of this study is to find a potential inhibitor to inhibit bifunctional protein in *M. aeruginosa.*

METHODS

Bioinformatics is vital to significantly improve the position and function of molecules in binding and simulation. In bioinformatics, the process of computer-aided drug design (CADD) exists as a specialized discipline to use the computational[6] methods to simulate the interactions between a drug and a receptor. CADD methods are heavily dependent on bioinformatics tools, applications and databases.

Modeling of target protein: Template-based modeling (TBM), also called homology modeling or comparative modeling, is a structure prediction method applied in this case using similar proteins as templates. GalaxyTBM program and its web server (http://galaxy.seoklab.org/tbm) are based on the TBM method, which was used to predict the structure of the target protein. The 3D structures were downloaded in pdb format.

Virtual Screening and Docking: The web server MTi Open Screen includes two services, MTi AutoDock and MTi Open Screen. MTiAutoDock allows to dock compounds into a binding site defined by the user or blind docking using Autodock 4.2[7] and MTi Open Screen performs automated virtual screening using docking with Autodock Vina[8]. Molecular docking would describe the best-fit orientation of a ligand that binds to the target protein and is used to predict the structure of the intermolecular complex formed between the two molecules. Ligand is a small molecule, which interacts with protein's binding sites. There are several possible mutual conformations for binding[9].

Protein-ligand Interaction using LIGPLOT: The LIGPLOT program automatically generates schematic 2-D representations of protein-ligand complexes [10]. The output is a color, or black and white, Post script file giving a simple and informative representation of the intermolecular interactions and their strengths, including hydrogen bonds, hydrophobic interactions. The target ligand interactions were studied using this program.

RESULTS

The quality of the target protein was checked using Rampage server. This study was conducted to understand the interactions between the proteins (Fig 1 and 2) and the ligand (Fig 3) to discover their binding affinity. This docking study was executed using MTi autodock which revealed 7176 compounds in the drug library and the best fit were 1500 compounds. The protein showed best affinity towards Mk3207 compound with the binding energy of -11.3Kcal/mol. The ligand is more stable than other compound due to the lower binding energy.

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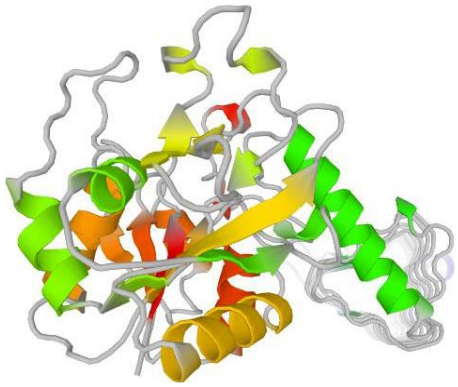

Figure 1 Predicted Structure of Bifunctional Protein

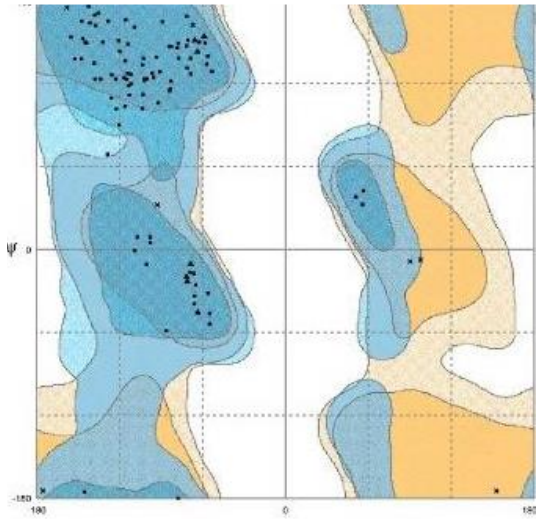

Figure 2 Quality of Predicted Structure

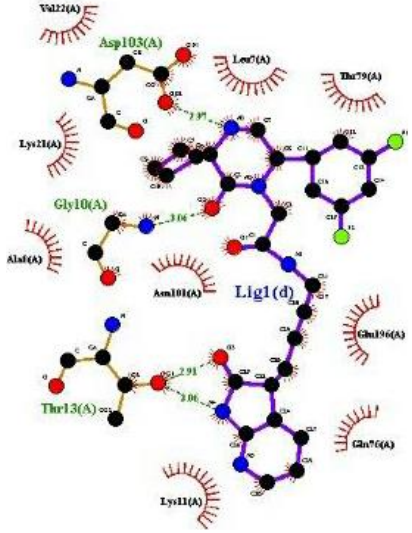

Figure 3 Protein-Ligand Interaction

The analysis of the intermolecular interactions including hydrophobic and hydrogen bonding interactions on the most representative structure were obtained from MD trajectories using cluster analysis by Ligplot. MK-3207 formed two hydrogen bonds with the protein. In addition to hydrogen bonding interactions the protein was involved in the hydrophobic interactions with Glu196, Lys11, Thr13, Gly10, Val22, Asp103, and Leu7.

CONCLUSION

Water pollution is an issue of great concern worldwide; the biological or chemical change in the quality of water due to the presence of contaminants in water is called water pollution. There is an urgent need to look into the measures to control water pollution. It can be broadly divided into three main categories, that is contamination by organic compounds, inorganic compounds (e.g., heavy metals) and microorganisms. While some microorganisms are helpful, others are harmful and cause diseases.

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Disease-causing microorganisms spread to aquatic wildlife, plants and to human beings. Microorganisms can also reduce the amount of oxygen in the water, thereby hindering the water's ability to support aquatic animal and plant life. In recent years, the number of research studies concerning the use of efficient processes to clean up and minimize the pollution of water bodies has been increasing.

Blue green algae are found in lakes, ponds, rivers and brackish waters throughout the world. In case of excessive growth such as bloom formation, these bacteria can produce inherent toxins in quantities causing toxicity in mammals, including humans. These cyanotoxins include cyclic peptides and alkaloids. Among the cyclic peptides are the microcystins and the nodularins. The alkaloids include anatoxina, anatoxina(S), cylindrospermopsin, saxitoxins (STXs), aplysiatoxins and lyngbyatoxin. Virtual screening and molecular docking approaches are widely studied nowadays to find protein-ligand interactions and to identify ligands that can inhibit a target protein. The Mk-3207 compound showed more affinity towards the protein with the binding energy of -11.3Kcal/mol. This compound was found to be more stable due to lower binding energy.

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PIUH - 04

Impacts of Air Pollutants on Human Health in Some Areas of Bengaluru

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ABSTRACT

Air is necessary for all living organisms for some basic and important things for vital roles. Oxygen plays a major role in this COVID-19 pandemic situation. All people should have free access to air and water of acceptable. Good quality of air is a fundamental human right and necessary to lead a healthy life. Present days the air pollution is a growing major problem due to presence of harmful substances in the atmosphere that leads to so many health and well being problems in human beings and other living organisms. It also causes damage to the climate. There are different types of air pollutants, such as gases, particulates and biological molecules. Primary pollutants and secondary pollutants are two major types of air pollutants. Primary pollutants enter directly to the environment and secondary pollutants through chemical reactions. Primary pollutants are natural such as volcanic ash. Dust is natural but exacerbated by human activities; it occurred when the ground is torn up for agriculture or development. Most of the primary pollutants are produced by the result of the direct emissions from vehicles, power plants and smokestacks. Secondary pollutants are photochemical smog, ozone we have taken data of some primary and secondary pollutants such as sulphur dioxide, Nitrogen dioxide, Ammonia, Ozone, Carbon monoxide and Benzene for our study from Pollution Control Board website, before few months, during and after few months of lockdown.

For the present study we have selected some areas of Bangalore city like City railway station, Sanegruvana halli, Veterinary College Hebbal, Shalini ground of 5th block Jayanagar, Kavika-Bapuji nagar, Rajeev Gandhi Chest Hospital Hombegowda nagar and HSR layout, near Central Silk Board. We compared AQIs of selected parameters in above mentioned areas from the month of January 2020 to June 2020 to create awareness among people to maintain green environment and energy sources. We found considerable decline of AQIs of selected areas during the months of March, April, May and June 2020 may be due to lockdown.

Key words: Air, Pollution, Pollutants, Health, Effect.

INTRODUCTION

Ecosystem is delicately balanced to support plant and animal life. When pollution is heavy in an area, it can directly impact on it. The groundwater becomes acidic and vital nutrients are leached out of the soil and air pollution has negative impacts on plant growth and animal health. Air pollutants also affect the metabolic functions of the leaves and interfere with net carbon fixation. Sulphur oxides include sulphur dioxide and sulphur trioxide. These form when sulphur from burning coal reaches the air. Sulphur oxides are components of acid rain[15]. Nitrogen oxides are formed when nitrogen and

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oxygen from the atmosphere come together at high temperatures. This occurs in hot exhaust gas from vehicles, power plants or factories. Nitrogen oxide and nitrogen dioxide are also greenhouse gases. Nitrogen oxides contribute to acid rain. NH_3 is highly reactive and soluble alkaline gas. It originates from both natural and anthropogenic sources. The main sources are like manure, slurries and fertilizers. It is formed by breakdown and volatilization of urea.

Photochemical smog forms when car exhaust is exposed to sunlight. The O then combines with an oxygen molecule (O_2) to form ozone (O_3). This reaction is reversible: Nitric oxide (NO) removes an oxygen atom from ozone to make it O_2. The direction the reaction goes depends on how much NO_2 and NO there is. If NO_2 is three times more abundant than NO, ozone will be produced. If nitric oxide levels are high, ozone will not be created. Ozone is one of the major secondary pollutants. It is created by a chemical reaction that takes place in exhaust and in the presence of sunlight. The gas is acrid-smelling and whitish. Warm, dry cities surrounded by mountains, such as Los Angeles, Phoenix, and Denver, are especially prone to photochemical smog. Photochemical smog peaks at midday on the hottest days of summer. Ozone is also a greenhouse gas[7].

Carbon oxides include carbon monoxide and carbon dioxide. Both are colour and odourless greenhouse gases. CO is toxic to both plants and animals.

Benzene is a colourless liquid; it evaporates into the air very quickly. It is highly flammable and formed from both natural and human activities. It is a natural part of crude oil, gasoline and coal. The industries use benzene to make plastic resigns, nylon, synthetic fiber, rubber, lubricants, dyes, detergents, drugs and pesticides.

Any city can have photochemical smog, but it is most common in sunny, dry location. A rise in the number of vehicles in cities worldwide has increased photochemical smog. Nitrogen oxides, ozone, and several other compounds are some of the components of this type of air pollutants[7]. In the present work we compared the air quality indices of some areas of Bangalore where there is a thick population. We selected Bangalore for the present study because it is capital of Karnataka state and also shows more population (>84.4 lakes). It is regarded as Silicon Valley of India and also second fastest growing metropolitan city of India.

Karnataka state pollution board was first established in twenty first of September 1974 for prevention of pollution under ministry of Environment and renamed in 1985 after the enactment of air act in 1981[8]. CPCB constituted an expert committee including members from renowned academicians, medical fraternity, research institutes, MoEF, advocacy groups, SPCBs. The AQI developed in this study is based on human exposure and health effects and may not be strictly applicable to ecologically sensitive areas.

The revised National Ambient Air Quality Standards (CPCB 2009) are notified for 12 parameters – PM_{10}, PM2.5, NO_2, SO_2, CO, O_3, NH_3, Pb, Ni, As, Benzo(a)pyrene and Benzene. Although AQI is usually based on criteria pollutants a new approach to AQI which considers as many pollutants from the list of notified pollutants as possible is desirable.

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MATERIALS AND METHODS

Committee members of CPCB surveyed AQIs of some areas by using various instruments, hourly or day wise depends on pollutants. As per CPCB's (Central Pollution Control Board) air quality standards, AQI is categorized into six parts. AQI between 0-50 is considered 'good', 51-100 'satisfactory', 101-200 'moderate', 201-300 'poor', 301-400 'very poor', and between 401-500 'severe'. For our study we took data from website of CPCB of desirable pollutants of some areas of Bengaluru city and done comparative study of AQIs from month of January 2020 to June 2020 before lockdown and during lockdown due to COVID – 19. We Plotted graph and studied effects of selected pollutants for counseling public.

RESULTS AND DISCUSSION

Table 1: Air pollutants in Bangalore city for the month of January-2020

SL No	Name of the monitoring station	In µg/m^3												AQI
		Average values of pollutants						Sub index						
		SO_2	NO_2	NH_3	O_3	CO	C_6H_6	SO_2	NO_2	NH_3	O_3	CO	C_6H_6	
1	City railway station	9.9	50.4	*	*	1.9	*	12	63	*	*	94	-	94
2	Sanegruvanahalli	3.5	11.1	*	*	0.9	*	4	14	*	*	43	-	43
3	Veterinary college, Hebbal	10.7	32.9	11.8	37.6	0.8	0.4	13	41	3	38	39	-	86
4	Shalini ground, Jayanagar 5th block	3.0	45.2	12.4	36.5	1.4	0.4	4	57	3	37	69	-	101
5	Kavika- Bapuji Nagar	8.6	47.4	2.9	60.6	0.7	2.6	11	59	1	61	34	-	84
6	Rajeev Gandhi chest hospital Hobegowda nagar	10.7	21.1	22.3	61.9	1.2	0.2	13	26	6	62	60	-	83
7	H.S.R Layout, near central silk board	3.1	28.4	11.1	29.6	1.2	1.6	4	36	3	30	59	-	102

Table 2: Air pollutants in Bangalore city for the month of February – 2020

SL No	Name of the monitoring station	In µg/m^3												AQI
		Average values of pollutants						Sub index						
		SO_2	NO_2	NH_3	O_3	CO	C_6H_6	SO_2	NO_2	NH_3	O_3	CO	C_6H_6	
1	City railway station	9.7	51.3	*	*	2.1	*	12	64	*	*	100	-	116
2	Sanegruvanahalli	3.6	10.9	*	*	0.9	*	4	14	*	*	43	-	43
3	Veterinary college, Hebbal	9.8	23.8	7.4	40.2	0.7	57	12	30	2	40	37	-	84
4	Shalini ground, Jayanagar 5th block	3.1	43.1	13.6	41.8	1.3	70	4	54	3	42	67	-	103
5	Kavika- Bapuji Nagar	9.5	49.4	10.9	40.7	0.7	58	12	62	3	41	35	-	86
6	Rajeev Gandhi chest hospital Hobegowda nagar	11.1	20.9	22.0	71.2	1.3	62	14	21	22	71	67	-	82
7	H.S.R Layout, near central silk board	2.7	26.5	9.7	36.4	1.1	70	3	33	2	36	57	-	97

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Table 3: Air pollutants in Bangalore city for the month of March - 2020

Sl.No	Name of the monitoring station	In µg/m³												AQI
		Average values of pollutants						Sub index						
		SO_2	NO_2	NH_3	O_3	CO	C_6H_6	SO_2	NO_2	NH_3	O_3	CO	C_6H_6	
1	City railway station	8.7	39.3	*	*	1.6	*	11	49	*	*	78	-	104
2	Sanegruvanahalli	4.2	16.9	*	*	0.5	*	5	21	*	*	23	-	70
3	Veterinary college, Hebbal	8.7	6.8	3.1	50.6	0.7	0.2	11	9	1	51	37	-	75
4	Shalini ground, Jayanagar 5th block	2.7	30.9	12.7	41.6	0.9	0.3	3	39	3	42	46	-	76
5	Kavika- Bapuji Nagar	10.1	22.6	11.6	58.1	0.6	1.3	13	28	3	58	30	-	76
6	Rajeev Gandhi chest hospital Hobegowda nagar	10.9	15.1	23.3	65.9	1.2	0.2	14	19	6	66	62	-	75
7	H.S.R Layout, near central silk board	2.6	19.4	10.1	34.4	1.1	0.6	3	24	3	34	57	-	82

Table 4: Air pollutants in Bangalore city for the month of April - 2020

Sl.No	Name of the monitoring station	In µg/m³												AQI
		Average values of pollutants						Sub index						
		SO_2	NO_2	NH_3	O_3	CO	C_6H_6	SO_2	NO_2	NH_3	O_3	CO	C_6H_6	
1	City railway station	6.6	59.4	-	-	1.2	-	8	74	-	-	58	-	91
2	Sanegruvanahalli	3.5	13.4	-	-	0.6	-	4	17	-	-	31	-	52
3	Veterinary college, Hebbal	8.5	2.6	2.7	40.1	0.6	0.1	11	3	1	40	30	-	50
4	Shalini ground, Jayanagar 5th block	1.7	19.4	11.5	39.6	0.5	0.1	2	24	3	40	25	-	42
5	Kavika- Bapuji Nagar	9.1	9.2	12.7	53.8	0.4	0.8	11	12	3	54	21	-	54
6	Rajeev Gandhi chest hospital Hobegowda nagar	11.3	5.7	22.3	60.2		0.1	14	20	6	60		-	60
7	H.S.R Layout, near central silk board	1.4	7.0	9.2	34.4	0.5	0.2	2	9	2	34	26	-	48

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Table 5: Air pollutants in Bangalore city for the month of May – 2020

SL.No	Name of the monitoring station	In µg/m³												AQI
		Average values of pollutants						Sub index						
		SO_2	NO_2	NH_3	O_3	CO	C_6H_6	SO_2	NO_2	NH_3	O_3	CO	C_6H_6	
1	City railway station	5.8	25.6	-	-	0.8	-	7	32	-	-	38	-	96
2	Sanegruvanahalli	3.4	24.4	-	-	0.4	-	4	22	-	-	31	-	42
3	Veterinary college, Hebbal	9.0	8.2	4.3	32.9	0.6	0.1	11	10	1	33	28	-	54
4	Shalini ground, Jayanagar 5th block	1.8	24.3	12.3	41.1	0.6	0.2	2	30	12	41	31	-	50
5	Kavika- Bapuji Nagar	8.2	13.6	12.3	45.1	0.5	0.7	10	17	3	45	27	-	51
6	Rajeev Gandhi chest hospital Hobegowda nagar	11.0	27.5	10.6	32.1	0.7	0.1	14	34	3	32	36	-	50
7	H.S.R Layout, near central silk board	1.8	7.3	4.3	32.6	0.6	0.2	2	9	1	33	31	-	58

Table 6: Air pollutants in Bangalore city for the month of June - 2020

SL. No	Name of the monitoring station	In µg/m³												AQI
		Average values of pollutants						Sub index						
		SO_2	NO_2	NH_3	O_3	CO	C_6H_6	SO_2	NO_2	NH_3	O_3	CO	C_6H_6	
1	City railway station	8.9	27.6	-	-	0.9	-	11	25	-	-	35	-	102
2	Sanegruvanahalli	3.6	33.6	-	-	0.8	-	4	42	-	-	42	-	50
3	Veterinary college, Hebbal	9.7	10.7	4.1	13.5	0.6	0.1	12	13	1	14	31	-	41
4	Shalini ground, Jayanagar 5th block	4.3	13.2	6.6	23.9	0.5	0.1	5	17	2	24	24	-	36
5	Kavika- Bapuji Nagar	9.9	20.5	7.6	18.7	0.6	0.9	12	26	2	19	28	-	38
6	Rajeev Gandhi chest hospital Hobegowda nagar	10.8	8.6	2.5	18.5	0.4	0.1	14	11	1	19	20	-	33
7	H.S.R Layout, near central silk board	4.3	12.2	7.3	21.9	0.6	0.8	5	15	2	22	30	-	53

If the range of AQI is between 0-50 it shows good impact on health, if it is 51-100 satisfactory, 101-200 moderate, 201-300 poor, 301-400 very poor, more than 400 means sever effect on health.

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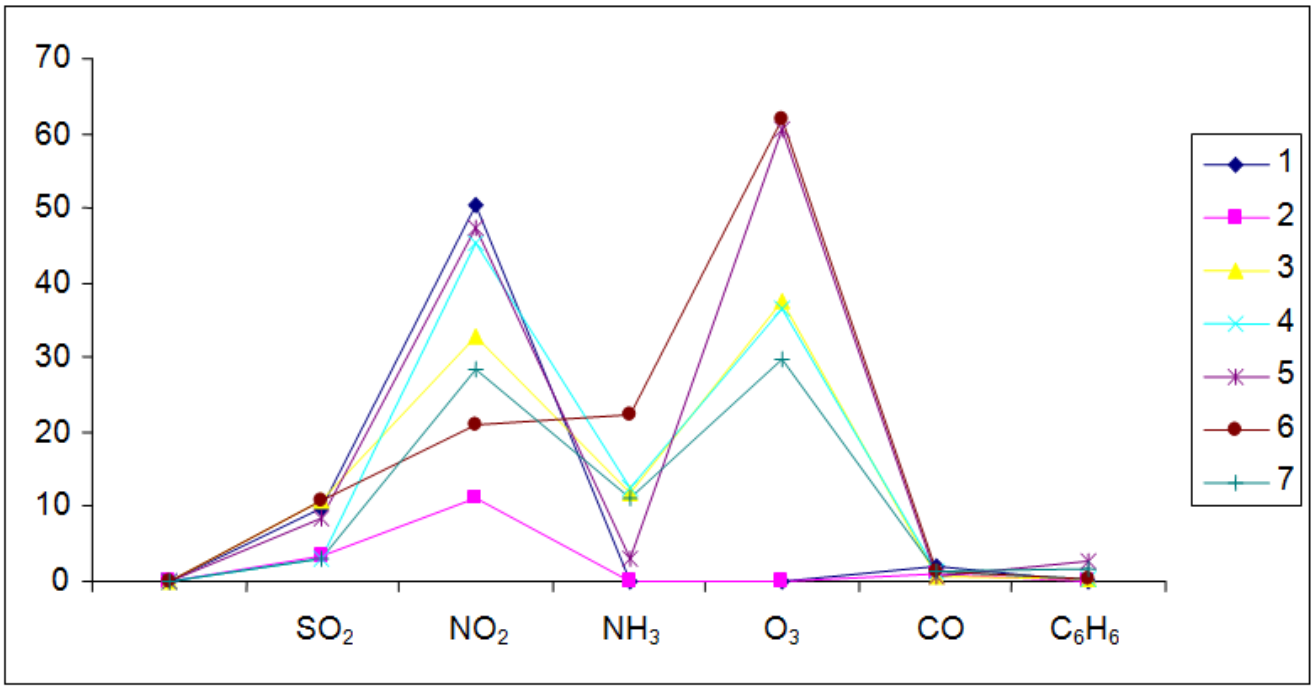
Table 7: AQIs IN SOME AREAS OF BENGALURU CITY FROM JANUARY TO JUNE 2020.

MONTH	AQIs IN SOME AREAS OF BENGALURU						
	City railway station	Sanegruvanah alli	Veterinary college, Hebbal	Shalini ground, Jayanagar 5th block	Kavika-Bapuji Nagar	Rajeev Gandhi chest hospital Hobegowda nagar	H.S.R Layout, near Central Silk Board
JANUARY 2020	94	43	86	101	84	83	102
FEBRUARY 2020	116	43	84	103	86	82	97
MARCH 2020	104	70	75	76	76	75	82
APRIL 2020	91	52	50	42	54	60	48
MAY 2020	96	42	54	50	51	50	58
JUNE 2020	102	50	41	36	38	33	53

Graph 1: Air pollution in Bengaluru city for the month of January - 2020



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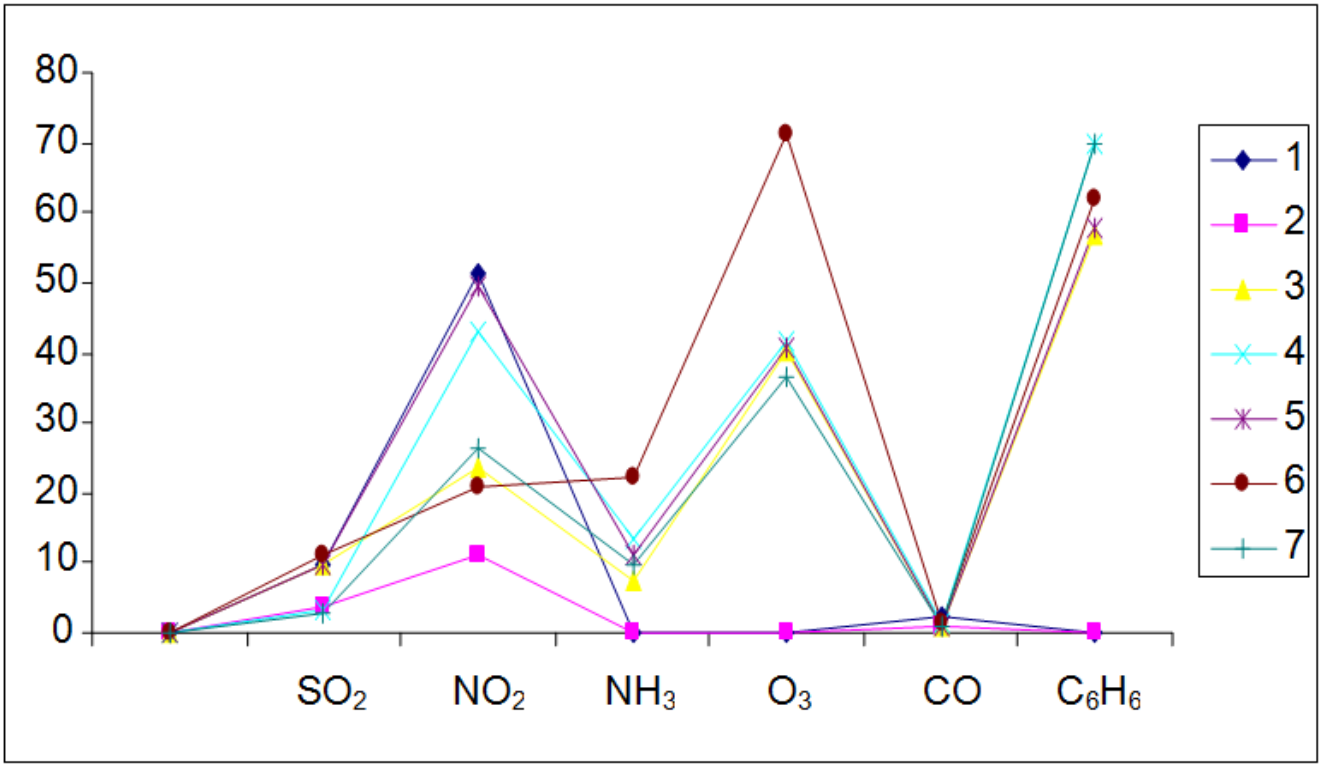
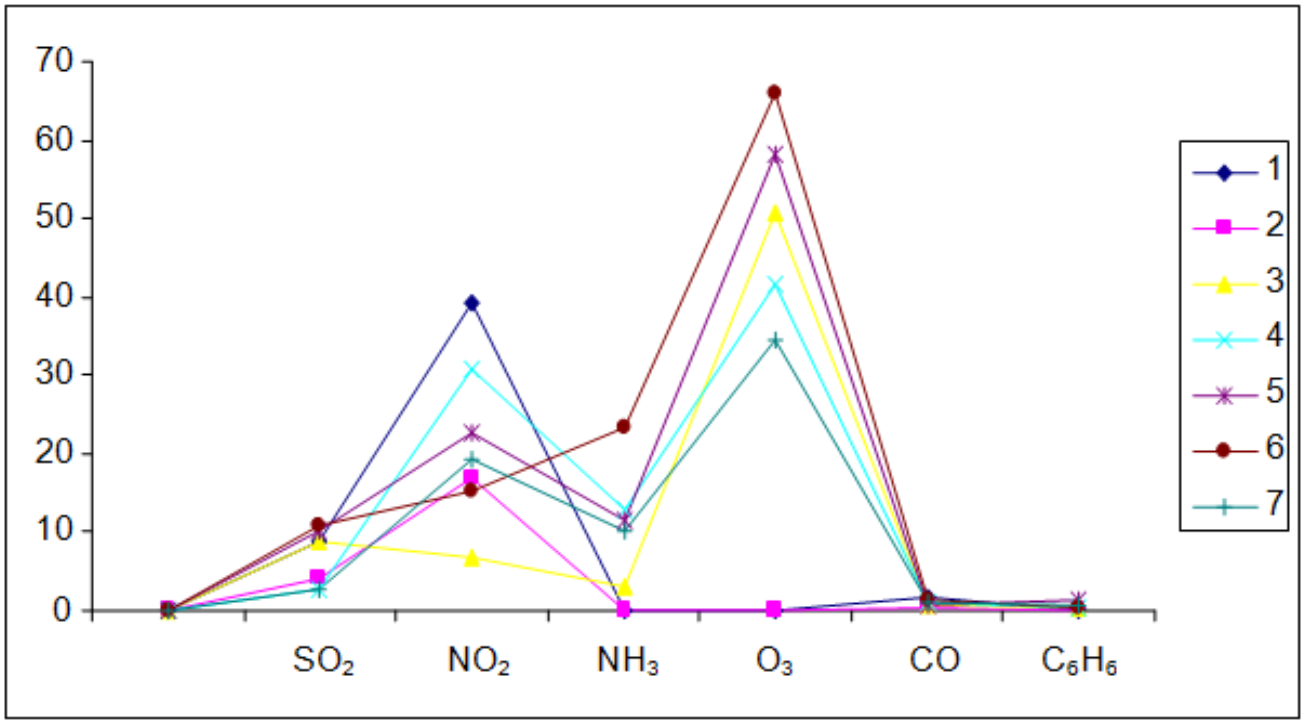
Graph 2: Air pollutants in Bangalore city for the month of February - 2020



Graph 3: Air pollutants in Bangalore city for the month of March – 2020



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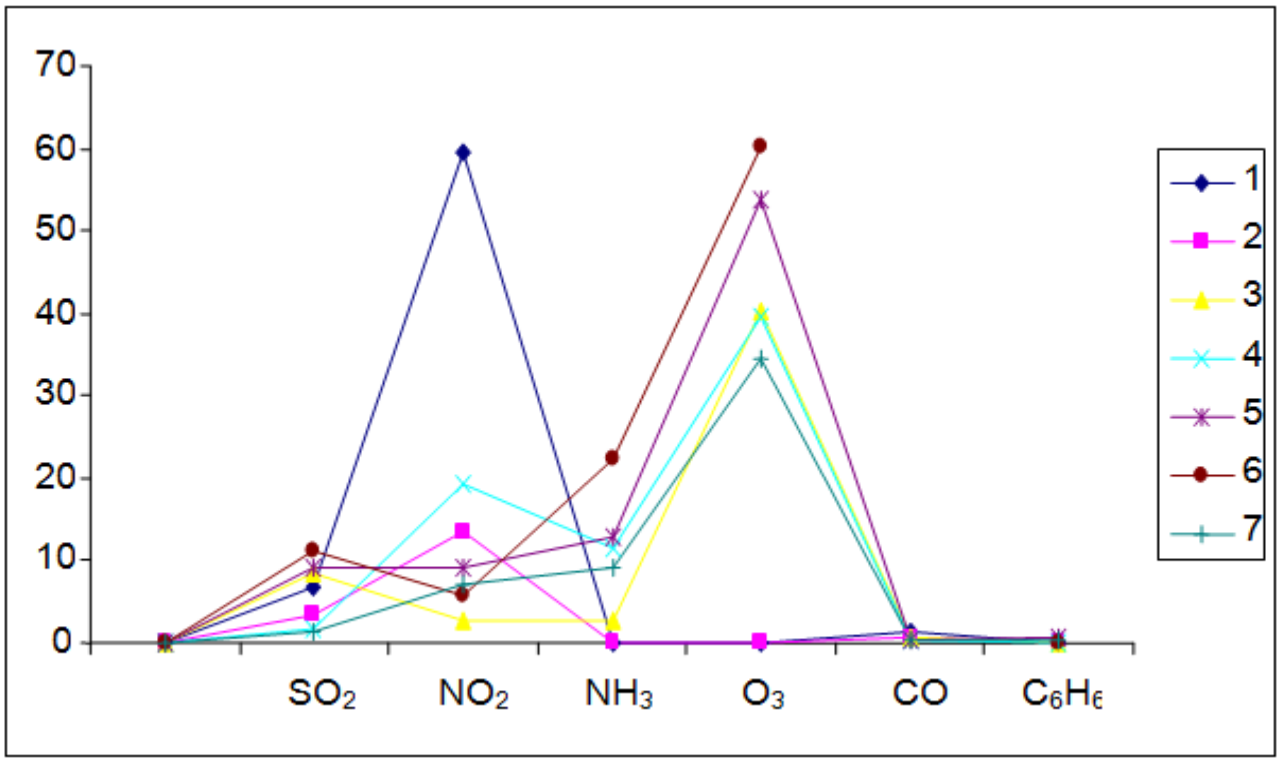
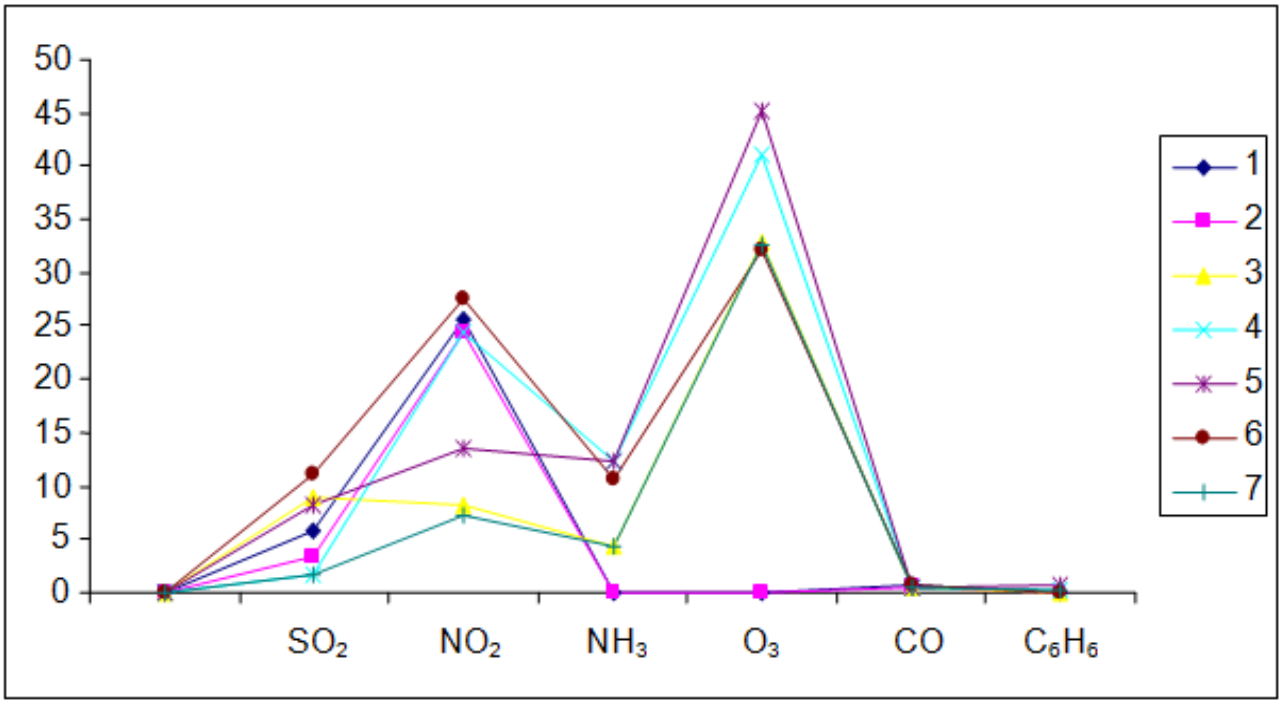
Graph 4: Air pollutants in Bangalore city for the month of April - 2020



Graph 5: Air pollutants in Bangalore city for the month of May - 2020



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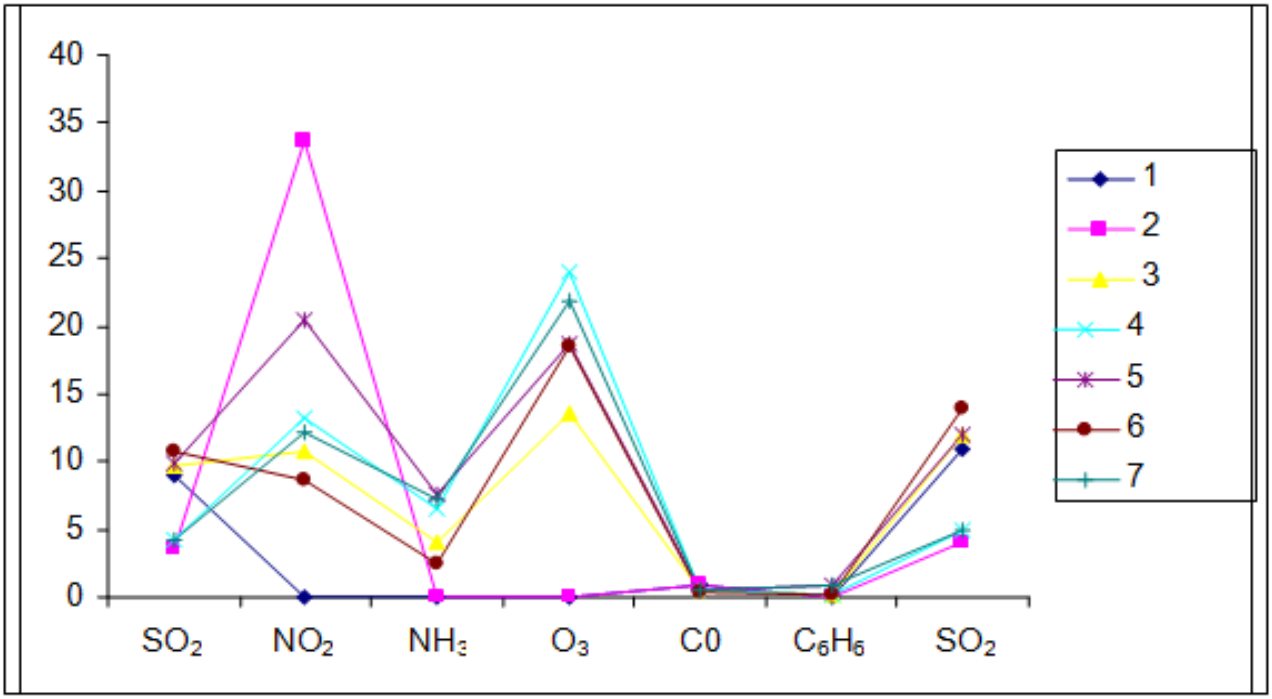
Graph 6: Air pollutants in Bangalore city for the month of June-2020



India ranks as the second most polluted country in the world & the first in air pollution. Bangaluru is also one of the polluted cities in India, it ranking as the 3rd most populous city in the whole India makes its 82nd placing in terms of pollution. Varieties of pollutants present in the atmosphere can have a multitude of harmful effects on the living beings, especially on human being who breathes frequently it in. These pollutants are principally the products of human activity. In that vehicles and industry play a major role. The construction industry would create high amounts of pollutants, in that SO_2, NO_2, NH_3, O_3, CO and C_6H_6 play a major role.

When SO_2 combines with water in the air to form sulphuric acid, then it will become the main component of acid rain[3]. The amount of SO_2 near industrial area recorded near about 350 µg/m^3 for one hour[15] and average SO_2 near station was recorded in different month ranges from 0.323 to 1.853[16], it clearly shows that industries emit more SO_2. Sulphur dioxide (SO_2) is primarily produced from the burning of coal and oil (fossil fuels) and the smelting of mineral ores that contain sulphur. For present study month wise average is considered. In the month of April the SO2 record is more near Rajeev Gandhi Hospital, Hombegowda nagar and less in the month of April near Shalini ground, Jayanagar and also near H. S. R Layout, near Silk Board (Table 5 & Graph 5). Exposure to SO_2 causes irritation of the eyes, affects the respiratory system, reduces the function of the lungs and Inflammation of the respiratory tract from SO_2 can aggravate asthma and chronic bronchitis, as well as increases the risk of infection, it leading to increased hospital admissions and visits to emergency rooms.

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Nitrogen dioxide mainly emitted by power generation, industrial and traffic sources, is an important constituent of particulate matter and ozone. There is growing evidence that independently. The nitrogen monoxide near industrial area is about 320 µg/m^3 for one hour was recorded[15] and average NO_2 near station was recorded in different month ranges from 0.002 to 0.033[4]. It clearly shows that the emotion of NO_2 is more near industrial area. In the present study the NO_2 record is more near city railway station in the month of April and it is less near veterinary college, Hebbal (Table 4 & Graph 4). It can increase symptoms of bronchitis and asthma, as well as lead to respiratory infections, reduces lung function and growth. Evidence also suggests that NO_2 may be responsible for a more diseases, with exposure linked to premature mortality and morbidity from cardiovascular and respiratory diseases[1][3][5]. High concentration of NH_3 leads to immediate burning of the nose, throat and respiratory tract. The record of NH_3 is more near Rajeev Gandhi chest Hospital Hombegowda nagar except in the month of May and June. This can cause bronchiolar, *alveolar edema*, and airway destruction resulting in respiratory distress or failure. Inhalation of lower concentrations can cause coughing and nose and throat irritation.

Ground level ozone is one of the major components of photochemical smog and a key health risk linked to breathing problems. It is a secondary pollutant, meaning that it is not directly emitted. Instead, it is produced when carbon monoxide (CO), methane or other volatile organic compounds (VOCs) are oxidized in the presence of nitrogen oxides (NOx) and sunlight. In addition to their role as ozone precursors, CO, VOCs and NOx are dangerous air pollutants themselves. Major sources of NOx and VOCs include emissions from motor vehicle exhaust, industrial facilities and chemical solvents. Major sources of methane include waste and the fossil fuel and agricultural industry. Aside from its health impacts, tropospheric ozone is a short lived climate pollutant and one of the most important greenhouse gases [2][9][12]. It is recorded more near Rajeev Gandhi chest hospital, Hombegowda nagar in the month of February (Table 2 & Graph 2) and less in June near veterinary college, Hebbal (Table 6 & Graph 6). The concentration of ozone can trigger chest pain, respiratory diseases, coughing, throat irritation and airway inflammation. It also can reduces lung function and harmful for tissues. Ozone can worsen bronchitis, emphysema and asthma, leading to increased medical care[3][11].

Carbon monoxide (CO) is a colourless and odourless gas, it is highly toxic & reduces O_2 transportation in the body, due to more affinity towards Hb, it combines readily and forms carboxyhaemoglobin and then oxygen concentration gradually reduces in the body and leads to anaemia[7]. The measurement of CO near industrial area is 320 µg/m^3 for one hour[15]. In the present study CO record was more near city railway station in the month of February (Table 2 & Graph 2) and less near Kavika, Bapuji Nagar and Sanegruvanahalli in the month of April (Table 4 & Graph 4). Which at high levels can be harmful to humans by impairing the amount of oxygen transported in the blood stream to critical organs? Although high concentrations of CO are more of a concern indoors, emissions outdoors, particularly in developing countries can be high. New evidence also reveals that long-term exposure to low concentrations is also associated with a wide range of health effects. The main sources of ambient CO include motor vehicle exhaust and machinery that burn fossil fuels[9].

Benzene is a simple cyclic organic compound. It is a well known genotoxic carcinogen and health hazard, found naturally in the environment at low concentrations. Benzene occurs naturally in crude oil

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and petrol. It is also formed during incomplete combustion of fossil fuels, petroleum products, coal and wood. In our study it is more near Shalini ground, Jayanagar and H.S.R Layout near central silk board in the month of February (Table 2 & Graph 2) and less in the months of May & April near veterinary college, Hebbal and Shalini ground, Jayanagar (Table 4, 5 & Graph 4, 5). Exposure to benzene causes irritation of eyes, mouth, lungs and abdomen, vomiting, dizziness, convulsions, pain in the abdomen, long exposure may leads to cancer and leukaemia[13].

The health effects of living organisms in a city with polluted air are numerous, with a large number of studies already has been conducted on the effects of exposure, in this paper we are focussing on pollutants and AQIs of before and after lockdown. The Air quality index is less in the month of April and may in almost all the selected areas (Table 7), it means pollution is less during lockdown due to less human interference. So we have to take care of our nature by reducing pollution, then nature will care us, otherwise we have to face so many pandemic situations in coming days.

CONCLUSION

When compared to all the places the air quality index is more near City Railway station in all most all the month and less near Sanegruvana halli. By observing AQIs of the different months we can clearly say that the pollution is less during lockdown. The improvement of air quality is very important and necessary to lead healthy life, for this Government taking so many measures, it is not only responsibility of Government, being a responsible citizen we should involve in educating people regarding air pollution, health consequences of polluted air, as well as requesting citizens to involve in controlling the pollution.

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PIUH - 05

Bioremediation of Soil Contaminated With Pesticides by Using Microorganisms from Fruit and Vegetable Waste: An Eco Friendly and Novel Approach

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ABSTRACT

The intentional use of pesticides for improved crop production has led to the intake of wide range of poisonous compounds contaminating the soil. The prevailing contaminants in soil are now environmental and health concerns today as they have resulted an alarming rate of health problems. The treatment of soils loaded with pesticides can be remediated by several processes and bioremediation is the best suitable approach. Although it is a time-consuming strategy but it is more environment friendly, economical and versatile. With the advent of nanotechnology which has opened a gateway to solve this major problem of pesticide residues which can be treated with nanoparticles present in compost prepared from fruit & vegetable waste. The pesticides present in the soil causing serious harm to human's health and the environment can be degraded with bioremediation techniques since the microorganisms are able to degrade different substrates and have good ability to survive on different media. Pesticides stay for longer duration in soils and are not easily biodegraded. So bioremediation is the only effective solution and is of great concern and challenge to the future generation. Nano particles used for adsorption of pollutants and their degradation are an effective green technology. Use of nanoparticles and microorganisms present in fruit and vegetable organic matter acts as phytoremediation and bioremediation which can potentially decontaminate the soil pesticides. The remediation of contaminated soil by using bioremediation and nanoparticles is to save the environment. Bioremediation is a common method of removing pesticide residues from soil and thereby decreasing the toxic effects from soil. Bioremediation is based mainly on the use of microorganisms and plants, for degrading contaminants from soil and to ease the transformation of soil into organic matter. Bioremediation is inexpensive and eco-friendly approach. Bioremediation requires the stimulation of microorganisms in the form of some nutrients which helps in maintaining those microorganisms for a longer duration in that environment and in turn accelerate the degradation of contaminants. To preserve the natural resources and to minimize the consequence on environment quality, microbial conversion of fruit and vegetable wastes to biofertilizer is a potential and feasible bioremediation tool which utilizes positive species of microorganisms to stimulate the process of soil transformation and produces a toxic free soil. In nature, there are numerous microorganisms which occur naturally and facilitate the conversion of the organic waste into plant macro and micro nutrients (value added products) thus increasing the soil productivity by lowering the C:N ratio and also helps in maintaining the flow of nutrients from one system to another without altering the ecological imbalance. The soil pesticide has become a major problem due to ineffective agro-technology involving crop treatments with pesticides for improved

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growth rates. The pesticide residues in surface soil, lead to toxicity in the soil-water environment. Bioremediation is advantageous due to capability of microbes and some plants for detoxification of the environmental pollutants. Microbes which were commonly reported in pesticides bioremediation include *Pseudomonas sp., Bacillus sp., Klebsiella sp., Pandoraea sp., Phanerochaete, Chrysosporium, Mycobacterium sp*. The pesticide thus transformed or degraded by the microorganism is used as a carbon source, nitrogen source, any other mineral source or a final electron acceptor in respiratory chain. Bioremediation contains all those processes and measures to facilitate biotransformation in an environment that are already distorted by contaminants, to its unique status.

Keywords: Biodegradation, Bioremediation, Nanoparticles, Pesticides, Microorganisms.

INTRODUCTION

These days major hazard confronting the world is the degradation of the environment due to the extensive utilization of the chemical fertilizers which greatly contributes in the deterioration of the environment. In addition to this, the excessive use of fertilizers results in the loss of soil fertility that has highly distorted the agricultural soil. Therefore, it is the need of the hour to sustain organic farming practices which will reverse the declining trends within the worldwide productivity. The presence of pesticides in soil is a serious threat to microorganisms living in below and above ground and are important for functioning of soil. Bioremediation is a common method of removing pesticide residues from soil and thereby decreasing the toxic effects from soil. Bioremediation is based mainly on the use of microorganisms and plants, for degrading contaminants from soil and to ease the transformation of soil into organic matter. Bioremediation is inexpensive and eco-friendly approach. Bioremediation requires the stimulation of microorganisms in the form of some nutrients which helps in maintaining those microorganisms for a longer duration in that environment and in turn accelerate the degradation of contaminants[23]. The soil can be loaded with pesticides mainly by two methods. One is directly applying to soil by dissolving in irrigation water or in the form of granular formulation and second is indirectly by washout of pesticides treated plants and aerial spraying of pesticides on plants. Microorganisms have an important role in degradation of pesticides. They can perform well by release of pesticide detoxifying enzymes. Microorganisms present in manure prepared from fruit and vegetable matter are remediating agents of contaminated soils[8]. On one hand tropical soils are deficient in all essential plant nutrients and on the other hand large quantities of such nutrients contained in agricultural by products and domestic materials are wasted. In cities and rural areas of India, almost 70 million ton organic waste is generated annually that is either land filled or burned[4]. Nature is comprised of large numbers of macro and microorganisms which have the capability to convert organic waste (waste of fruits and vegetables) into value added resources/products like organic matter and plant nutrients that helps in enhancing the productivity of the soil and reduce the degradation of the environment. To preserve the natural resources and to minimize the consequence on environment quality, microbial conversion of fruit and vegetable wastes to biofertilizer is a potential and feasible bioremediation tool which utilizes positive species of microorganisms to stimulate the process of soil transformation and produces a toxic free soil. In nature, there are numerous microorganisms which occur naturally and facilitate the conversion of the organic

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waste into plant macro and micro nutrients (value added products) thus increasing the soil productivity by lowering the C:N ratio and also helps in maintaining the flow of nutrients from one system to another without altering the ecological imbalance[25]. This review paper is written with the following objectives:

1. Conversion of fruit & vegetable waste into organic manure.
2. Bioremediation as an effective tool for biotransformation of soil environment.
3. Useful micro flora of soil.

REVIEW OF LITERATURE

Fruits and vegetable waste as microbes

The contaminated soils can be treated with bioremediation process. Pesticides are complex chemicals so more robust and versatile techniques are required to degrade these complex compounds into simpler ones. These techniques should be result oriented & economical[35]. Biodegradation acts by microorganisms which breakdown the complex pesticides or any other organic compounds to fewer complex compounds, ultimately to water and CO_2. The complete breakdown of pesticides into inorganic components is known as biomineralization. This degradation leads to formation of less complex and less toxic organic compounds, hence known as partial biodegradation. In some cases, the pesticide thus transformed or degraded by the microorganism is used as a carbon source, nitrogen source, any other mineral source.

Some fruits and vegetables have ideal conditions for the growth and survival of different types of microorganisms as the internal tissues of such fruits and vegetables are nutrients rich and have pH neutral since starch is present as a principal storage content in them. There are various microbiological processes which can help in fruits and vegetable waste disposal by recycling the solid waste into functional manure with the action of decomposing bacteria.

Fruits and vegetable as bioactive compounds

Fruits and Vegetables are the most common available organic matter sources because of their raw consumption, ample amount of nutrients, minimally processed properties and the presence of health promoting compounds. Due to the growth in the population and altering diet habits, the manufacturing and processing of fruits, vegetables and other horticulture crops have been increasing rapidly to fulfill the demands. But the losses and wastes of such horticulture crops (fruits and vegetables) during processing in industries has given rise to serious environmental problem. For example, the United Nations Food and Agriculture Organization (FAO) have calculated that wastes and losses in fruits and vegetables are the maximum amongst each and every kind of foods and can reach up to 60%. The processing operations of fruits and vegetables generate significant wastes and by-products that comprise approx 25% to 30% of a total commodity group. The wastes generated from these fruits and vegetables by-products contains bioactive compounds like polyphenols, carotenoids, enzymes, vitamins, oils as these wastes are composed of skin, rind, pomace and seed. These bioactive compounds have great potential in food industry for the production of enriched or functional foods. Apart from food industry it also has potential in other industries like medicine industry for drugs, health industry for medicines and

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textile industry. Hence, the utilization of waste for the production of various bioactive components or phytochemical compounds is an important step toward sustainable environment.

The soil pesticide has become a major problem due to ineffective agrotechnology involving crop treatments with pesticides for improved growth rates. The pesticide residues in surface soil, lead to toxicity in the soil-water environment. Bioremediation is advantageous due to capability of microbes and some plants for detoxification of the environmental pollutants. Microbes which were commonly reported in pesticides bioremediation include *Pseudomonas sp, Bacillus sp, Klebsiella sp, Pandoraeasp, Phanerochaete, Chrysosporium, Mycobacterium sp*[14]. The pesticide thus transformed or degraded by the microorganism is used as a carbon source, nitrogen source, any other mineral source or a final electron acceptor in respiratory chain. On the other hand, waste is also that food which is fit for consumption but cannot consume and despite discarded. This reflects the behavior of the consumer or retailer[13]. Moreover, losses and wastes happened are diverse so it has become difficult to distinguish each and every waste as each has its own reasons but these can be assessed both quantitatively and qualitatively[11]. Quantitatively they represent to volumes or masses, which minimize the amount of food available for consumption. Qualitatively, they refer decline in nutrition, edibility, caloric value, economic value, consumer acceptability, all of which are known before the food item is redundant. It is very difficult to quantify and assess the qualitative losses due to waste. In developing as well as in developed countries, waste and losses of horticultural commodities are high at different points of the handling chain due to lack of appropriate handling techniques. In other words, food losses are generally the result of technical limitations in infrastructure and handling, while food waste is commonly the result of negligence in affluent societies.

Reported that around one-third of all fruits and vegetables produced globally are vanished through post harvest and do not reach the buyer. Waste after reaching the buyer is also very significant, particularly in developed countries. Depending on the commodity, postharvest losses in the United States are estimated to be 2% to 23%, with an overall average of 12%. United Kingdom estimated tentative postharvest losses to be 9%, except the losses left in the field as they failed to meet the quality criteria[16]. Further in the United States, total worth of fruit and vegetable losses at the retail and consumer levels were $42.8 billion in 2008 or roughly $141 per person[5].

Global agricultural losses possibly will be decreased by 47% and global consumption of waste by 86% pointing out that the global potential development is largest in regions wherever there is the lowest need for the supplying extra food[22].

Bioremediation contains all those processes and measures to facilitate biotransformation in an environment that are already distorted by contaminants, to its unique status. While the processes that are being utilized in order to attain the advantageous results may vary as they still have the similar principles like the utilization of microorganisms and their enzymes which are either indigenous or are stimulated by the accumulation of nutrients, optimization of conditions and are seeded into the soil. Such methods have various advantages of the implementation but generally they include lack of interference with the ecosystem ecology.

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There are many applications of bioremediation in the food industry. Further the advancement in the genetic engineering; microbiology and biotechnology have given a valuable tool to the scientists to deal with contaminants in the environment. In the biogeochemical cycles, there are new contaminants such as chemicals, pesticides, insecticides, herbicides, cleaning chemicals which have entered along with the food chain. Bioremediation process transforms the contaminants into substances which can be absorbed and utilized by the autotrophic microorganisms with no lethal effect on them.

Earlier, man's utmost challenge resided in speeding up the industrialization process. Presently, man attempts to find possible ways to deal with the rising industrialization and its associated problems. Ever since of this growing development, problems occur in forests, landfills and water resources. Major sources of the contaminants include pesticides, fertilizers followed by industrial processes, waste and waste water sludge disposal and accidental release[10]. Acidification is recurrently a trans boundary issue as deposition of acid is higher than critical in approximately 60% of Europe, along with central parts of Europe having 20 times more acidity than the ecosystem's critical loads.

Presently, in many developing countries, the management of urban waste streams is not optimized so far. In addition to this in many cases these wastes are disposed unprocessed in open dumps and this gives rise to serious problems like environmental and health issues due to the presence of contaminants and pathogens. Generally, the utilization of specific low-priced strategies reduces the total quantity of wastes. These strategies are primarily related to the identification, separate collection and composting of specific organic waste streams like vegetable and fruit refuses from food markets and urban gardening activities.

According to *Parfitt et al.*, 2010 the composting technology is not only for the management of the organic waste fluxes from food market and gardening activities to be scaled-up in other developing regions, but also to obtain an end-product with a commercial value as organic fertilizer. Three co-composting mixtures were organized by utilizing market wastes mixed with pruning of trees and ornamental palms as bulking agents[25].

During the past few decades, the food processing industries have seen increased growth throughout the world. Further, fruit and vegetable losses and waste directly represent the wasting of food commodities and indirectly the wasting of critical resources for example land, fertilizers, water, chemicals, energy, as well as labor. These massive quantities of lost and wasted food commodities contribute towards vast environmental problems because they decay in landfills and release harmful greenhouse gases[45]. Subsequently domestic waste, fruit and vegetable processing units commonly generate the highest wastes into the environment. In the past horticulture by-products have not been taken very seriously for valuable materials but later on the scenario has been changed when fruit & vegetable waste could be used to recover highly valuable biomolecules. The horticultural waste has a potential of valuable bioactive compounds as these are the sources of phenolic compounds, pigments, dietary fibers, sugar derivatives, organic acids and minerals. Some of these bioactive compounds possess valuable health applications: antibacterial, cardioprotective antitumor, antimutagenic and antiviral, activities. Various fruits and vegetables, such as apples, oranges, peaches, pineapples, potatoes, green peas carrots, onions,

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asparagus and artichokes are utilized for jams, juice or pulp extraction, and frozen pulp, generating significant amounts of waste[26].

The management of food waste is a worldwide issue of concern. Technologies such as clean and green require to be optimized to avoid the land filling, dumping or incineration of waste food. Moreover, food for sale is safe for consumption in grocery stores and in compliance with the microbial and chemical residue surveillance program. In Canada, 65% of food has been lost as waste[16]. Consequently, few grocery stores train workers to eliminate packing material and put trimming and rotting fruit and vegetable in a appropriate container for farm composting, in which microorganisms decompose organic matter and release CO_2, H_2O, heat and produce compost. Conventionally, for farm composting, nitrogen (N) source has been added with carbon (C) source, like manure or slurry with straw or other C sources. In the ancient times, this leachate was lost to the soil along with its environmental impact left unnoticed[3]. Recommended using anaerobic and aerobic bioreactors and constructing ponds. However, this would require innovative equipment, knowledge, land and investment. On the contrary, farmers required a low-cost advancement to feed their crops and to close the nutrient loop by reusing the leachate throughout the summer months. For that, farmers need to be ready to use a common slurry spreader and pursue the fertilization plan organized by an agronomist to evade soil P builds up.

Studies revealed compost leachate being utilized as a plant mineral fertilizer whereas others noted phytotoxicity[3][20][18][19]. Certainly, the recycling of compost leachate requires further research if the cycle of plant nutrients has to be stopped devoid of phytotoxic effects. So, the physicochemical composition along with effects of the leachate formed by fruit and vegetable waste compost were investigated. Initially, the plant mineral nutrients composed of the trace elements were determined. After that, under controlled environmental conditions, the phytotoxicity of leachate for cress and corn germination and corn grown in pots were considered [27][46].

In the past years, due to rapid rise of world population along with the intensification of human activities brought severe environmental issues like soil, water and air pollution, forest destruction, etc. In the future these harmful impacts can cause global climatic changes such as greenhouse effect and may be a menace for the survival of the human race. To avoid these negative influences of human activities direct measures are necessary. Several industrial processes result in a huge quantity of wastes. The management of food and agricultural wastes has a significant role in the conservation of the natural resources in many countries, together with the Balkan region. The word "composting" is defined as the development of controlled biological maturity below aerobic conditions whereas organic matter of animal or vegetal origin is decayed to materials with shorter more stable, molecular chains, hygienic and humus rich leads to benefits for the agricultural crops and for recycling of soil organic matter[34]. The method is mediated with the help of different microorganisms in aerobic environments such as bacteria, fungi, algae, actinomycetes and protozoa that participates in nature as organic biomass or are added artificially[41].

Nowadays the concern about the composting process is related to the subsequent points: 1. Environmental opinion, since during this process the biomasses are converted into material rich in

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nutritional substances which can improve the structural quality of the soil[31]. 2. Hygienic approach, since during the process the organic matter is disinfected by the influence of the high temperatures [09]. Energy management approach, as during the process energy has released through the degradation of large organic molecules[33][38]. The term "composting" is generally used (though it is not correct) for the depiction of aerobic stabilization of the organic matter (solid wastes), obtained without separation of different fractions[34][41]. Compost offers many advantages to the landscape and garden. For instance, compost (1) enhances soil condition and structure; (2) improves the soil's ability to hold water and nutrients; (3) helps living soil organisms; (4) supports to dissolve mineral forms of nutrients; (5) develop buffers soil from chemical imbalances; (6) can supply biological control of certain soil pests and (7) supports to return organic materials to the soil and keeps them out of landfills and waterways. Compost can be utilized as mulch, a liquid "fertilizer" or incorporated into the soil or potting mixes.

CONCLUSION

This review focused the, nature, production, different kinds of waste originating from fruits and vegetables. It also discussed the potential of bioactive compounds such as dietary fibers, flavors, phenolic compounds, enzymes, and organic acids present in fruit & vegetable waste. Further, it demonstrates the high number of losses and waste, not only the major quantity of non-edible materials but also the high quantity of lost and wasted with no proper handling operations such as lack of inadequate field management, classification, harvest, transportation, storage, marketing, and industry infrastructure, in addition to waste generated because of discard of major amounts for various reasons. These major high quantities of lost and wasted fruits and vegetables along with their components represents losses of edible food materials along with the waste of by-products together with bioactive compounds of immense potential benefits for several industries and uses. Extraction techniques, conventional and nonconventional, are described comprehensively. There is a need to make use of new novel techniques regarding to the waste materials to attain higher retrieval rates of bioactive compounds. Extracted compounds are capable of used in different industries such as food, pharmaceuticals, cosmetic, and chemical along with food research and the advancement of functional foods.

Biodegradation is fruitful remedy for cleaning, managing and recovering technique for solving polluted environment as well as soil through microbial activity. In future researchers should explore novel microbial species having great potential. The unwanted waste substances can be degraded and its speed can be determined by the presence of biological agents. If there is inadequate supply of essential nutrient, uncomfortable external abiotic conditions (aeration, moisture, pH, temperature), and low bioavailability of the pollutant then, biodegradation in natural condition is not more successful and leads to be less favourable. Bioremediation can be effective only where environmental conditions permit microbial growth and activity. Bioremediation has been used globally with achieving great success. Mainly, the advantages are greater than that of disadvantages which is evident by the number of researchers using this technology and its increasing popularity through time. Generally, different species are explored from different sites and they are effective in control way.

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PIUH - 06

Characterisation and Removal of Priority Organic Pollutant Phenol through Adsorption Process from Aqueous Waste Using Almond Shell Based Activated Carbon

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ABSTRACT

Large amount of organic compounds are present in industrial and domestic waste waters which are carcinogenic in nature. Removal of these organic compounds from waste waters has become a great challenge to waste water treatment technologies as many of them are non-biodegradable in nature. The present work includes the study of almond shell based activated carbon as adsorbent for the removal of phenolic impurities. The main objective of this work was to determine the capacity of activated carbon for phenol removal from aqueous waste water. The almond based activated carbon is impregnated by using phosphoric acid in definite proportion. N_2BET surface area and XRD patter has been studied and compared with commercially available activated carbon which is found to be comparable to commercially available

Keywords: SEM, FTIR, Almond shell, XRD.

INTRODUCTION

The presence of phenol, phenolic compounds, aldehydes, aromatic and aliphatic compound is of great public concern from several days[1][2][3]. Natural water have resulted in different environmental problems resulting in development of different methods for the removal of Phenols[4]. Most of these compounds are released as by-products from different types of processes in the industries so prior to discharge to nearby water bodies, it must be treated. Different types of activated carbon, a highly porous adsorbent, are widely used in industry for purification processes. For example, a liquid which is to be purified is passed through a bed of granular activated carbon. As the liquid passes through the activated carbon bed, molecules of impurities in the liquid are adsorbed onto the surface of the activated carbon. Consequently, the larger the surface area of the activated carbon the more efficient the filter will be in removing impurities[5]. The main sources of phenols in environment are production of drugs and several pesticides like pentachlorophenol, dinoseb or diaryl-ether pesticides[6]. Mostly phenols and their derivatives are released into the environment through municipal/industrial waste and landfill leachate[7]. The presence of phenolic compounds have been documented in different mediums such as sewage sludge, influent and effluent of wastewater, river water and soil[8][9][10]. Phenols are also included in The List of Priority Pollutants by the US Environmental Protection Agency (EPA)[6]. The removal of such dangerous pollutants to permissible limit is mandatory as per environment protection Laws. They

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are also highly toxic which is very important due to ecological aspects[11]. Most previous research using adsorbents for organic compounds is based on batch kinetic and batch equilibrium studies were carried out[12]. Walnuts and almonds are among the most extensively consumed agricultural products in Iran. Huge amounts of their shells are not reused or recycled and are disposed of directly into the environment. Hence, they are available widely at no or low cost in Iran. Their shells have a porous structure and have not been used previously as phenol adsorbents in the context of low-cost adsorbents applications[13].

Activated carbon in modern technology of water treatment for organic pollutants is an effective adsorbent primarily due to its extensive porosity and very large surface area. In the present investigation, almond shell based activated carbon produced from the raw shells of almond nuts were used as adsorbents to remove phenol from aqueous solutions and adsorption studies were carried out. The carbon was characterized to analyse its structural and adsorption properties.

MATERIALS AND METHOD

Materials: Phenol of analytical reagent grade of reputed company such as Merck, India and Raw almond shells from local market and sweet industry.

Method: Raw almond shells from local market were collected from sweet industry waste. Then it is crushed to small pieces using hand crusher. Material was oven dried at 108 °C for about 2 and half hour. This process was done to mildly oxidize shells so that volume of reactive sites will be available for activation. 15g of these shells were weighed exactly and digested with phosphoric acid in 1:1 ratio for 28 h and carbonized at 750 °C in furnace reactor for two hours. The furnace reactor has the facility to heat the material from room temperature to 850 °C and the temperature was controlled to an accuracy of ±5 °C by means of a temperature controller. During carbonization the carbonaceous material along with the impregnation agent turns black forming a plastic mass, which turns into a dry powder on continued heating. The carbonized material was cooled to room temperature and washed thoroughly with 5 N HCl until excess acid was totally removed and the pH of the washed water was neutral. After washing the material was dried at 105 °C overnight and meshed into 325 mm size with the help of sieve and was used for further experiments for characterization of prepared activated carbon. Preparation of stock solution for adsorption studies. All the reagents used were of analytical grade. A fresh aqueous solution of phenol was prepared using boiled distilled water cooled to room temperature. The solutions of different concentrations varying from (mol/g) were prepared by adding required amount of stock solution for each concentration in 250 ml of volumetric flask and diluting it to make up the volume with distilled water.

Spectrophotometric Method of Estimation of Adsorbate phenol

The adsorbate concentration in their aqueous solutions, were determined by the UV/VIS absorbance spectroscopy. Adsorbate concentration of the solution was measured by UV/VIS spectroscopy by measuring the optical density of the components at their respective wavelengths of maximum

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absorbance. The complete analytical work of UV/VIS. absorption measurements were carried out on a Perkin Elmer Lambda 35 UV/VIS spectrotometer. The absorbance measurements were carried using matched 1cm path length glass and quartz cuvettes. The adsorbate used in the present work had very strong absorption bands at 270 nm. The absorption maxima and molar extinction coefficient (ε) values are reported in Tables

RESULTS AND DISCUSSION

Table 1 Ultraviolet absorption spectroscopy data of Adsorbates

Sl. No.	Adsorbate	λ max(nm)	ε ($cm^{-1}ppm^{-1}$)	R^2
1	pH	270	0.0148	0.9993

Table 2 Physico-chemical analysis of activated carbon ABAC

Almond based activated Carbon(ABAC)	M%	A%	V.M%	F.C%	C%	H%	N%
Raw AS	**9.8**	**2.01**	**67.98**	**19.87**	**43.98**	**6.89**	**0.786**
ABAC	**23.1**	**5.2**	**18.1**	**60.8**	**93.24**	**3.16**	**1.66**

Table 3 Results for Iodine No. And B.E.T surface area

Almond based activated Carbon(ABAC)	Iodine Number	B.E.T surface area m^2/g
ABAC	**1040**	**1492.34**

Table 4 Phenol-B.E.T adsorption isotherm data

Adsorbent	B.E.T adsorption constants	
Activated carbon	Q_0	Z
ABAC	90.90	57134.35

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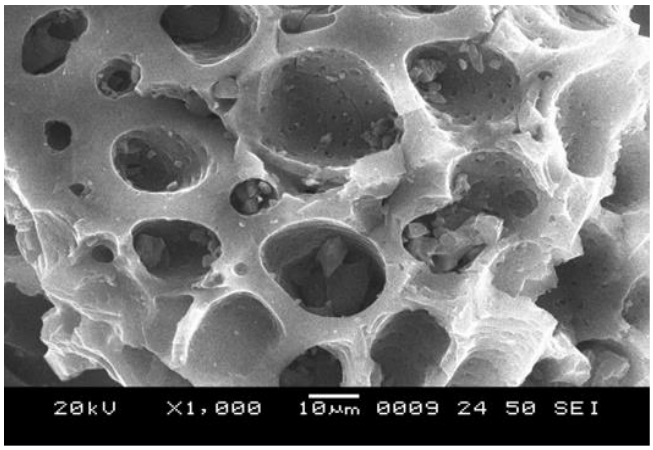

Figure 1 Electron micrograph of Almond SDS

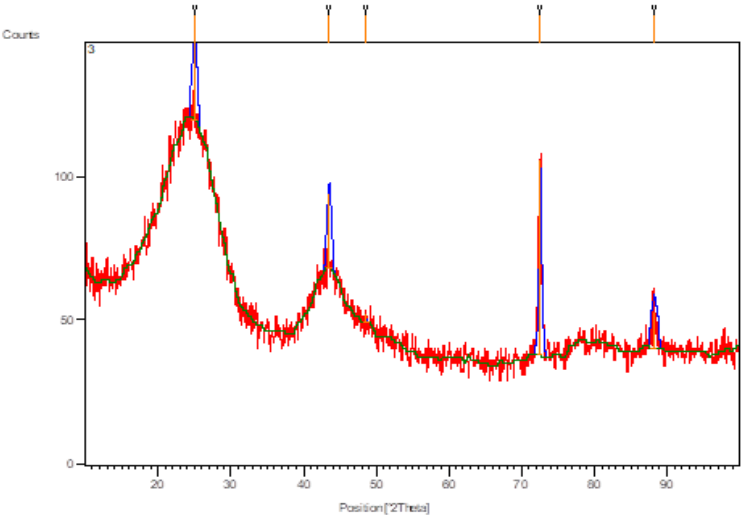

Figure 2 XRD pattern of Almond

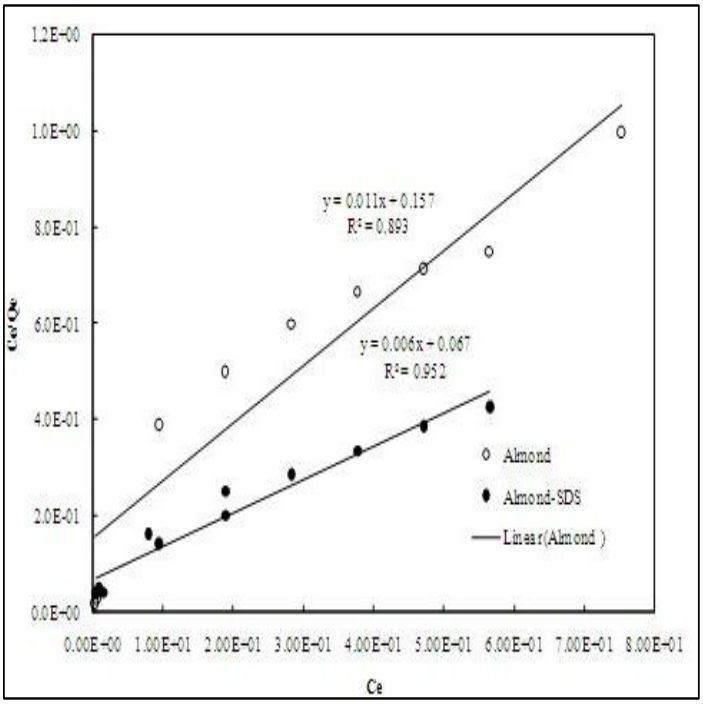

Figure 3 B.E.T adsorption isotherm of Phenol with Almond shell Activated carbon

Physico-chemical (Elemental) analysis: The data obtained for physicochemical properties of the activated carbon are presented in Table 2. The values describing Brunaer Emmett Teller surface area (BET), Iodine and methylene blue (MB) numbers of the ABAC are shown in Table 3 illustrates that the almond shell based activated carbon have better application in phenol removal. Fig 1 represents SEM micrographs and Fig 2 represents results for XRD analysis for the studied ABAC.

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N2-BET Surface area measurement: Specific surface area was determined by the N2-BET isotherm technique using a Micromeritics ASAP 2010 surface area analyser. The samples were initially outgassed at 393 K for 24 h before adsorption isotherms were generated. An adsorptive (typically Nitrogen) is admitted to the solid in controlled increments. After each dose of adsorptive, the pressure is allowed to equilibrate and the quantity of gas adsorbed is calculated. The gas volume adsorbed at each pressure defines an adsorption isotherm at constant temperature, from which the quantity of gas requires to form a monolayer over the external surface of the solid and its pores is determined. With the area covered by each adsorbed gas molecule known, the surface area can be calculated.

SEM morphology analysis and XRD pattern of ABAC

The physical surface morphology was examined using a JEOL Scanning Electron Microscope (JSM-6380 Model No.). A thin layer was mounted on the Al specimen holder by a double-sided tape. It was coated with Au/Pd, with a thickness of about 30 nm. The SEM of ABAC was recorded at 500 x and 3000x magnifications. The pore formation of activated carbon is mainly due to the addition of phosphoric acid which opens the surface structure. Phosphoric acid is a strong dehydrating agent, and helped in generation of empty spaces. At high temperatures the reactive sites leave a hard aromatic carbon porous structure for adsorption. It could be observed from Fig 1 that the surface is full of various shape and sizes of pores. Also the surface shows a lot of grooves, cracks and crevices in the surface matrix after activation. The macropores are highly developed deep inside the surface. Surrounding the surface, plenty of micropores can be observed leaving greater adsorption sites for phenols. It indicates that the precursor material and method for preparation of activated carbon is adequate for the purpose. It indicates that the precursor material is adequate for the purpose. XRD pattern of ABAC suggested amorphous nature of carbon with broad peaks of amorphous phases shown in Fig 2.

Adsorption isotherm

The B.E.T adsorption capacity was determined by using different concentrations varying from 1-100 ppm (mg/L) in 100 mL phenol solution by using 0.1 g almond shell activated carbon. The mixture was shaken continuously on automatic shaker for 4 days at the speed of 240 rpm. The sample was then filtered through Whatman filter paper No 1. The initial and final concentration of phenol was analyzed on UV-Vis spectrophotometer-Perkin Elmer Lambda 25 at λmax 660 nm. The amount of adsorption at equilibrium (Qe mg/g) and sorption efficiency (%) were calculated according to the expressions.

$$qe(\mathrm{mg/\,g}) = \frac{[(C0 - Ce)V]}{m}$$

$$\text{Sorption efficiency } \% = \frac{[(\mathrm{Co} - \mathrm{Ce})]}{\mathrm{Co}} \times 100$$

Where, Co and Ce are the initial and equilibrium concentration (mg/L), V the volume of solution (L), m the weight of almond shells activated carbon (g) and C is the solution concentration at the end of the sorption process (mg/L)15. Fig 1 shows the B.E.T isotherms obtained for phenol adsorption on ASAC that illustrate the synthesis of microporous structures with a good surface area and micropore volume.

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The isotherm is a type I for solids with large numbers of micropores as well as mesopores. The adsorption of phenol was found to be 90.90 (mg/g).

CONCLUSIONS

A scanning electron microscopic study shows that the external surface of activated carbon is full of cavities. From SEM micrographs it has been cleared that highly developed mesopores and micropores are available for adsorption which shows highly porous and amorphous nature facilitating phenol adsorption. Phosphoric acid used for impregnation enhanced the surface property. It was clearly established from SEM micrographs that highly developed mesopores and micropores are available for adsorption. Morphological Studies indicates that the ASAC can be effectively used for the quantitative removal of phenols. The adsorption capacity reveals that removal of phenol from aqueous solution is possible by using abundantly available low cost almond shell adsorbents.

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PIUH - 07

Global Environmental Issues

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ABSTRACT

Global Environmental Issues may be a phrase that refers to the effect on the climate of human actions, specifically the ablaze of fossil fuels (coal, oil and gas) and large-scale deforestation, which cause emissions to the atmosphere of huge amounts of 'greenhouse gases', of which the foremost important is CO2. Such gases take up infrared emission emitted by the Earth's surface and act as blankets over the surface keeping it warmer than it might somewhat be. Connected with this warming are changes of climate. The essential science of the 'greenhouse effect' that results in the warming is well implicit. More detailed understanding relies on numerical models of the climate that integrate the essential dynamical and physical equations describing the entire climate system. Many of the likely characteristics of the resulting changes in climate (such as more frequent heat waves, increases in rainfall, increase in frequency and intensity of the many extreme climate events) will be identified. Substantial uncertainties remain in knowledge of a number of the feedbacks within the climate system (that affect the magnitude of change) and in much of the detail of likely regional change. Adaptation to the inevitable impacts and mitigation to scale back their magnitude are both necessary. International action is being taken by the world's scientific and political communities. Due to the necessity for urgent action, the best challenge is to manoeuvre rapidly to much increased energy efficiency and to non-fossil-fuel energy sources. This paper will presents the global environmental major issues.

Keywords: Environmental issues, Greenhouse effect, Crisis, Fossil-fuel, Manoeuvre.

INTRODUCTION

An Introduction to Global Environmental Issues presents a comprehensive and stimulating introduction to the key environmental issues presently threatening our global environment. Offering an authoritative introduction to the key topics, a source of latest environmental information, and an innovative stimulus for debate, this is often an editorial for all those studying or concerned with global environmental issues[4][8]. Major global environmental issues are brought into focus. Human impact and management of the natural environment, and concerns for maintaining biodiversity are emphasized throughout. The rapid growing population and economic development is resulting in variety of environmental issues in India thanks to the uncontrolled growth of urbanization and industrialization[1][3], expansion and big intensification of agriculture and therefore the destruction of forests. Major environmental issues are forest and agricultural degradation of land, resource depletion (water, mineral, forest, sand, rocks etc.), environmental degradation, public health, loss of biodiversity, loss of resilience in ecosystems, livelihood security for the poor.

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It's estimated that the country's population will increase to about 1.26 billion by the year 2016. The projected population indicates that India are going to be the primary most populous country within the world and China are going to be ranking second within the year 2050. India having 18% of the world's population on 2.4% of world's total area has greatly increased the pressure on its natural resources. Water shortages, soil exhaustion and erosion[8][9], deforestation, air and pollution afflicts many areas. The condition of the environment could be a worldwide issue. Air and pollution don't recognize borders; poor soil conditions in one nation may reduce another country's food supply. At the identical time, different regions do face different problems. One key distinction is between the environmental threats faced by developed nations like the U. S. and Western European countries, and developing nations, like India and Mexico[9][6]. Most agree that these nations may have dissimilar crises, but debate remains over whether the solutions to their problems are unique likewise.

The environmental problems faced by developed nations are largely the results of their economic strength and better standards of living. Overconsumption is cited by many observers as a reason for resource depletion within the First World. Environmentalists contend that this high level of consumption will ultimately cause the depletion of the planet's resources[7] leading to adverse consequences for human populations. Developed nations have reduced their rate of increase, so overpopulation isn't as great an issue because it was previously considered to be; however, thanks to the high level of consumption, each new person in an exceedingly developed nation will use thrice the maximum amount water and ten times the maximum amount energy as a toddler born during a developing country[5]. The industries needed to form products for consumption also affect the environment through the emission of greenhouse gases and other wastes. In contrast, the environmental crises faced by developing nations are the results of poverty.

METHODOLOGY

The risks inherent in gathering and interpreting observed evidence made it essential to design a methodology that allowed access to a diverse range of sources, so that data could be verified before being accepted as evidence. The methodology made different types of data. Relevant data collected from printed materials, internet, books, journals, articles and thesis etc.

OBJECTIVES

• To discuss the global environmental major issues
• To formulate the Problems faced by global warming and climatic changes

Global environmental major issues

One of the first causes of environmental degradation during a country can be attributed to rapid climb of population, which adversely affects the natural resources and environment. The uprising population and also the environmental deterioration face the challenge of sustainable development. The existence or the absence of favourable natural resources can facilitate or retard the method of socio-economic

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development. The three basic demographic factors of births (natality), deaths (mortality), human migration (migration) and immigration (population going in a rustic produces higher population) produce changes in population size, composition, distribution and these changes raise variety of important questions of cause and effect. Growth and economic development are contributing to several serious environmental calamities in India. These include heavy pressure toward land, land degradation, forests, habitat destruction and loss of biodiversity. Changing consumption pattern has led to rising demand for energy. The ultimate outcomes of this are pollution, heating, global climate change, water scarcity and pollution. Environmental issues in India include various natural hazards, particularly cyclones and annual monsoon floods, increment, increasing individual consumption, industrialization, infrastructural development, poor agricultural practice and resource mal-distribution have led to substantial human transformation of India's natural environment. An estimated 60% of tillage suffers from erosion, water logging and salinity. It's also estimated that between 4.7 and 12 billion plenty of topsoil are lost annually from wearing away. From 1947 to 2002, average annual per capita water availability declined by almost 70% to 1,822 cubic meters and overexploitation of groundwater is problematic within the states of Haryana, Punjab and province. Forest area covers 18.34% of India's geographic region (637000 km^2). Nearly 1/2 the country's forest cover is found within the state of Madhya Pradesh (20.7%) and also the seven states of the northeast (25.7%); the latter is experiencing net forest loss. Forest cover is declining due to harvesting for fuel wood and also the expansion of agricultural land. These trends, combined with increasing industrial and car pollution output, have led to atmospheric temperature increases, shifting precipitation patterns and declining intervals of drought recurrence in many areas.

The Indian Agricultural Research Institute of Parvati has estimated that a 3°C rise in temperature will end in a 15 to twenty loss in annual wheat yields. These are substantial problems for a nation with such an outsized population betting on the productivity of primary resources and whose economic process relies heavily on industrial growth. Civil conflicts involving natural resources-most notably forests and arable land-have occurred in eastern and north-eastern states. Global environmental problems at the dawn of the third millennium, a strong and complicated web of interactions is contributing to unprecedented global trends in environmental degradation. These forces include rapid globalization, urbanization, pervasive poverty, unsustainable consumption patterns and growth. Often serving to compound the consequences and intensity of the environmental problems described within the previous section, global environmental challenges require concerted responses on the part of the international community. Global global climate change, the depletion of the ozonosphere, desertification, deforestation, the loss of the planet's biological diversity and therefore the transboundary movements of hazardous wastes and chemicals are all environmental problems that touch every nation and adversely affect the lives and health of their populations. Like other environment-related challenges, children are disproportionately susceptible to and suffer most from the results of those global trends. Moreover, all of those global environmental trends have long-term effects on people and societies and are either difficult or impossible to reverse over the amount of 1 generation. Unless, effective global actions are taken early, we are going to find yourself plundering our children's heritage and future in an unprecedented

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way. This chapter describes five major global environmental problems and points to the potential impact on children and future generations.

The scientific community has clearly documented and quantified global environmental change with increasing precision and improved models to grasp the longer term consequences of our actions, although large uncertainties remain. The community has also developed tools to quantify our footprints and therefore the effects of our lifestyles beyond our immediate surroundings and that we have far greater potential to know our interconnectedness across scales, in both biophysical and socioeconomic terms, which as suggests may cultivate increased empathy. But it's perhaps at the interface between individual and collective perceptions and action that research has progressed the smallest amount but where there's the best potential to deal with the challenges we understand so well. Interdisciplinary research on global environmental change must engage further with psychological, behavioural sciences, ethics to know motivation, behavioural change in its socio-economic and political context, also the varieties of institutions, governance which will foster new technologies and concepts of progress.

Environmental issues at global level

• Depletion of natural resources • Water pollution • Air pollution • Ground water pollution • Toxic chemicals & soil pollution • Ozone layer depletion • Global warming • Loss of bio-diversity • Extinction of wildlife and loss of natural habitat • Nuclear wastes and radiation issues.

CONCLUSION

Global climate change is causing these areas to experience an increasingly sparse and erratic rainfall pattern and a lengthened dry season, affecting the livelihoods of thousands of villagers, some areas are also facing water shortages. People are becoming aware of sick of global warming, so they cultivate more and more trees, planting mangrove forest by the sites of the coastal areas and reduce the usage of plastic. They have sowed more than 12 million seeds & half a million of plants. Planting trees balances carbon emissions and pollution. There are organizations that will help you offset your carbon footprint. The deforestation comes in a close second in causes for global warming. There is still much that is unknown about the potential health effects of global climate change. The various phenomena that can be said to contribute to the rubric include stratospheric ozone depletion, global warming, acid aerosol formation, desertification and deforestation. At the current time, these phenomena are being investigated separately, yet the case can and should be made that these things are happening concurrently and there are many instances where interactions are possible as well as likely. Thus, a more global view is required, particularly with regard to the science, but also with regard to policy. These phenomena are not occurring independently and to analyze them and try to develop responses to them as though they were seems an exercise designed to fall short of the optimum solution. Although it is sometimes helpful to divide a problem into components in order to analyze what contributions are made by the various pieces, at some point the analyst has to reassemble the parts and look for the sum of the effects. This has not yet been done in the public health arena regarding global climate change and there is very little evidence that it is being done in other important areas such as agriculture and natural resources. At last, global

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warming can be dealt with only through international agreement. The context is one of game theory, and the stressing need is to design incentive systems for global cooperation. The Montreal protocol on ozone may be an ineffective guide to the prospects for a greenhouse agreement. The most urgent need is to develop appropriate policy instruments and compensatory mechanisms for the best results. The growing recognition that greenhouse gas reductions are not the only option we have to slow and ultimately reverse global warming. Restoring and expanding global forests can also cool the planet.

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PIUH – 08

Assessment of Ground Water Quality/Pollution in Kolar District, Karnataka, India

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ABSTRACT

Kolar district falls under eastern dry agro climatic zone of Karnataka. The supply of water in the district is decreasing rapidly and its quality is deteriorating due to its over exploitation. A vast majority of ground water quality problems are caused by contamination and by overexploitation, or by combination of both. Presently over 94% of drinking water is met by ground water hence quality is important. The physico-chemical parameters of water are main criteria in determining its quality. This paper deals with the study of physico-chemical parameters of groundwater drawn from bore wells of various villages of Kolar district. 25 different sampling sources were selected for procurement of water and analyzed for different physico-chemical parameters including pH, chloride, nitrate, fluoride and total hardness. Variations in the physico-chemical parameters in the water samples were observed. Analyzed parameters of selected water samples were compared with norms of IS 10500:2012. It was found that some of the water quality parameters were above permissible limit and some were not. This study helps different regions in understanding the potential threats to their ground water resources.

Key words: Ground water, Phsico- chemical parameters, Kolar district, Overexploitation and Variations

INTRODUCTION

Water is an essential natural resource for sustaining the life and environment[22]. In the last few decades, there has been tremendous increase in utilization of ground water for drinking, irrigation, industry and much commercial purpose. Ground water is an invisible and endangered open or common access resource[4]. Presently over 94% of drinking water is met by ground water. Use of groundwater has gradually increased due to the increase of freshwater demand and the exhaust of surface water[18]. It is believed that bore well water (groundwater) is much purer than surface water and less susceptible to contamination but due to highly intervention of anthropocentric activities (agricultural explanation, deforestation, urbanization, industrialization, over utilization of agrochemicals etc) ground water quality highly varied with heavy metal contamination. The influence of solid waste dumping site, aquifer material mineralogy together with semiarid climate, other anthropogenic activities and increased human interventions have adversely affected the groundwater quality[17]. Water is a precious commodity but in the last few decades there has been tremendous increase in the demand for freshwater due to rapid growth of population and the accelerated place of industrialization[1]. Presence of heavy metals in grains, vegetables, fruits and milk has shown that nothing has remained pure in this universe and this level of water pollution have reached to the alarming stage[3]. The purpose of the study is to ascertain the quality

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of groundwater collected from different sources and in different seasons (pre and post monsoon seasons) during 2014 and 2015.

MATERIALS AND METHODS

Study area

Kolar district, spread over 4,012 sq Km, has population of about 16.50 lakhs.5 Taluks of Kolar District are Kolar, Bangarpet, Malur, Mulbagal and Srinivaspur. It is stretched between north latitude $12^{o}45^{l}\ 54^{ll}$ to east latitude $77^{0}50^{l}29^{ll}$.

The District Kolar has 1798 villages under 156 gram Panchayats. The main occupation of the people is agriculture which is supported by only bore well water. Meteorologically the district is a dry agro climate and experiences a semiarid climate, characterized by tropical monsoon, tropical weather with hot summer and mild winter. There are no major surface water sources in the study area and main source of drinking water is by bore wells (ground water).

Table1 Parameters and Methods used in the analysis of ground water quality

Sl No	Parameters	IS 10500:2012	ICMR:1975	BIS:1999	WHO:2006
1	pH	6.5-8.5	7.0-8.5	6.5-8.5	6.5-8.5
2	Chloride	250-1000	200	250	200
3	Nitrate	45	50	100	45
4	Fluoride	1.0-1.5	1.5	1.5	1.5
5	Total hardness(TH)	200-600	600	600	500

Water samplings

Ground water samples were collected from 25 different bore wells located at villages in Kolar district during pre and post monsoon season of 2014 and 2015. Samples were collected in pre-cleaned and rinsed bottles of 2 liter capacity with necessary pre caution and transferred to the laboratory for analysis of physico-chemical parameters.

Analysis of samples

All the samples were analyzed for different physico-chemical parameters such as pH, chloride, nitrate, fluoride and total hardness. The analysis of water samples were carried out in accordance of standard analytical methods. The chemical solutions used for analysis of water samples were prepared with double distilled water and the chemicals were of SD-fine. The details of the analyzed methods are summarized in Table 1.

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Table 2 Standards for drinking water quality

Sl. No.	Parameters	Unit	Methods used
1	pH	-	Digital pH meter
2	Chloride	mg/liter	Titrimetric method by using $AgNO_3$
3	Nitrate	mg/liter	Spectrophotometric method
4	Fluoride	mg/liter	Electrode screening method by using fluoride electrode
5	Total hardness (TH)	mg/liter	Titrimetric mehod by using EDTA

ISI (Indian standard institute), ICMR (Indian council of medical research), BIS {Bureau of Indian standards), WHO (World health organization)

RESULTS AND DISCUSSION

The physico-chemical parameters analyzed (Results) are presented in Table 1 and compared with national and world standard units. For convenient purpose, the average values of each parameter were taken in to consideration for discussion purpose. The pH is a measure of acidic or basic (alkaline) nature of a solution. The acceptance pH limit is 6.5 to 8.5(Table 1). In the present study pH ranged from 6.675 (minimum) to 8.025(maximum). The PH levels is greatly affected areas are often less than 4.0 and the associated environmental impacts includes fish kills, retarded growth of crops and changes in water chemistry[8]. pH has no direct adverse effect on health. However, a lower value below 4.0 will produce some taste and higher value above 8.5 hastens the scale formation in water heating apparatus and also reduces the germicidal potential of chloride. Higher pH induces the foundation of trinalo methana, which are toxic. Negative effect of acidification of groundwater is the corrosion of water pipes, which leads to leakage and high content of heavy metals in drinking water[7]. pH below 6.5 starts corrosion in pipes, thereby releasing toxic metals in to surrounding. Domestic bores affected by low pH is due to water to allow peat excavation for urban development and low annual rainfall[5].

Chloride is an-ion that is most commonly associated with salt such as sodium chloride (common table salt as an article of diet). Often it also associated with potassium calcium and magnesium in nature. all natural water contains chlorides in varying degree. In general chlorides shows seasonable concentration and are not harmful to mankind. A water with chloride above 250mg/L causes salty taste to water and unfit for drinking. Saline water pollution of ground water is mainly results from static fossil water and dynamics of sea water intrusion[12].The increase of chloride concentration in groundwater is indication of mixing of sewage water with groundwater[16]. In the present study chloride ranged from 81 to 283.25 mg/liter (Table 3) which was in the range below permissible limit.

Nitrate is a common nitrogenous compound, due to natural process like nitrogen cycle and highly intervention of anthropocentric activities the concentration of nitrate in ground water greatly increased. The largest anthropocentric activity is intense farming which includes excess applications of nitrogen fertilizers, manure application and growing of leguminous plants without employing of crop rotation pattren. Another potential source of nitrate to groundwater is leaching process from storage area of

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manure in farmland. Use of fertiliers, discharging of waste water from treatment plants and leakage of wastewater from cesspools, increased levels in nitrate concentration in ground water[6]. When nitrate-nitrogen level is exceeds the permissible limit it can cause threat to human beings especially infants, pregnant and nursing women's and elderly people. Nitrate pollution is one of groundwater's mostly identified contaminants, an indicator of serious pollution as they are associated with septic waste and agricultural endeavors, leads to numerous health problems to human beings and animals[2]. The occurrence of high nitrate level in groundwater has to be recognized as a threat to humans and animals. Infant methaemoglobinaemia and nitrate poisoning of livestock occur at unexpected times and places[19]. Over exploitation of ground water and continuous depletion of groundwater table due to insufficient rains and no recharge of groundwater the concentration of Nitrate is on the rise[9]. In the present study nitrate ranged from 12.3775 to 364.25 mg/liter (Table 3). Desirable limit for nitrate is 45 and no relaxation in permissible limit. The value observed in the present study is in the range below permissible level. It may be due to minimum usage of fertilizers and pesticides because of rain fall is lesser than minimum and lesser agricultural activities.

Fluoride is the most negatively charged, light and highly active substance react with all elements of earth i.e. fluoride is anything but benign and it does not occur in the elemental state. Fluoride enrichment occurs in groundwater through the dissolution of fluoride-rich minerals[20]. Generally the concentration of fluoride in ground water is controlled by local geological setting: leaching and weathering of bed rock and climatic condition of an area[15]. Optimum (0.5 to 1.5 mg/L)level of fluoride concentration is very essential for animals and humans, long term exposure to 1.5 mg/L and above causes severe health effect on human beings such as dental and skeletal fluorosis, osteoporosis, hip fracture, arthritis, mental retardation, perturbations in hormone concentrations due to effect on endocrine system, effects on thyroid and pineal, impaired glucose metabolism, effects on immune cells of bone marrow, effects on fertility, reproductive hormones and developmental outcomes of reproductive system, effects gastrointestinal system, effects on the kidney functioning, causes cancer etc. Fluoride has profound effect on teeth and bones when its concentration exceeds the permissible limit. Concentration in the range of 1.0 to 1.5 mg/L strengthens the enamel and in the range of 1.5 to 4.0 mg/L results dental fluorosis where as with prolonged exposure to higher concentration (4 to 10 mg/L) results fluorosis in children's as well as adults[19]. Irrigated with fluoride contaminated water transfers the fluoride to different tropic levels of food chain leads to biomagnifications it is causing larger risk to the already fluoride contaminated affected population. Moreover, this new avenue of fluoride highly endangers the most susceptible infants and childrens towards dental fluorosis[10]. Most of the fluoride found in ground water is geogenic in origin. Fluoride concentration in the range of 0.8 to 1.20 mg/L is considered to be beneficial, concentration above 1.5 mg/L are reported to be harmful to the teeth and bone structure of human and animals. As excess of fluoride (>1.5 mg/L) in drinking water is harmful to the human health[14]. In the present study fluoride ranged from 0.5mg/L to 1.9375mg/L (Table 3). As per IS 10500:2012 the desirable limit of fluoride is 1 to 1.5mg/L. The value observed in the present study some of the samples are is in the range below and above permissible limit of drinking water standard.

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Hardness is defined as variable and complex mixture of cations and anions or multivalent cations in solution. Hardness of water was understood to be a measure of the capacity of the water for precipitating soap. Soap is precipitated chiefly by the calcium and magnesium ions commonly present in water but also may be precipitated by ions of other polyvalent metals such as aluminum, iron, manganese and zinc because only the calcium and magnesium are usually present in significant concentration in natural waters. Hard water is not suitable for bathing and washing. Hard water has high boiling point and so are not suitable for cooking. Hardness in water is naturally occurring in groundwater which weathering of limestone, sedentary rock and calcium bearing minerals[11]. Presence of hardness ions in the municipal drinking water is the major health concern, this directly affects the rural and low community society. In the present study total hardness ranged from 232.25mg/L to 1304.25mg/L (Table 3). As per IS 10500:2012 desirable limit of hardness is 200 to 600 mg/L in permissible limit. The value observed in the present study some samples are in the ranged above permissible limit of drinking water standards. Drinking water containing very high values of hardness (magnesium) can cause vomiting, diarrhea, thirst, tiredness, shirred speech, confusion, muscular weakness and breathlessness[13].

Table 3 Average results of physico-chemical parameters of groundwater in Pre and Post monsoon seasons during 2014 and 2015

Source No	pH	Chloride	Nitrate	Fluoride	Total Hardness
I	6.965	250.75	31.125	1.0575	621.25
II	6.95	128	41.6725	1.475	515.25
III	7.4	81	19.48	1.44	432.5
IV	8.025	283.25	41.8	1.3975	519
V	7.63	292	28.0975	1.175	319
VI	7.525	229	12.3775	1.325	570.5
VII	7.325	143	97	0.5125	664
VIII	7.525	148	61.8	0.5	1304.25
IX	7.325	176.25	28.96	1.1275	387.75
X	7.65	185.25	24.1375	0.78	616.5

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XI	7.68	325.5	35.8	1.2425	777
XII	7.9075	71.75	12.475	1.3575	467
XIII	7.45	147.75	38.75	1.09	418.5
XIV	7.525	215.75	24.4175	1.33	485
XV	7.47	277.25	31	1.23	345.5
XVI	7.43	148.75	45.0575	1.5025	474.75
XVII	7.425	245	43.0625	1.225	282.75
XVIII	7.375	156.25	36.6375	1.1325	441.75
XIX	7.485	57.75	49.25	1.44	232.25
XX	7.275	199.75	41.525	1.395	338.75
XXI	7.2	341.75	24.8775	1.5475	386.75
XXII	5.445	400	35.925	1.4625	604.25
XXIII	7.625	323.25	21.0675	1.9375	272.75
XXIV	7.6	364.5	37.125	1.4225	535
XXV	7.55	161.75	21.0625	1.5575	580.5

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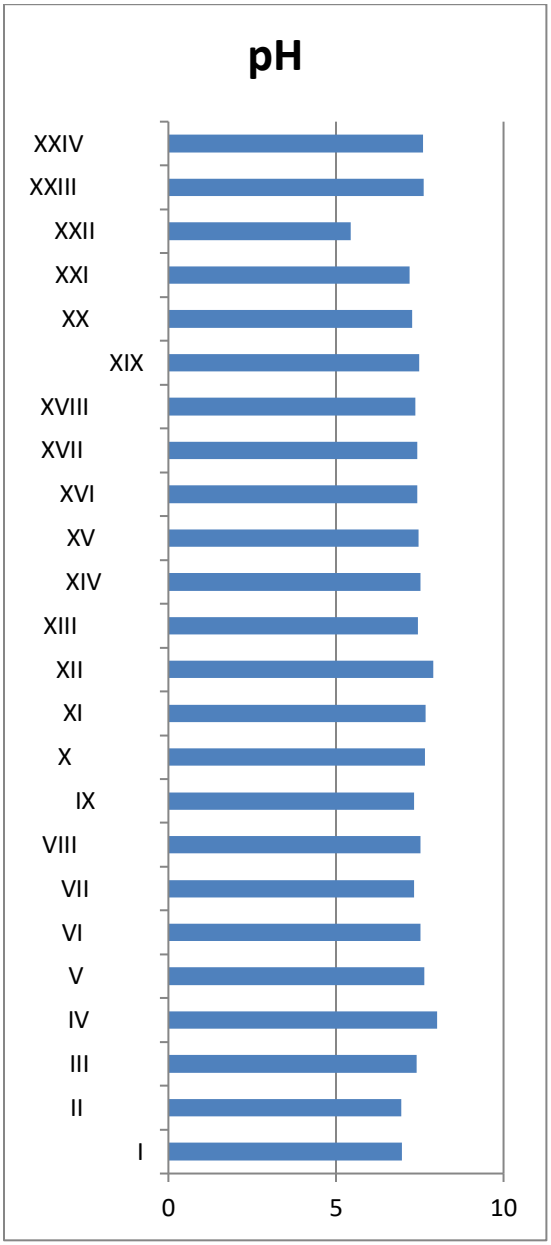

Figure 1 Average results of pH of ground water in pre and post monsoon seasons during 2014 and 2015

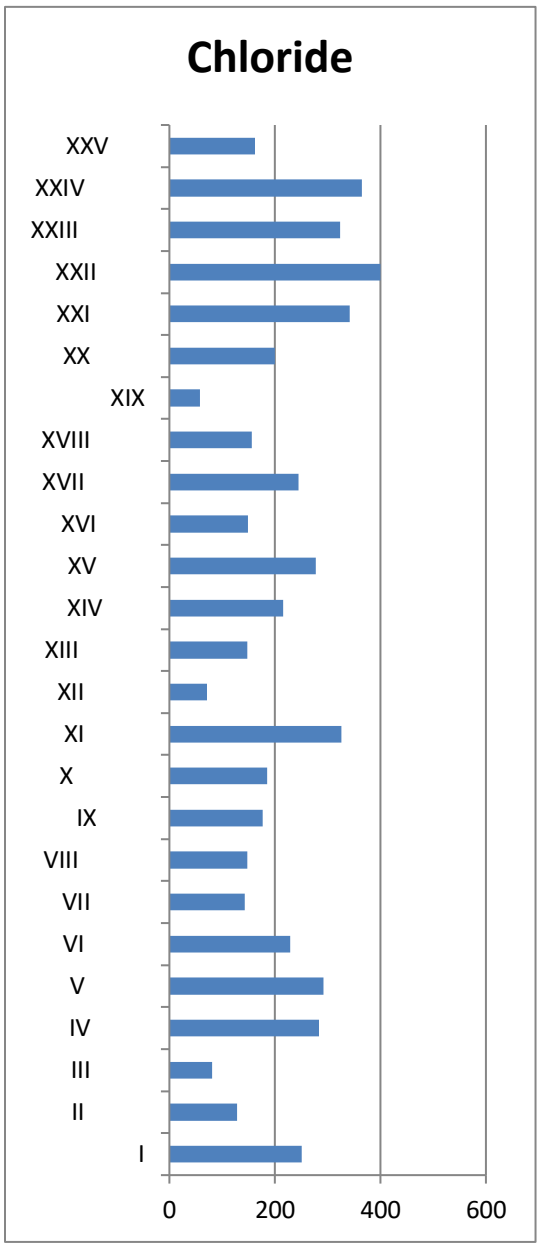

Figure 2 Average results of Chloride of ground water in pre and post monsoon seasons during 2014 and 2015

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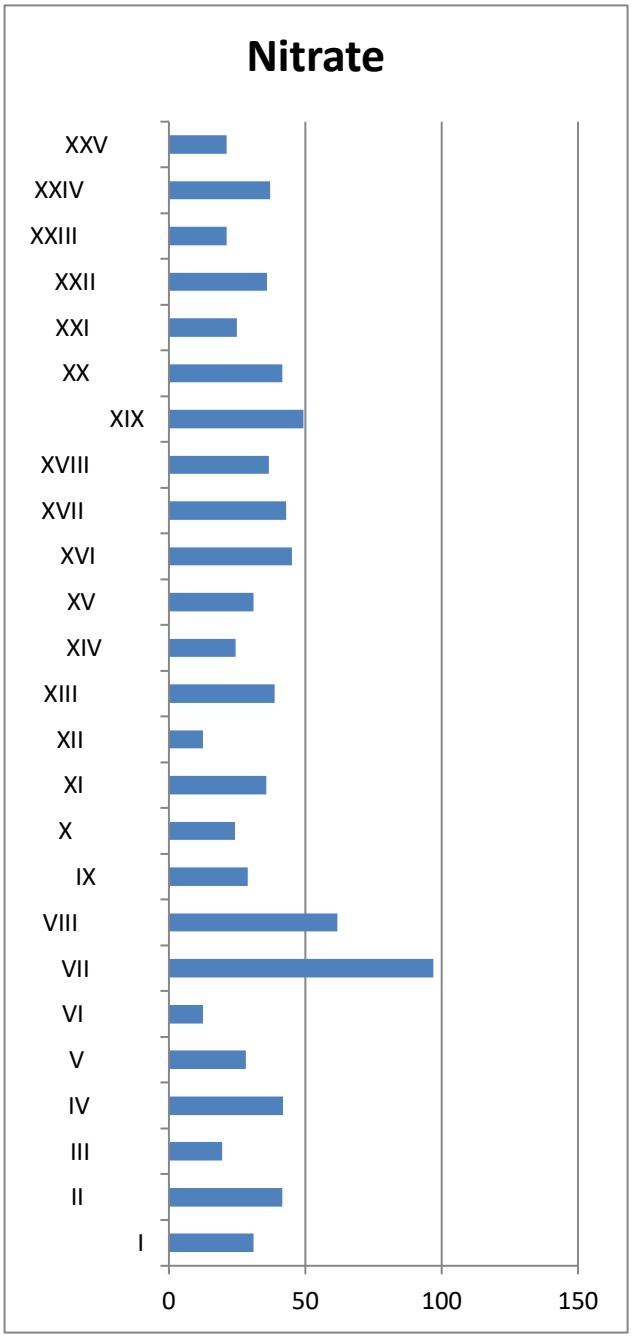

Figure 3 Average results of Nitrate of ground water in pre and post monsoon seasons during 2014 and 2015

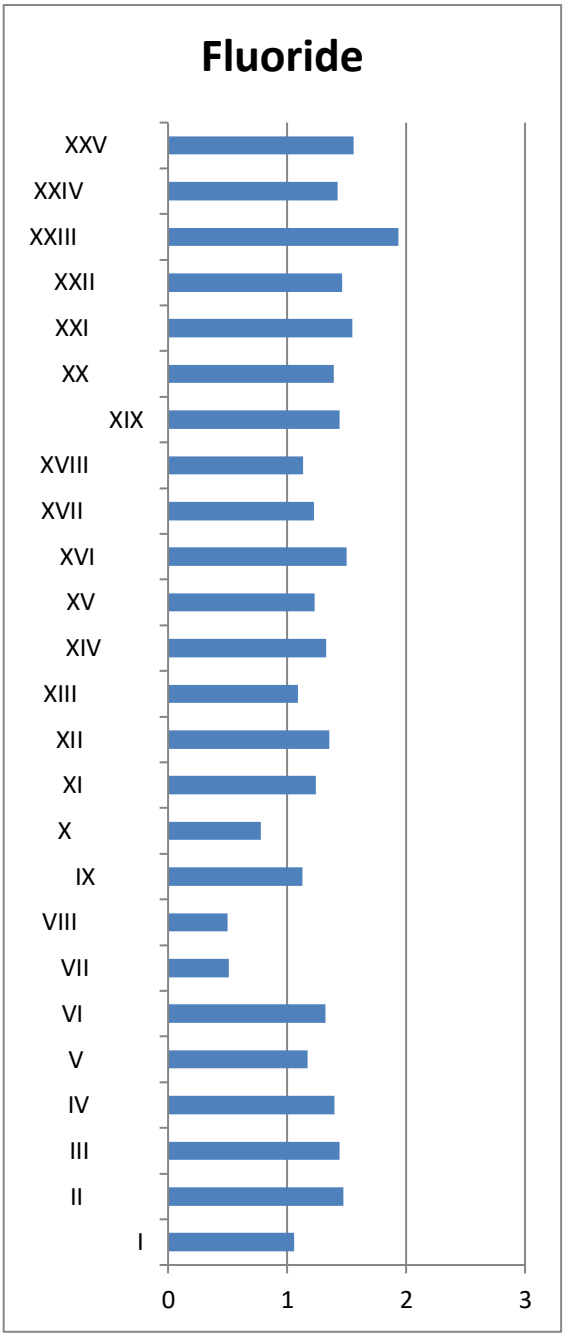

Figure 4 Average results of Fluoride of ground water in pre and post monsoon seasons during 2014 and 2015

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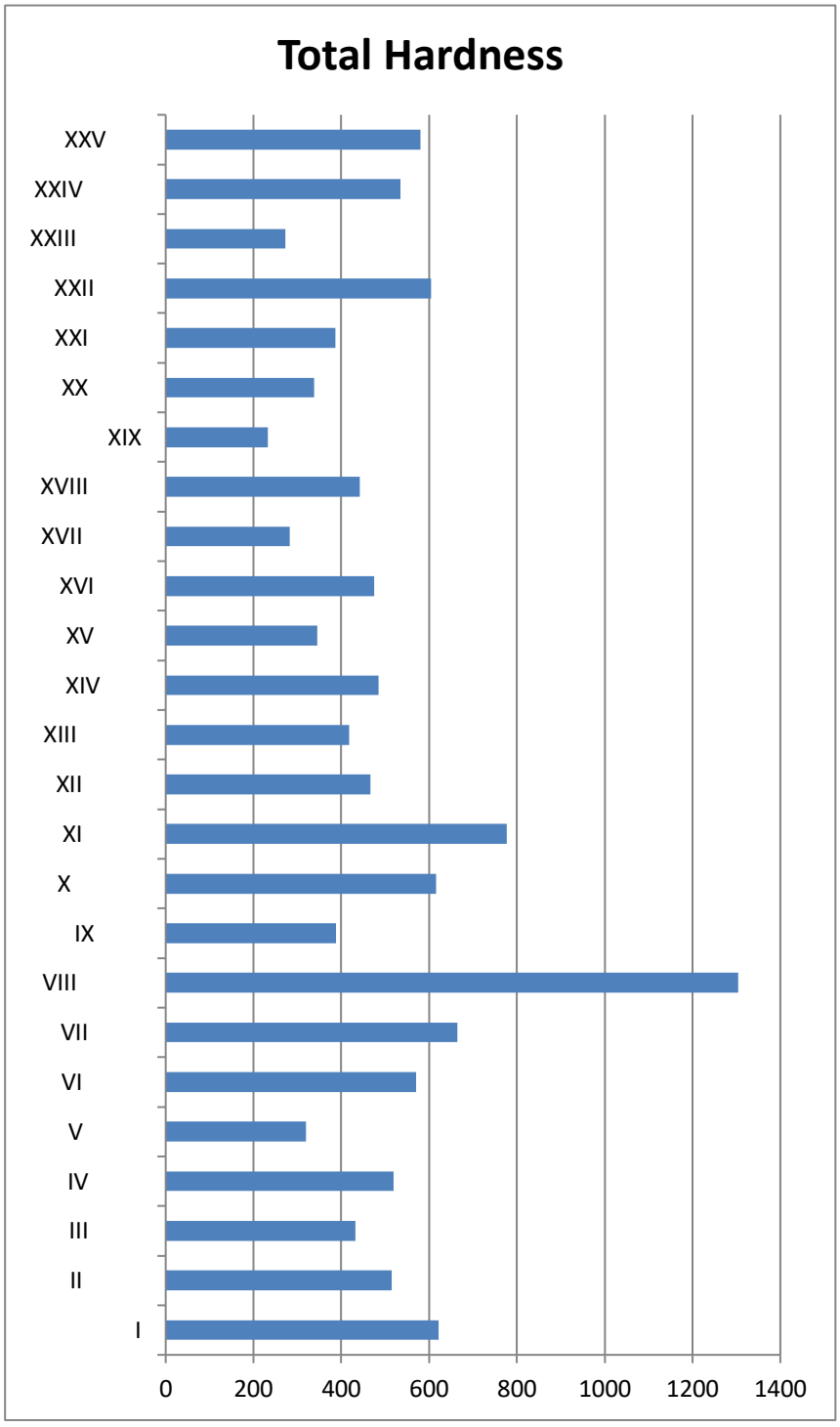

Figure 5 Average results of Total hardness of ground water in pre and post monsoon seasons during 2014 and 2015

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CONCLUSION

In the present study, the values of different physico-chemical parameters observed for some parameters were below and above the permissible limits. The acceptance pH limit is 6.5 to 8.5, in present study pH ranged from 6.675 to 8.025. Fluoride and total hardness were beyond the permissible limit. Similarly chloride and nitrate were below the permissible limit. The results of study reveals that, quality of groundwater is not fit for drinking purposes due to contamination, especially the fluoride and total hardness. Hence, it is suggested that the water should be properly treated before consumption.

Note: In figures 'X' axis Showing Sources and 'Y' axis showing concentration of parameter in mg/liter.

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PIUH- 09

Lead Poisoning - A Hazard to Environment

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ABSTRACT

Lead has wonderful properties and used in wide range of application in and around our homes, including paint, ceramics, pipes and plumbing materials, solders, gasoline, batteries, ammunition and cosmetics. Lead is found in small quantities in our environment like air, drinking water, soil and food. Lead affects all the systems in the body. Lead enters the human body get absorbed and is distributed to the brain, liver, kidney and bones. It is stored in the teeth and bones, where it accumulates over time. It also crosses the blood brain barrier in infants and damages central nervous systems (CNS).This article reviews the works listed in the literature with recent updates regarding the toxicity of lead. Focus is also on toxic effects of lead on the renal, reproductive and nervous system. Finally the techniques available for treating lead toxicity are presented with some recent updates.

Keywords: Lead, Toxicity, Environment, Human body, CNS.

INTRODUCTION

Lead is a naturally occurring toxic metal found in the Earth's crust. Due to its important physico-chemical properties, its use can be retraced to historical times. It's important properties like softness, malleability, ductility, poor conductibility and resistance to corrosion seem to make difficult to give up its use. Its widespread use has resulted in extensive environmental contamination, human exposure and significant public health problems in many parts of the world. Lead is a cumulative toxicant that affects multiple body systems and is particularly harmful to young children. Globally it is an abundantly distributed, important yet dangerous environmental chemical[3]. Due to its non-biodegradable nature and continuous use, its concentration accumulates in the environment with increasing hazards. Important sources of environmental contamination include mining, smelting, manufacturing and recycling activities. Lead in natural water comes from leaching of soil and manmade pollution. Lead in drinking water comes from PVC pipes from which it supplies. Lead in air comes from vehicle exhaust, industrial fumes and smelting and grinding. Lead is present as a suspended particulate matter in the atmosphere. Lead exposure is unpreventable because it finds applications as a major constituent of the lead-acid battery used extensively as a car battery, used as a colouring element in ceramic glazes, notably in colours red and yellow, frequently used in PVC, which coats electrical cords. It is used as shielding from radiation, used as electrodes in the process of electrolysis. Molten lead is used as coolant. Human exposure to lead and its compounds occurs mostly in lead related occupations like Battery

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breakers, recyclers and manufacturers, brass or copper foundry workers, automotive body or radiator repairers, building, construction and demolition workers like painters, plumbers and pipe fitters.

Lead is a highly poisonous metal affects all the systems in the body. Lead enters the human body get absorbed and is distributed to the brain, liver, kidney and bones. It is stored in the teeth and bones, where it accumulates over time. It also crosses the blood brain barrier in infants and damages central nervous systems. Infants and young children are especially sensitive to even low levels of lead, which may contribute to behavioural problems, learning deficits and lowered IQ[4]. Long-time exposure to lead has been reported to cause anaemia, along with an increase in blood pressure, and that mainly in old and middle aged people. Severe damage to the brain and kidneys, both in adults and children, were found to be linked to exposure to heavy lead levels resulting in death. In pregnant women, high exposure to lead may cause miscarriage. Chronic lead exposure was found to reduce fertility in males[5]. Blood disorders and damage to the nervous system have a high occurrence in lead toxicity.

RESULT AND DISCUSSION

Causes of Lead poisoning

Lead poisoning, also called plumbismis a medical condition caused by increased levels of the heavy metal lead in the body. Lead poisoning is a deleterious effect of a gradual accumulation of lead in body tissues, as a result of repeated exposure to lead-containing substances.

Lead interferes with a variety body processes and is toxic to many organs and tissues including the heart, bones, intestines, kidneys and reproductive and nervous systems. It interferes with development of nervous systems and is therefore particularly toxic to children, causing potentially permanent learning and behaviour dis-orders. Symptoms include abdominal pain, confusion, headache, anaemia, irritability and in severe cases seizures, coma and death. Lead exposure accounted for 1.06 million deaths and 24.4 million years of healthy life lost disability-adjusted life years (DALYs)[1] worldwide due to long-term effects on health. The highest burden was in low and middle income countries. IHME also estimated that in 2016, lead exposure accounted for 63.2% of the global burden of idiopathic developmental intellectual disability, 10.3% of the global burden of hypertensive heart disease, 5.6% of the global burden of the is chaemic heart disease and 6.2% of the global burden of stroke(IHME).

Sources and routes of exposure

Major source of lead poisoning includes soil, water, air and paint. Residual lead in soil contributes in urban areas. Lead content in soil may be caused by broken- down lead paint, residues from lead containing gasoline or pesticides used in the past, contaminated landfills, by industries such as foundries and smelters.

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Lead from the atmosphere or soil can end up in ground water and surface water. It is also potentially in drinking water from plumbing and fixtures that are either made of lead or have lead solder.

Major sources of lead in the air are ore and metals processing and piston-engine aircraft operating on leaded aviation fuel. Other sources are waste incinerators, utilities, and lead-acid battery manufacturers. The highest air concentrations of lead are usually found near lead smelters.

Some lead compounds are colourful and are used widely in paints. These lead paints are the major route of lead exposure in children. Deteriorating lead paint can produce dangerous lead levels in house hold dust and soil. Deteriorating lead paint and lead containing house hold dust are the main causes of chronic lead poisoning.

Routes of exposure to lead include contaminated air, water, soil, food and consumer products. Occupational exposure is a common cause of lead poisoning in adults. One of the largest threats to children is lead paint that exists in many homes.

Symptoms of lead poisoning

Symptoms of lead poisoning vary from person to person and different for adults and children, may develop gradually or appear suddenly after chronic exposure. In adults are in early stages with low concentration leads to the appetite fails, headache, memory loss, kidney failure, male reproductive problems, later with high concentration leads to dizziness, confusion, visual disturbances, severe abdominal pain, with spasms of the abdominal muscles (lead colic).

Peripheral nerve involvement results in a paralysis (lead palsy) that generally first affects the fingers, hands and wrists (wrist drop). The toxicity in children is greater impact than in adults. This is because their tissues, internal as well as external, are softer than in adults. Symptoms may appear in children at lower blood levels than in adults. The classical signs and symptoms in children are loss of appetite, abdominal pain, vomiting, weight loss, anaemia, irritability, learning disabilities, slowed growth, blindness and deafness. Exposure of pregnant women to high levels of lead can cause miscarriage, stillbirth, premature birth and low birth weight.

Detection of lead poisoning

The main tool to detect elevated levels of lead in the body is to measure the level of lead in blood samples. Evaluation of lead in blood and urine can be carried out with the aid of lead analyser, based on the principle of Anodic Stripping Voltammeter (ASV).This instrument is widely used due its high sensitivity at low concentration, good precision and accuracy, simple operation, requirement of small blood volume. The blood samples are preserved with meta exchange reagent and then calibrated in the instrument for estimation of lead. The standard elevated blood lead level for adults to be 10 μg/dL and for children 5 μg/dL of the whole blood[2].

X-ray Fluorescence (XRF), Atomic Absorption Spectrometer (AAS) and Auto Titrator methods can be adopted to estimate the lead in soil, paint and dust at ppm levels. If the

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concentration of lead is more than 300 ppm levels Complexo-metric titration method can be employed.

Susceptibility and Treatment

Individual susceptibility to lead poisoning varies widely and depends not only on the extent of environmental or occupational exposure but also on certain genetic factors.

Lead that has accumulated in tissues may be removed gradually with substances such as the calcium salts of ethylenediaminetetraacetic acid (EDTA) and penicillamine.

Effects of lead on ecosystems

Lead is a naturally occurring toxic metal found in the Earth's crust. Its widespread use has resulted in extensive environmental contamination, human exposure and significant public health problems. Lead is persistent in the environment and can be added to soils and sediments through deposition from sources of lead air pollution. Other sources of lead to ecosystems include direct discharge of waste streams to water bodies and mining. Elevated lead in the environment can result in decreased growth and reproduction in plants and animals and neurological effects in vertebrates.

CONCLUSION

Lead is a nonessential metal which enters the body through various means and is considered as one of the most common health toxins. Lead poisoning is the major of all the heavy metal poisonings. Lead is a cumulative toxicant that affects multiple body systems and is particularly harmful to young children. Lead toxicity is evident from the literature and there is almost no function in the body which is not affected by lead. Lead toxicity disrupts the functions of the digestive system, nervous system, respiratory system, reproductive system, *etc*. In addition, lead prevents enzymes from performing their normal activities. Lead even disrupts the normal DNA transcription process and causes disability in bones. Human exposure is usually assessed through the measurement of lead in blood. Lead exposure is preventable. The levels of lead can be reduced from the body by a number of techniques used nowadays. The prominent ones among them are chelation therapy, nano-encapsulation, N-acetylcysteine (NAC). A number of antioxidants also help in the removal of lead from the body.

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PIUH- 10

PotentiaHydrogenii of Pond Water, Bisar Pond, Gaya

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ABSTRACT

Potentiahydrogenii (pH) is one of the chief physiochemical parameters of pond water, which has been observed round the year 2017 in Bisar Pond, Gaya; Bisar Pond is one of the Urban Pond, it has been observed that a pH range of 8.03 to 8.63, which is alkaline range, is indicative of fairly good medium for growth of phytoplanktons. Water quality in ponds is affected by the interactions of several chemical components like carbon-dioxide; pH, alkalinity and hardness are interrelated and can have profound effects on pond productivity, the level of stress and fish health, oxygen availability and the toxicity of ammonia as well as that of certain metals. Most features of water quality are not constant, carbon dioxide and pH concentrations fluctuate or cycle daily, while alkalinity and hardness are relatively stable but can change over time, usually weeks to months, depending on the pH or mineral content of watershed and bottom soils. Alkalinity is the buffering capacity of a water body. Without this buffering capacity, any acid added to a lake would immediately change its pH. The pH remained in limit throughout the period of investigation and no trend towards acidity has been observed.

Key words: Potentiahydrogenii, Phytoplankton, Alkalinity, Toxicity

INTRODUCTION

Potentiahydrogenii (pH) is the measure of intensity of acidity or alkalinity as well as concentration of hydrogen ions. In the present investigation this has been observed in the pond water of Bisar Pond, New Area, Gaya District during the year 2017. It measures the ability of water bodies to neutralize acids and bases thereby maintaining a fairly stable pH, water that is a good buffer contains compounds, such as bicarbonates, carbonates and hydroxides, which combine with H^+ ions from the water thereby raising the pH (more basic) of the water. Without this buffering capacity, any acid added to a pond would immediately change its pH. As the concentration of CaCO3 increases, the alkalinity increases and the risk of acidification decreases. Fish and other vertebrates have an average blood pH of 7.4. Fish blood comes into close contact with water (1 or 2 cell separation) as it passes through the blood vessels of the gills and skin. A desirable range for pond water pH would be close to that of fish blood (i.e., 7.0 to 8.0). Fish may become stressed and die if the pH drops below 5 (e.g., acidic runoff) or rises above 10 (e.g., low alkalinity combined with intense photosynthesis by dense algal blooms –phytoplankton or filamentous algae). Pond pH varies throughout the day due to respiration and photosynthesis. After sunset, dissolved oxygen (DO) concentrations decline as photosynthesis stops and all plants and animals in the pond

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consume oxygen (respiration). In heavily stocked fish ponds, carbon dioxide (CO_2) concentrations can become high as a result of respiration. The free CO_2 released during respiration reacts with water, producing carbonic acid (H_2CO_3) and pH is lowered.

MATERIAL & METHODS

The principal material is Bisar Pond, New Area, Gaya District, pH of the water was calculated by pH Meter (Systronics) following the instruction written in its operation manual. In this context, the alkalinity which is acid neutralizing capacity of water has been estimated by titrimetric method using mixed indicator i.e. Phenolphthelein & methyl orange. Other chemicals are sodium carbonate, 0.1 N (Na_2CO_3) and Hydrogen chloride, 0.1N (HCl).

Calculation has been done as per the method given below, (A.P.H.A., 1985)[3]

$$\text{P.A as } CaCO_3, \text{ mgl}^{-1} = \frac{A \times \text{Normalcy of HCl} \times 1000 \times 50}{\text{ml. of sample}}$$

$$\text{T.A. as } CaCO_3, \text{ mgl}^{-1} = \frac{B \times \text{Normalcy of HCl} \times 1000 \times 50}{\text{ml. of sample}}$$

Where, A = ml of HCl used with phenolphthelein

B = ml of HCl, used with phenolphthelein& methyl orange

PA = Phenolphthelein Alkalinity

TA = Total Alkalinity

OBSERVATION

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg
pH	8.18	8.23	8.63	8.18	8.63	8.03	8.03	8.03	8.08	8.1	8.2	8.2	8.21
Alkalinity (mg)	139	129	133	134	141	140	128	140	133	133	137	139	135

RESULT AND DISCUSSION

pH of pond water was found to be alkaline, overall a minimum pH of 8.03 was observed in July & August, while maximum was 8.63 in March and May with an average of 8.21 = 0.73.

Hydrogen ion concentration (pH) expresses the intensity of an acid / alkali depending upon its dissociation as well as the total amount that is present. This does not fall smoothly as contamination proceeds; this may either drop or rise erratically, depending on various other factors including carbon dioxide concentration and presence of other solutes, both inorganic and organic. The alteration of pH of water is accompanied by change in other physiochemical aspects of the medium. Edmondson[8] pointed out that certain sessile Rotatoria are very likely

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excluded from lake by high bicarbonate concentrations, but not necessarily by high pH. Hussainy[10] and Verma and Shukla[29] believed that pH would prove to be an ecological factor of major importance in controlling the activities and distribution of aquatic flora and fauna. Some workerssuggested that pH of the environment has little or no importance. Similar findings have been reported by Islam[12]. The present investigation is suggestive of that the effect of pH is not very significant with reference to other physio – chemical as well as biological features, rather it is limited and variable.

Alkalinity (mg:L^{-1}) was recorded as 128 during July as lower value and 141 as higher value in May with an annual average of 135 $\pm$1.69.

Alkaline water has high buffering capacity. It has been observed that the utilization of bicarbonates and dissolved carbondioxide from the bicarbonate / carbonate buffer system resulted in rise in pH value. Lakshminarayan[14] has pointed out that bicarbonate utilization in river Ganges was also evident by the increase of pH values. Similar observation were also made by Prowse and Tailing [24]; Osterlind[20] and Kratz and Myers [13], pH fluctuations due to bicarbonates / carbonate utilization has been emphasized by Hutchinson [11] and Singh and Mahajan [27]. It has also been recorded that a maxima of pH was in summer months and minima in winters with slight advancement in monsoon months. Similar trends have been reported by Vijayaranghvan [30]. On site wise analysis a comparatively low pH state was observed, where human activities were low; this is in agreement with Zutshi and Vass [34], Zutshi [35] and Singh [26]. These changes in carbondioxide and hardness also tend to change the pH of the water. The pH rises as the algae increase their photosynthetic activity during day light hours. The pH then decreases at night when the algae are not carrying on photosynthesis but are releasing carbondioxide in respiration [21]. Alkalinity of water, as usually interpreted, refers to the quantity and kinds of compounds present which collectively shift the pH to the alkaline side of neutrality. The property of alkalinity is usually imparted by their presence of bicarbonates, carbonates and hydroxides and less frequently in inland waters by borate, silicate and phosphates [31].

The CO_2-HCO_3CO_3 equilibrium system is the major buffering mechanism in fresh water. Alkalinity over 150 mg L^{-1} has been found to be conducive to higher production[5]. In the present observation the annual average of alkalinity (mg L^{-1}) was 136.14 $\pm$ 1.69, which reflects the good productive nature of water body. Moyle [19] and Sorense[28] have classified water bodies into nutrient status based on alkalinity levels according to which Bisar Pond was also containing hard water, as per classification of Moyle (1949), Mehra (1986)[17] and confirmation of Yadav *et al*., [32] and Agarwal *et al*., [1]. Rise in total alkalinity in warmer months (141.98 in May & June) may be accounted for the depletion in water level[7]. Carbondioxide is essential for Photosynthesis. A direct correlation between free CO and bicarbonate alkalinity has been reported by Mandal and Hakim [15] in a fresh water pond at Bhagalpur. Similar observations have also been made by Atkins[4], Pearsal[22], Howland[9], Pringsheium[23], Zafar[33], However, Singh[25] claimed that the high alkalinity of sheets of

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water in Uttar Pradesh does not seem to be affected by oxygen or carbondioxide. The present study showed a fall in the amount of total alkalinity during monsoon months as compared to the summer months especially in June, when the highest value was observed, the same can be attributed to heavy monsoon showers which result in dilution of water. These observations are also in accordance with the results obtained by Chakrabarty *et al*.,[6], Michael [18] and Marshall and Falconer [16] where they have also recorded a change in the levels of total alkalinity in rainy season.

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