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Identification of the Adverse Effect of Turbidity and Iron Concentration on the Water Quality of Ghaghra River in Saran District of Bihar

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ABSTRACT

According to Article 51-A (g) of the Indian Constitution, it is the duty of all Indians to protect and improve the natural environment including forests, lakes, rivers and wildlife, and to have compassion for living beings. River water pollution is causing a great deal of trouble in India, its bottom water sources are also contaminated with toxic, organic and inorganic pollutants. Lack of water quality is risky for every human use and ecosystem. That is why I have actually done research on water estimation in terms of heavy metal and physico-chemical characteristics of Ghaghra river in Saran district and its side effects. In pre-monsoon and post-monsoon more than one hundred water samples were collected from specific sites of Ghaghra river from Doriganj to Tajpur in Saran district. It lies between 25.782261 North Latitude and 84.626096 East Longitude to 25.876387 North Latitude and 84.493640 East Longitude. pH, turbidity, electrical conductivity, TDS, overall hardness, calcium, magnesium, chloride, alkalinity, iron, nitrate, sulfate, fluoride, arsenic and magnesium were analyzed on site and in the laboratory.

The pre-monsoon mean values of pH, EC, TDS, TH, Ca, Mg, CI^-, Alkalinity, NO_3^-, SO_4^-, F^- parameters were found to be 8.39, 349.56 µs/cm, 227.09 ppm, 179.11 ppm, 34.02 ppm, 22.51 ppm, 13.21 ppm, 180.42 ppm, 0.05 ppm, 18.47 ppm3, 0.19 ppm respectively and its post-monsoon mean values were found to be 7.88, 219.18 µs/cm, 142.29 ppm, 90.58 ppm. 23.15 ppm, 8.11 ppm, 12.01 ppm, 117.07 ppm, 2.57 ppm, 28.33 ppm, 0.16 ppm respectively The all parameters were almost within the standard limits. It was determined that the pre-monsoon water samples' turbidity ranged between 0.30 NTU and 7.40 NTU, with an average of 2.69 NTU and a median of 2.60 NTU. In post-monsoon turbidity was determined to be in the range of 8.40 ppm to 24.10 ppm with an average of 14.87 ppm and a median of 13.80 ppm. The turbidity of water in both pre-monsoon and post-monsoon is more than the standard limit.

The iron level of the water samples was found to vary between 0.21 ppm and 0.77 ppm, with an average and a median of 0.46 ppm pre-monsoon and in post-monsoon between 1.06 ppm and 1.94 ppm, with an average of 1.45 ppm and a median of 1.43 ppm. Iron content is within the standard limit in pre-monsoon but iron content in post monsoon is more than the BIS's permitted ranges.

As a result of studying the data of the test report of water quality of Ghaghara River in Chapra district, it was found that all the parameters were almost within the standard limits but some important parameters like turbidity and iron were found to be more than the permissible limits of BIS and WHO. The mean value of turbidity during pre-monsoon was found to be 2.69 NTU, but the post-monsoon average value was 14.87 NTU. Here the figure was found to be more than the permissible limit (1.0-5.0 NTU) of BIS and WHO. The average level of TDS in pre-monsoon is 227.09 ppm and post-monsoon is 142.29 ppm. TDS of water increases. The various parameters tested during pre- and post-monsoon were within the safe standard limits of BIS, WHO and USEPA. During pre-monsoon the maximum iron content in water was found to be 0.77 ppm which is within the permissible limit but the post-monsoon maximum iron level is 1.94 ppm which is more than the permissible limit. As the BIS and WHO iron content in water should be less than 1 ppm. Turbidity and iron overdose can affect microorganisms, surrounding animals and agricultural activities. The silt, organic and inorganic counts inside the river water and various dissolved effluents, sediments get deposited inside the river, due to which the Ghaghara river is gradually disappearing from Rivilganj to Doriganj in Saran district of Bihar.

Keywords: Turbidity, Iron, Agricultural Work, Pre-Monsoon, Post-Monsoon, Ghaghara River, Saran District

I. INTRODUCTION

Lack of quality in river water is a big problem for India and its surface water resources are also contaminated with toxic, organic and inorganic pollutants. In many cases, these sources have been made unsafe for human consumption as well as other activities, such as irrigation and industrial necessity. Almost every river system in India is now largely polluted. As assessed by scientists from the National Environmental Engineering Research Institute (NEERI) Nagpur, about 70% of the water in India is polluted. This proves that due to the decline in water quality, both human life and ecosystem can be affected. According to Article 51-A (g) of the Indian Constitution, it is the duty of all Indians to protect and improve the natural environment including forests, lakes, rivers and wildlife, and to have compassion for living beings.

Ghaghara River is known as Karnali River in Nepal while in India it is known as Ghaghara River but in Uttar Pradesh it is also known as Sarayu River. On 13

January 2020, the Uttar Pradesh government has passed a proposal to change the name of the entire Ghaghara River to the Saryu River from its cabinet and forwarded the proposal for change of name to the central government. Therefore, after getting approval by the central government, the Ghaghara River will be called Sarayu River and it will be named Sarayu River in all revenue records.

The river Saryu has been described as the main symbol of the identity of Ayodhya in the chaupai of Tulsi Ram Charitmanas. He said that the Ram Janmabhoomi Ayodhya seems more pleasant due to the south direction of the Saryu River. Ayodhya is one of the ancient and seven sacred pilgrimage sites of the Hindus. Ayodhya is described in the Atharvaveda as the city of God (Ishpuri) and its splendor is compared to heaven. According to Ramayana, Lord Rama took water samadhi in this river. From the Bahraich district of UttarPradesh to Ayodhya via Gonda, it is known as the Saryu River, but after this it is known as the Ghaghra River. Earlier this river used to meet the Ghaghra River at a pilgrimage place called Paska in Paraspur Tehsil of Gonda. But now due to the construction of a dam here, this river meets at a place called Chandapur, about 8 kilometers ahead of Pasaka. On 9 November 2019, the Supreme Court has given the decision to construct the Ram temple in Ayodhya. Ayodhya has become the biggest center of faith of Hinduism due to the construction of a huge temple at Ram Janmabhoomi. The river Sarayu has special significance in Hinduism as it flows through Ayodhya, the birthplace of Lord Rama.

A. Industrial Wastes

Their water is getting polluted due to the release of waste water, waste and material in the rivers without refining by the industries. It is a matter of concern that many toxic metals like mercury, arsenic, copper, cadmium are poisoning these water sources by mixing them with industrial plants. Not only this, due to the mixing of various organic and inorganic elements in the immersed waste, the clouds of danger are also hovering over the aquatic fauna and flora. Many aquatic creatures are on the verge of extinction. It is estimated that 2 million tonnes of waste is dumped in rivers, lakes and streams every day. One liter of waste polluted water pollutes about eight liters of fresh water. According to one calculation, there is about 12000 cubic kilometers of polluted water in the world, which is more than the water present in the ten largest river basins in the world.

B. Fertilizers Wastes

In some places, vegetables and fruits like watermelon, cucumber, etc. are cultivated in the alluvium on the banks of rivers. Fertilizers and pesticides applied during their cultivation are also found in the river water. By using them on the river bank, the possibilities of getting them in the water are also more and their effect is also more, because they get mixed directly in the water.

C. Idol Wastes

There is a tradition of idol worship in our country. After the worship, these idols are immersed in the rivers. Earlier these statues were made of clay, but now most of the statues are made from plaster of Paris due to the ease of making, shaping and convenient in transportation. The finishing of the idols made from chemical paints, varnishes, colors etc. are used to give attractive look and decoration to these idols. During immersion, all these harmful chemicals which include heavy metals like lead chromium, copper, mercury, cadmium and organic solvents etc., get mixed in the water sources. All substances soluble and insoluble in water cause water pollution in addition to heavy metals, other chemical solvents or carcinogenic chemicals are found in paints, varnishes and paints, which get mixed in water by immersion of idols in water. Similarly plaster of pair is also a mixture of different chemicals. It does not naturally melt into the soil, but remains in the insoluble state and collects in the form of debris. This debris not only reduces the depth of water bodies but also reduces their water holding capacity. Rather, by accumulating on the foothills of water bodies in the form of silt, it also

reduces their porosity, so that water does not enter the surface of the land.

As a result, the process of natural recharge through surface water bodies slows down and stops over time. Studies have found that the water quality of water bodies gets affected during and after immersion of idols. During and immediately after immersion, the amount of dissolved oxygen in the water becomes extremely low or sometimes even zero. That is, the chemicals present in the idol fully utilize the dissolved oxygen in the water. In this way, due to reduction in dissolved oxygen, there is an adverse effect on aquatic life and vegetation.

D. Polythene waste

Every year, about 126,513 metric tones of plastic waste is reaching the seas through 1,169 rivers in India. Rivers are also a major source of plastic waste reaching the oceans. Every year millions of tons of plastic waste reach the oceans through rivers. This is the reason that for a long time scientists have been trying to know about the rivers through which this waste is reaching the oceans. A recent research on this has shown that about 80 percent of the world's 1,000 rivers reach the oceans through rivers, while the remaining 20 percent of plastic waste reaches the oceans through about 30,000 rivers reaching. This information has recently come up in research conducted by the voluntary organization Ocean Cleanup and its partners, which is published in the journal Science Advances.

E. Study Area

Years ago, the Ghaghara River flowed from Tajpur to the Bengali Baba Ghat of Douriganj in the Saran district of Bihar which was about 42 kilometers in length. But at present, Ghaghara River starts from Tajpur and joins Revelganj itself. Its length is about 22 kilometers. The location of my water samples is Revelganj Ghat, Middle of Revelganj Ghat, Opposite side of Revelganj Ghat, Simariya Ghat, Middle of Simariya Ghat, Opposite side of ofSimariya Ghat, KauruDharu Ghat, Middle of KauruDharuGhat, Opposite of KauruDharu Ghat, DhaniChhapra Ghat, Middle of DhaniChhapra Ghat, Opposite side of DhaniChhapraG hat, Sri Bhajan Barambh Baba Ghat, Middle of Sri Bhajan Barambh Baba Ghat, Opposite side of Sri Bhajan Barambh Baba Ghat, Bahoran Tola Manjhi, Middle of Bahoran Tola Manjhi, Opposite side of Bahoran Tola Manjhi, Rail bridge Ghat, Middle of Rail bridge Ghat, Opposite side of Rail bridge Ghat, Naga Baba Math Ghat, Middle of Naga Baba Math Ghat, Opposite side of Naga Baba Math Ghat, Sona Shakti Ghat (Shiv Mandir), Middle of Sona Shakti Ghat (Shiv Mandir), Opposite side of Sona Shakti Ghat (Shiv Mandir), Baba Madheshwar Nath Ghat, Middle of Baba Madheshwar Nath Ghat, Opposite side of Baba Madheshwar Nath Ghat, Hira Brahm Baba Ghat, Middle of Hira Brahm Baba Ghat, Opposite side of Hira Brahm Baba Ghat, Sati Mai Mandir Ghat, Middle of Sati Mai Mandir Ghat, Opposite side of Sati Mai Mandir Ghat, Bhabhauli Ghat, Middle of Bhabhauli Ghat, Opposite side of Bhabhauli Ghat, DumariBhabhauli, Middle of DumariBhabhauli, Opposite side of DumariBhabhauli, Kali Mandir Dumaigarh Ghat, Middle of Kali Mandir Dumaigarh Ghat, Opposite side of Kali Mandir Dumaigarh Ghat

II. METHODS AND MATERIAL

In pre-monsoon and post-monsoon water samples were taken from different places of Ghaghara River, some experiments like TDS, pH etc were done on spot and other experiments were done as per Indian standard in the laboratory of A. N. College Patna. The turbidity of water was determined by the instrumental nephelometric method. Water iron is determined by the phenanthroline method. In this method water is boiled with acid and hydroxylamine and treated with phenanthroline at pH 3.2 to 3.3 obtained by addition of specified buffer. An orange-red complex is formed. The color of a solution follows Beer's law. The standard color is ready. The reading is taken on a spectrophotometer.

III. RESULTS AND DISCUSSION

A. Statistical Data of Turbidity Pre-Monsoon Post-Monsoon (Table 01)

Parameters.	Unit	Desirable Limit*	Mximum	Minimum	Average	Median
Pre-Turbidity	NTU	1	7.40	0.30	2.69	2.60
Post-Turbidity	NTU	1	24.10	8.40	14.87	13.80

B. Statistical Data of Iron Pre-Monsoon Post-Monsoon (Table 02)

Parameters.	Unit	Desirable Limit*	Mximum	Minimum	Average	Median
Pre-Fe	mg/l	1.0	0.77	0.21	0.46	0.46
Post-Fe	mg/l	1.0	1.94	1.06	1.45	1.43

C. Histogram of Turbidity (Table 03)

Histogram of Turbidity (Post-monsoon)		
Range	Frequency	Cumulative %
05-10	2	4.55%
10-15	28	68.18%
15-20	3	75.00%
More	11	100.00%

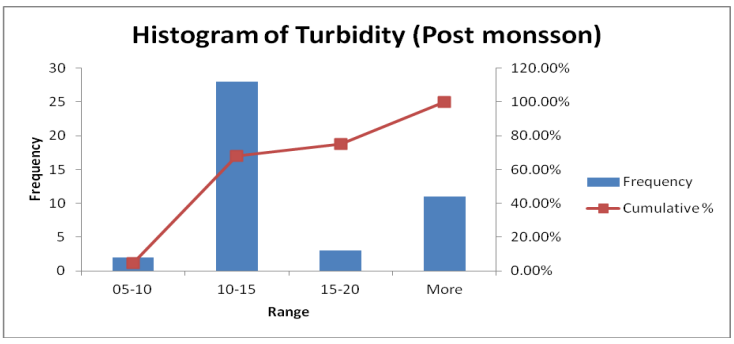


Figure 01: Bar Chart of Histogram of Turbidity

D. Histogram of Iron (Table 04)

Histogram of Iron (Post-monsoon)		
Range	*Frequency*	*Cumulative %*
1.0-1.2	10	22.73%
1.2-1.4	10	45.45%
1.4-1.6	9	65.91%
1.6-1.8	10	88.64%
More	5	100.00%

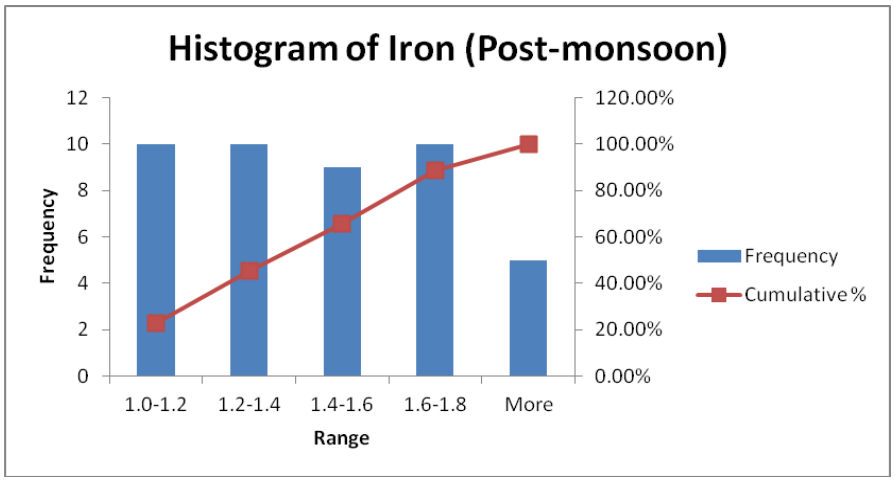
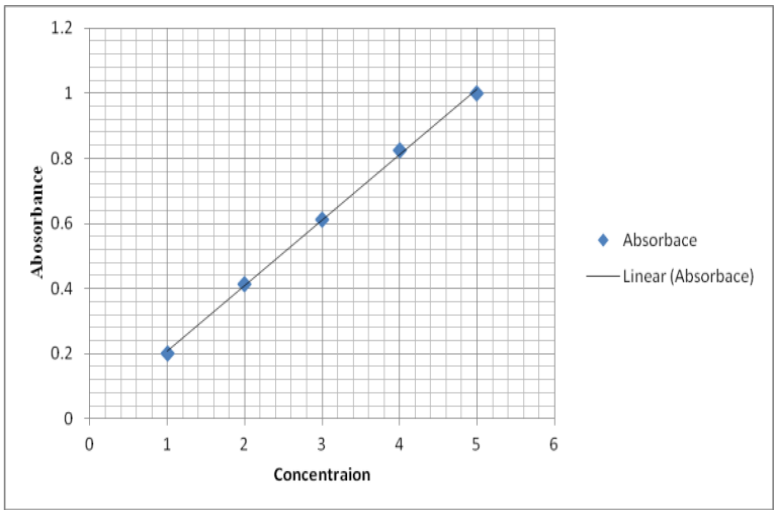


Figure 02: Bar Chart of Histogram of Iron



Graph 01: Iron Graph(ppm)

E. Data Analysis & Discussion

The pre-monsoon mean values of pH, EC, TDS, TH, Ca, Mg, CI^-, Alkalinity, NO_3^-, SO_4^-, F^- parameters were found to be 8.39, 349.56 μs/cm, 227.09 ppm, 179.11 ppm, 34.02 ppm, 22.51 ppm, 13.21 ppm, 180.42 ppm, 0.05 ppm, 18.47 ppm, 0.19 ppm respectively and its post-monsoon mean values were found to be 7.88, 219.18 μs/cm, 142.29 ppm, 90.58 ppm. 23.15 ppm, 8.11 ppm, 12.01 ppm, 117.07 ppm, 2.57 ppm, 28.33 ppm, 0.16 ppm respectively Theall parameters were almost within the standard limits.

It was determined that the pre-monsoon water samples' turbidity ranged between 0.30 NTU and 7.40 NTU, with an average of 2.69 NTU and a median *of 2.60 NTU.* In *post-monsoon turbidity was determined to be in the range of 8.40 ppm to 24.10 ppmwith an average of 14.87 ppm and a median of 13.80 ppm*. The turbidity of water in both pre-monsoon and post-monsoon is more than the standard limit.

The iron level of the water samples was found to vary between 0.21 ppm and 0.77 ppm, with an average and a median of 0.46 ppm pre-monsoon and in post-monsoon between 1.06 ppm and 1.94 ppm, with an average of 1.45 ppm and a median of 1.43 ppm. Iron content is within the standard limit in pre-monsoon but iron content in post monsoon is more than the *BIS's permitted ranges.*

Effect of Turbidity

The waste material in the Ghaghra River, which remains in the form of organic matter and inorganic matter, due to mixing in the water, the water becomes blurry. As a result of which the quality of water decreases, first of all it affects the existing aquatic organisms. The use of this water in agricultural work also affects the production of cereals. The worst effect is that the residual substances found in the water, which is insoluble, act as sediment in the river, due to which the existence of the river gradually ends, like the Ghaghra River from Rivilganj to Doriganj has been gradually ending.

Effect of Iron

The presence of excess iron in the water of Ghaghra River after monsoon is unfavorable for aquatic life and agricultural activities. Getting a small amount of iron in water is not harmful for human life, but being in excess is harmful. The water of the river is found in the surrounding fields and in the sources of water for daily use, then it is carried to the villages and cities through *Jal-Nal* scheme and other schemes of Bihar Government.

Effect on microscopic aquatic organisms

Protozoa, bacteria, and fungi are among the microorganisms found in the Ghaghara River in the Chapra district. These organisms only have one thing in common, and that is their diminutive size. Although colonies of some can be seen with the unaided eye, the majority cannot be seen without a microscope.

This river is home to several microorganisms that can endure harsh climatic and chemical conditions. Numerous microbes serve crucial roles in aquatic ecosystems by using photosynthesis to harvest the sun's energy and decomposing organic tissue to release nutrients that had been stored there.

Bacteria

Bacteria are among the smallest and oldest organisms on Earth, are common in all aquatic systems and may be found in almost every basin. Numerous microorganisms are removed from the environment by rivers and streams. They are abundant across the area, and after rain, their numbers rise significantly. Bacterial populations are numerous and often range from millions to billions per ml. Especially in productive or dirty water, occurs in hundreds of parts per ml.Bacteria may grow vast numbers in a short period of time by simply dividing themselves when the conditions are favourable. The bacteria can be found floating in the water, adhering to objects thrown into rivers, including dead wood or leaves, or embedded in biofilms, which are slippery coatings on

river rocks, boulders, and sand cereal. They may account for a sizable amount of the aquatic systems' living population.

Fungi

Examples of solitary cells are fungi called hyphae. The most prevalent and significant aquatic fungi are hyphomycetes, which are tiny and make up the majority of the species. In order to receive nourishment from their immediate environment, heterotrophic fungi, like heterotrophic bacteria, secrete exoenzymes that break down molecules into simpler components that the fungus can absorb. Fungi are among the few creatures that can degrade specific plant structural components like cellulose and lignin, making them crucial for the breakdown of plant materials in aquatic systems.

Protozoa

In the Ghaghra River, protozoa, which are tiny, single-celled organisms, form colonies. Autotrophs and heterotrophs are the two different categories of protozoa. Contrary to bacteria and fungi, which take up organic substances that have decomposed from their surroundings, heterotrophic protozoa (such amoeba and paramecium) eat other organisms like bacteria, algae, or other protists. Although some protozoa are free-swimming, protozoa, like other microbes, develop hard surfaces on biofilm coating sediments and river banks. Giardiasis and other parasitic disorders are brought on by some protozoa (beaver fever).

Algae

Algae refer to a number of groups of primarily autotrophic protists. This phrase which is used to describe photosynthesizing microorganisms-often including cyanobacteria as algae replaces the word "microorganisms." Sizes of algae range from microscopic to enormous colonies known as macrophytes. Numerous kinds of algae contribute significantly to the energy supply at the base of numerous aquatic food webs.

IV. CONCLUSION

As a result of studying the data of the test report of water quality of Ghaghra River in Chhapra district, it was found that all the parameters were almost within the standard limits but some important parameters like turbidity and iron were found to be more than the permissible limits of BIS and WHO. The mean value of turbidity during pre-monsoon was found to be 2.69 NTU, but the post-monsoon average value was 14.87 NTU. Here the figure was found to be more than the permissible limit (1.0-5.0 NTU) of BIS and WHO. The average level of TDS in pre-monsoon is 227.09 ppm and post-monsoon is 142.29 ppm. TDS of water increases. The various parameters tested during pre- and post-monsoon were within the safe standard limits of BIS, WHO and USEPA. During pre-monsoon the maximum iron content in water was found to be 0.77 ppm which is within the permissible limit but the post-monsoon maximum iron level is 1.94 ppm which is more than the permissible limit. As the BIS and WHO iron content in water should be less than 1 ppm. An overdose of iron can affect the surrounding animals and agricultural work.

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