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Review Article

Analysis of the Extraction and Identification of Toxins in Biological System

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Abstract:

The hydrosphere, lithosphere, and atmosphere are all potential entry points for pollutants into the ecosystem. The main aim of the study is analysis on the Extraction and Identification of Toxins in the biological system**.** Following an accurate identification, the cyanobacteria samples that were obtained were then split in half for the purposes of additional processing and investigation. In this study, three fish ponds, namely Padumpur, Oyster, and Hakaripur, located within the geographical boundaries of District Jaunpur (28°98' N longitude to 77°07' E latitude), were chosen as the research sites.

Keywords: Ecosystem, Geograpical, Pollutants, Geographical, Identification

1. INTRODUCTION

The hydrosphere, lithosphere, and atmosphere are all potential entry points for pollutants into the ecosystem. Pollutants enter the environment for a variety of reasons, some of which are natural (such as volcanic activity and the weathering of rocks), but human activity is a major contributor. Shipwrecks, oil spills, mine accidents, and house fires are all examples of unintentional releases; vector control applications of biocides are another; and industrial effluents and sewage disposals are examples of waste disposals. Temperature, the motion and direction of surface waters, the circulation of air masses, and the velocity of the wind all have a role in the dispersal of heavy metals and other contaminants. In addition to these, the partition coefficient, polarity, vapour pressure, and molecular stability all play roles in the dispersion and migration of contaminants.

(A) Soil pollution

Intentional or unintentional soil contamination both exist. Wastewater reuse, pesticides, animal manures, fertilizers, leaded paint, mine ore waste (mine tailing), sewage sludge, spills of petroleum distillates, coal combustion residues, and trash dumping all fall under the category of intentional pollution. Because of the widespread usage of untreated sewage and wastewater, heavy metals have accumulated

in our farmland and, ultimately, in the food we consume. Accidents involving trucks carrying harmful substances and the accidental release of their cargo are two examples of accidental pollution. Heavy metals persist in the soil for eons because they are resistant to breakdown by microbes and chemicals.

(B) Water pollution

Water pollution has mostly come from two sources: urbanization and industrialization. The sediments of water bodies get contaminated with metals due to runoffs from cities, towns, and industry. It's possible that even if traces make it to bodies of water, they'll still be very harmful to people and ecosystems. The toxicity of heavy metals is conditional on several variables, including the specific metal present, the metal's chemical make-up and biological function, the organism exposed, and the stage of development at which the organism is exposed. If one creature is harmed, it will ripple across the whole food web. Since humans are often at the bottom of the food chain, we will be hit the worst since we will have gathered the greatest amount of heavy metal. Typically, sewage systems receive both municipal and industrial waste.

(C) Air pollution

Urbanization and industrialization are at blame for both water and air pollution. There are many distinct types of air pollution. Particles, droplets, gas, or gas in combination with particles or droplets are all viable entry modes. In general, particles and droplets have a limited range and fall to the earth after traveling just a short distance. Gaseous particles, on the other hand, may be carried by air masses over great distances.

2. LITERATURE REVIEW

Gheorghe, Iuliana. (2011). Air pollution is a major issue that has far-reaching consequences for people's health and the environment. While modern technology is largely to blame for air pollution and its negative consequences, it also serves as a rallying cry for the global community to work together to find solutions. Source, chemical content, size, and method of release into indoor or outdoor settings are all used to categorize atmospheric pollutants. Outdoor pollution comes from factories and vehicles, whereas inside pollution comes from human activities including cooking and burning as well as particle resuspension, building materials, air conditioning, consumer items, smoking, heating, and biological agents. Human health systems, including the respiratory and cardiovascular systems, are impacted by air pollution. Many nations' economies and rates of growth are negatively impacted by air pollution, as are the crops grown there. The publisher asked several writers from other nations, and these authors, who don't know each other, put together almost two dozen chapters covering a broad range of topics related to air pollution. This book was written to add to the body of information on air pollution. The impacts of air pollution on human health, the environment, the economy, and agriculture are the subject of the book's 21 chapters. There are four sections to this book. The first one discusses the effects of air pollution on people's health and various bodily systems, such as the link between air pollution and respiratory diseases, the effects of fine particle matter on people's hearts, the dangers of breathing polluted air during pregnancy and childbirth, and the correlation between air pollution, vitamin D levels, and the incidence of so-called "civilization-related diseases.

Cen, Shihong. (2015). Compared to more conventional methods, air quality monitoring via plants saves money, saves time, and has a high level of credibility. It is possible to identify the species of air pollutants by studying the signs of damage

shown by plants in response to exposure to each. Extent of plant damage and length of time plants were exposed to pollution may also be used to assess the mass concentration scope of pollutants. This study draws on local and international research to outline the concepts, mechanism, benefits, and drawbacks of plant-monitoring. It then provides several examples of such plants as well as the minimum mass concentration and pollution time at which the plants begin to display damage symptoms. In conclusion, this paper discussed how exposure to air pollution can have negative effects on human health, including lowered immune function, diminished lung function, alterations to the respiratory and cardiovascular systems, and the induction and promotion of allergic diseases, respiratory diseases, and other illnesses.

Gheorghe, Iuliana. (2011). Water, air, and soil are all negatively impacted by human activity, which has a counterproductive effect on the ecosystem. Technology, society, and the delivery of a wide range of services all advanced thanks to the industrial revolution. However, with this achievement came the creation of massive amounts of various air pollutants, which are damaging to human health. There is no denying that pollution has many negative effects on human health across the world. This big issue is connected to social, economic, administrative, and lifestyle factors. Consequently, it is abundantly obvious that urbanization and industrialization have reached unprecedented and unsettling dimensions around the globe in the modern period. According to the globe Health Organization (2019), anthropogenic air pollution causes around 9 million deaths annually throughout the globe. One definition of air pollution is "the introduction into the atmosphere of chemicals, particulates, or biological materials that cause discomfort, disease, or death to humans, damage other living organisms such as food crops, and damage the natural environment or built environment." An air pollutant is any element in the air that may be harmful to people or the environment. These contaminants might be airborne droplets, particulate matter, or gases.

Cen, Shihong. (2015) All living things rely on air for survival, and organisms can't thrive without access to clean air. However, modern industries and urbanization have led to severe pollution of this air. Plants and crops produced in polluted locations have a diminished biological and physiological response due to air pollution. Plants are the backbone of any ecosystem, yet they're also the ones scientists have found are most vulnerable to the harmful effects of air pollution. The effects of air pollution on plant physical and biochemical characteristics are discussed in this article.

Kumar, Pradeep & Vishwakarma, A K & Kumar, Dharmendra & Yadav, Shweta & Pandey, Durgvijay & Ram, Sanjeev & Arora,. (2020). When dangerous substances are released into the air, including gases, dust particles, fumes (or smoke), and odors, this is known as air pollution. Polluted air poses a risk to the well-being of all Earth's inhabitants. It depletes the ozone layer, speeds up global warming, causes cancer and respiratory disorders, and exacerbates pollution and acid rain. While it is impossible to totally remove air pollution in today's industrial society, it is possible to significantly cut down on it. In an attempt to reduce air pollution, the government has enacted and is continually updating air quality norms and emission restriction legislation. We can all do our part to alleviate the pollution crisis by sharing rides or using the bus. The bulk of industrial air pollution comes from the generation of electricity, therefore cutting down on our

usage of this resource is another way to lessen our impact on the environment.

3. METHODOLOGY

3.1 EXTRACTION AND IDENTIFICATION OF TOXINS:

Following an accurate identification, the cyanobacteria samples that were obtained were then split in half for the purposes of additional processing and investigation. The sun and then the oven were both used to dry off one portion. The other portion was use in the process of isolating and determining the identity of poisons that are produced by cyanobacteria.

3.1.1. Extraction of toxins: The procedures for the extraction and purification of toxins were carried out in accordance with the recommendations made by Harada et al. (1988). The water that had cyanobacterial cells in it was filtered using Whatmann No. 1 filter papers, and then the filter papers, together with the supernatant they contained, were left to dry in a desiccator at room temperature for one full day. After then, the supernatant was separated into two distinct components once again. Methanol and water were mixed in a proportion of 70:30 (v/v) and used to extract one portion of the supernatant. Sonication was performed three times for a total of five minutes on the mixture. After being placed in the freezer for a night, total extracts were then centrifuged. After being separated, the supernatant was passed through filter sheets of the Whatmann No. 1 kind. After that, the filtrate was collected and put to use in the High-Performance Liquid Chromatography (HPLC) analysis in order to identify the toxic substances. Acetic acid at a concentration of 5% was used to extract the remaining component of the supernatant. Evaporating the supernatant and then resuspending it in 1 ml of 5% acetic acid was done in this experiment. After adding 250 ul of 1M sodium hydroxide and then 25 ul of 5% hydrogen peroxide to 100 ul of the extract, the peroxide reaction was carried out. After giving the solution a swirl and allowing it to sit undisturbed for ten minutes at room temperature. After that, 20 l of acetic acid was added to the solution, and it was put through High Performance Liquid Chromatography (HPLC) so that it could be identified.

3.1.2. The naming of toxic substances: Following the discovery of cyanobacteria, the primary objective of the investigation was to identify the poisons that are produced by cyanobacteria. In order to accomplish this goal, the high-performance liquid chromatography (HPLC) technology was used throughout this investigation. This examination was carried out at Jaunpur.

4. RESULTS

4.1 OBSERVATIONS FOR TOXICITY

The existence of life in aquatic environments is entirely influenced by the qualities of water, including both its physico-chemical and biological attributes. Life is limited to a certain set of qualities, which are sustained by water throughout the seasons. The examination of the physico-chemical environment is a fundamental aspect in assessing the productivity of an ecosystem. This research focuses on the hydro-biological examination of three freshwater fish ponds located in the Jaunpur area, namely Padumpur, Oyster, and Hakaripur. The specific emphasis is placed on the variety of cyanobacteria and their potential effects on higher organisms inside these ponds. The climate of the Jaunpur area is distinguished by its significantly inland location, with intense summer heat, severe winter cold, and a distinct monsoon season. The climate exhibits notable periodicity, characterized by seasonal variations, and is primarily impacted by significant swings in air temperature, precipitation, duration of daylight, and solar radiation. The climate in

the Jaunpur area has a cyclical pattern, with distinct seasons including a dry and hot summer period from March to June, a monsoon season from July to September, and a chilly winter period from October to February. Hence, the climate of Jaunpur district is influenced by many dominant elements that exhibit variability throughout the area.

4.1.1 Physico-Chemical Environment

The physico-chemical characteristics of aquatic environments in three fish ponds (Padumpur, Oyster, and Hakaripur) were assessed over a period of two years (July 2019 to June 2021). These characteristics include water temperature, pH, dissolved oxygen, Free CO2, turbidity, alkalinity, nitrate-nitrogen, and total phosphate. The data collected for each pond is presented in Tables 4.12 to 4.14 and will be described in the following sections.

- **Water Temperature:**

The lowest water temperature in the ponds was observed during the month of January. Specifically, the temperature was recorded as 9.80 ±0.44°C at Padumpur, 9.50 ±0.66°C at Oyster, and 11.10 ±0.92ºC at Hakaripur, as shown in Tables 4.12 to 4.14. The data indicates an upward trajectory in water temperature over the summer season, with the highest recorded values occurring in June and July. Specifically, in Padumpur, the water temperature reached a maximum of 33.87 ±2.85ºC, while at Oyster and Hakaripur, the maximum temperatures were recorded as 31.03 ±1.00ºC and 32.23 ±1.69ºC, respectively. The water temperature exhibited a progressive decline in subsequent months across all three ponds, ultimately reaching its lowest point during the winter months. Following a decrease in January, the water temperature in all ponds exhibited an upward trajectory leading up to the summer months. Throughout the year, it was noted that the water temperature in the Hakaripur fish pond consistently remained higher compared to the Padumpur and Oyster fish ponds, as shown in Tables 4.12 to 4.14. The variation in water temperature may be ascribed to the relatively shallow nature of the Hakaripur fish pond. Throughout the duration of the research, significant fluctuations in temperature have been observed in the water of several fish ponds, exhibiting distinct seasonal patterns. The temperature range observed in the Padumpur fish pond over the period of July 2019 to June 2020 was 10.07 ±0.80 - 33.87 ±2.85 0C. Similarly, the temperature range in the Oyster fish pond was 9.50 ±0.66 - 31.03 ±1.00 OC, and in the Hakaripur fish pond, it was 11.20 ±1.05 - 32.23 ±1.69 OC.

During the period spanning from July 2020 to June 2021, the water temperature in the Padumpur fish pond ranged from 9.80 ±0.44 to 33.20 ±1.95 OC. Similarly, in the Oyster fish pond, the water temperature varied between 10.60 ±0.80 and 29.33 ±1.53 OC. Lastly, in the Hakaripur fish pond, the water temperature fluctuated between 11.10 ±0.92 and 31.03 ±1.53 OC. Hence, it was noted that the temperature exhibited significant fluctuations across all three ponds over the whole duration of the research.

According to the Pearson correlation coefficient (Table 4.1) computed using SPSS statistical software, a significant positive association was observed between water temperature and the pH of water ($r=0.499$, $P< 0.01$, $n=24$), turbidity ($r=0.909$, $P< 0.001$, $n=24$), and BOD ($r=0.597$, $P>0.001$, $n=24$). In the Padumpur fish pond, a significant negative correlation was observed between water temperature and dissolved oxygen ($r=-0.958$, $P< 0.001$, $n=24$), as well as nitrate-nitrogen ($r=-0.705$, $P< 0.001$, $n=24$).

The researchers also conducted an analysis to determine the association between temperature and other parameters in the

Oyster fish pond (Table 4.11). The results indicated that temperature showed a strong positive correlation with free CO2 (r=0.437, P< 0.05, n=24) and a substantial negative correlation with turbidity (r=-0.890, P< 0.001, n=24). The results indicate a strong negative association between dissolved oxygen (DO) and nitrate-nitrogen (r = -0.508, P < 0.01, n = 24) as well as a moderate negative correlation between DO and nitrate-nitrogen (r = -0.448, P < 0.05, n = 24).

In the investigation of the connection between temperature and other physico-chemical parameters of the Hakaripur fish pond, it was observed (as shown in Table-4.12) that there exists a statistically significant positive correlation between temperature and turbidity (r=0.862, P< 0.001, n=24), as well as between temperature and BOD (r=0.441, P< 0.05, n=24). The results indicate a strong negative connection between temperature and dissolved oxygen (r=-0.571, P< 0.01, n=24), nitrate-nitrogen (r=-0.640, P< 0.001, n=24), and total phosphate (r=-0.527, P< 0.01, n=24).

Table 4.1 Padumpur Fish Pond's Physicochemical Profile Over Two Consecutive Years (July 2019 – June 2021)

Months	Physicochemical Parameters																	
	Temp. (°C)		pH		D.O. (ppm)		Free CO_2 (ppm)		Turbidity (NTU)		Alkalinity (ppm)		B.O.D. (ppm)		Nitrate Nitrogen		Total Phosphate	
	Mean	±S.D.	Mean	±S.D.	Mean	±S.D.	Mean	±S.D.	Mean	±S.D.	Mean	±S.D.	Mean	±S.D.	Mean	±S.D.	Mean	±S.D.
Jul. 19	31.20	1.30	8.20	0.30	7.57	0.45	3.70	0.36	398.33	36.50	70.00	3.00	26.00	2.65	0.47	0.04	0.47	0.21
Aug. 19	31.00	1.00	8.27	0.65	7.60	0.26	3.43	0.75	326.00	19.00	58.00	11.00	17.33	4.51	0.49	0.07	0.47	0.12
Sep. 19	23.00	2.00	7.77	0.15	7.87	0.23	3.80	0.26	226.67	16.01	92.33	13.50	18.33	1.53	0.45	0.05	0.43	0.06
Oct. 19	22.33	2.52	7.77	0.45	7.90	0.46	3.70	0.30	176.00	16.00	75.00	34.00	14.00	3.00	0.54	0.04	0.40	0.10
Nov. 19	18.03	1.25	8.30	0.40	8.83	0.31	3.67	0.42	97.00	4.36	60.33	28.50	13.00	2.00	0.52	0.05	0.50	0
Dec. 19	13.27	0.75	8.60	0.30	8.93	0.42	3.10	0.20	50.00	10.00	51.33	5.51	13.33	3.51	0.92	0.14	0.67	0.06
Jan. 20	10.07	0.80	7.57	0.35	9.27	0.35	4.23	0.21	46.33	9.50	35.00	7.00	21.33	2.52	0.86	0.04	0.53	0.12
Feb. 20	12.20	0.90	7.60	0.30	9.07	0.35	5.13	0.76	68.00	16.00	48.00	14.00	23.50	2.50	1.08	0.07	0.40	0
Mar. 20	21.50	3.50	7.70	0.20	8.20	0.26	4.53	0.25	88.33	8.50	49.00	9.00	33.00	3.00	0.59	0.13	0.40	0
Apr. 20	25.60	1.40	8.57	0.35	7.83	0.31	3.73	0.35	146.00	13.00	59.33	7.51	70.33	7.51	0.51	0.02	0.27	0.12
May 20	31.53	1.50	8.47	0.25	7.60	0.26	4.30	0.40	281.33	25.50	39.00	7.00	83.33	2.52	0.46	0.09	0.33	0.12
Jun. 20	33.87	2.85	8.50	0.40	7.63	0.06	4.13	0.15	333.33	40.50	45.00	8.00	96.00	8.00	0.48	0.07	0.27	0.06
Jul. 20	30.93	1.68	8.13	0.47	7.47	0.35	3.67	0.40	395.33	47.43	75.33	9.29	22.33	2.08	0.51	0.04	0.47	0.06
Aug. 20	29.67	1.53	8.03	0.38	7.77	0.42	3.17	0.76	328.33	22.59	62.33	17.90	17.00	4.00	0.56	0.06	0.37	0.06
Sep. 20	22.33	1.15	7.70	0.10	8.40	0.44	3.73	0.35	223.67	11.68	95.33	18.23	17.67	0.58	0.52	0.05	0.40	0
Oct. 20	21.67	1.53	7.70	0.36	8.47	0.15	3.57	0.15	123.33	12.22	71.33	28.68	13.30	2.04	0.60	0.03	0.47	0.06
Nov. 20	17.70	0.79	8.20	0.26	8.90	0.20	3.90	0.10	94.67	2.52	57.67	24.58	12.33	1.15	0.56	0.09	0.63	0.12
Dec. 20	13.13	0.57	8.53	0.21	9.20	0.26	3.13	0.21	47.00	6.08	48.67	2.52	13.73	4.15	0.54	0.13	0.47	0.12
Jan. 21	9.80	0.44	7.50	0.26	9.37	0.31	4.10	0.44	44.00	6.24	34.00	5.57	21.00	2.00	0.81	0.04	0.40	0
Feb. 21	11.93	0.55	7.53	0.21	9.07	0.25	5.03	0.25	67.00	14.53	44.33	9.07	22.83	1.16	0.56	0.07	0.27	0.12
Mar. 21	20.83	2.57	7.67	0.15	8.50	0.26	4.47	0.15	86.33	5.51	49.67	9.50	32.67	2.52	0.44	0.04	0.23	0.06
Apr. 21	25.27	0.95	8.50	0.26	8.00	0.10	3.97	0.67	142.00	7.81	57.00	4.36	68.00	4.36	0.52	0.03	0.43	0.06
May 21	31.20	1.06	8.43	0.21	7.97	0.15	4.20	0.26	273.00	14.73	37.33	4.73	82.67	1.53	0.39	0.01	0.33	0.12
Jun. 21	33.20	1.95	8.40	0.26	7.53	0.15	4.10	0.10	320.33	23.69	43.00	5.29	94.00	5.29	0.45	0.07	0.27	0.06

Table 4.2 Oyster Fish Pond's Physicochemical Profile Over Two Consecutive Years (July 2019 – June 2021)

Months	Physicochemical Parameters																	
	Temp. (°C)		pH		D.O. (ppm)		Free CO_2 (ppm)		Turbidity (NTU)		Alkalinity (ppm)		B.O.D. (ppm)		Nitrate Nitrogen		Total Phosphate	
	Mean	±S.D.	Mean	±S.D.	Mean	±S.D.	Mean	±S.D.	Mean	±S.D.	Mean	±S.D.	Mean	±S.D.	Mean	±S.D.	Mean	±S.D.
Jul. 19	31.03	1.00	7.47	1.05	5.67	0.55	4.80	0.66	350.00	13.00	68.67	6.51	18.33	3.06	0.53	0.06	0.51	0.09
Aug. 19	30.20	0.80	7.17	0.75	5.37	0.31	5.27	0.35	336.67	10.50	48.33	2.52	15.33	3.79	0.52	0.06	0.50	0.07
Sep. 19	29.10	0.62	8.07	1.31	5.83	0.35	5.27	0.40	320.33	13.50	49.67	7.51	17.33	2.08	0.49	0.03	0.47	0.13
Oct. 19	22.40	1.80	8.17	0.65	6.33	0.31	4.03	0.23	227.33	6.51	57.00	5.00	15.00	3.61	0.58	0.06	0.54	0.10
Nov. 19	16.00	1.25	8.30	1.10	6.73	0.25	4.13	0.15	114.00	13.00	76.00	4.00	12.33	2.08	0.53	0.15	0.51	0.09
Dec. 19	11.50	0.98	8.57	1.15	7.03	0.31	3.43	0.21	84.33	6.51	65.33	2.52	12.67	3.21	0.62	0.08	0.56	0.05
Jan. 20	9.50	0.66	7.90	1.50	5.83	0.40	4.23	0.25	48.67	7.51	44.00	8.00	20.33	2.52	0.53	0.19	0.50	0.05
Feb. 20	11.27	1.02	7.77	1.15	6.60	0.20	5.03	0.12	86.00	4.00	72.00	10.00	22.33	3.06	0.60	0.04	0.54	0.05
Mar. 20	19.43	0.91	7.50	0.80	5.07	0.29	4.47	0.32	65.67	9.07	71.00	7.00	28.33	2.52	0.54	0.28	0.51	0.05
Apr. 20	23.47	0.99	8.10	0.70	4.67	0.35	4.07	0.25	96.67	9.07	76.33	4.51	66.33	5.03	0.47	0.13	0.46	0.07
May 20	26.33	1.35	8.90	0.80	5.40	0.40	4.73	0.21	194.00	8.00	80.33	3.51	82.33	4.04	0.52	0.18	0.49	0.10
Jun. 20	28.17	1.70	8.07	0.65	5.63	0.35	4.33	0.15	294.00	7.00	124.00	7.00	95.00	8.19	0.51	0.10	0.48	0.15
Jul. 20	29.33	1.53	7.37	0.70	5.80	0.62	4.93	0.51	338.00	34.04	66.67	9.07	17.67	4.93	0.52	0.14	0.50	0.03
Aug. 20	28.67	1.53	7.33	0.40	5.33	0.15	5.53	0.74	324.67	56.52	47.67	3.06	15.67	2.31	0.53	0.03	0.51	0.19
Sep. 20	28.90	0.40	7.97	1.16	6.07	0.81	5.47	0.84	315.00	10.00	52.33	3.79	16.67	6.66	0.54	0.06	0.51	0.05
Oct. 20	26.17	0.32	7.90	0.60	6.47	0.15	4.00	0.35	229.67	7.23	57.67	3.21	16.33	9.45	0.56	0.05	0.52	0.15
Nov. 20	18.90	1.11	7.70	0.98	6.93	0.71	4.40	0.72	116.33	11.93	77.67	4.93	13.00	5.29	0.53	0.03	0.51	0.08
Dec. 20	13.13	1.39	8.00	1.21	7.40	0.44	3.70	0.92	87.00	3.00	73.00	4.00	13.33	4.51	0.59	0.30	0.55	0.11
Jan. 21	10.60	0.80	7.60	0.98	6.23	0.80	4.47	0.90	50.33	3.79	46.00	7.00	23.33	4.04	0.57	0.08	0.53	0.05
Feb. 21	11.73	0.90	7.40	0.56	6.70	0.53	5.20	0.46	88.33	5.03	70.67	3.06	23.67	3.51	0.53	0.08	0.50	0.04
Mar. 21	17.23	0.60	7.47	0.74	5.27	0.45	4.40	0.36	72.33	4.93	75.67	9.45	30.00	3.61	0.72	0.09	0.62	0.04
Apr. 21	22.73	1.23	7.27	0.57	4.57	0.90	4.13	0.51	98.00	14.73	79.33	1.53	67.67	3.06	0.59	0.05	0.53	0.05
May 21	26.20	1.25	8.63	0.42	5.47	0.15	4.67	0.35	192.33	3.51	76.33	7.37	81.67	3.21	0.47	0.06	0.45	0.10
Jun. 21	27.27	0.42	8.07	0.25	5.80	0.36	4.43	0.74	295.33	6.51	128.67	7.37	93.67	6.11	0.56	0.07	0.49	0.13

Table 4.3 Hakaripur Fish Pond's Physicochemical Profile Over Two Consecutive Years (July 2019 – June 2021)

Months	Physicochemical Parameters																	
	Temp. (°C)		pH		D.O. (ppm)		Free CO_2 (ppm)		Turbidity (NTU)		Alkalinity (ppm)		B.O.D. (ppm)		Nitrate Nitrogen		Total Phosphate	
	Mean	±S.D.	Mean	±S.D.	Mean	±S.D.	Mean	±S.D.	Mean	±S.D.	Mean	±S.D.	Mean	±S.D.	Mean	±S.D.	Mean	±S.D.
Jul. 19	32.23	1.69	8.13	0.81	6.60	0.87	4.77	0.21	313.67	16.86	77.67	5.13	19.00	2.00	0.53	0.10	0.51	0.04
Aug. 19	29.93	1.79	8.15	0.09	6.93	0.90	4.07	0.60	249.00	33.65	55.67	4.93	16.33	4.04	0.56	0.11	0.53	0.07
Sep. 19	28.97	1.76	8.10	0.52	6.67	0.25	4.73	0.78	279.67	11.06	55.00	3.00	17.33	3.51	0.57	0.11	0.53	0.07
Oct. 19	28.83	0.76	8.07	0.31	6.57	0.21	4.47	0.75	186.00	3.61	55.00	6.24	18.33	1.53	0.64	0.04	0.39	0.09
Nov. 19	19.03	1.71	8.13	0.06	7.50	0.36	4.40	0.56	98.00	8.19	87.00	13.11	14.33	2.52	0.62	0.04	0.44	0.04
Dec. 19	13.20	1.51	7.97	0.32	7.47	0.25	4.03	0.31	82.00	5.57	66.33	5.51	14.33	1.53	0.98	0.06	0.63	0.05
Jan. 20	11.20	1.05	8.50	0.36	6.90	0.36	3.47	0.31	46.67	4.16	50.67	6.81	22.33	3.21	0.87	0.05	0.52	0.05
Feb. 20	11.33	1.26	8.37	0.31	7.20	0.56	3.83	0.15	74.67	5.13	69.00	7.94	20.67	4.04	1.03	0.03	0.69	0.04
Mar. 20	19.67	2.08	8.63	0.21	6.80	0.72	3.80	0.46	69.67	4.16	72.33	6.51	26.00	3.00	0.57	0.03	0.54	0.04
Apr. 20	22.33	2.46	8.67	0.71	5.53	0.91	4.63	0.61	93.67	3.21	75.00	7.94	65.67	1.53	0.42	0.10	0.39	0.06
May 20	30.10	2.79	8.70	0.96	5.47	0.74	4.77	0.76	168.00	13.45	68.00	2.65	78.33	9.29	0.41	0.05	0.34	0.05
Jun. 20	31.27	3.74	8.63	0.59	5.43	0.55	3.63	0.67	284.00	29.82	134.33	17.90	88.33	2.52	0.44	0.06	0.42	0.07
Jul. 20	29.43	1.69	8.23	0.31	7.00	0.20	3.60	0.36	278.00	23.26	78.00	5.20	21.33	3.06	0.59	0.04	0.43	0.06
Aug. 20	28.17	1.04	8.17	0.51	7.13	0.25	2.97	0.32	211.33	16.26	59.67	5.03	16.67	2.08	0.67	0.05	0.48	0.09
Sep. 20	25.93	1.72	8.23	0.21	7.07	0.32	3.90	0.30	244.67	23.46	53.00	5.29	18.00	4.00	0.51	0.07	0.49	0.07
Oct. 20	25.70	1.51	7.97	0.31	7.07	0.25	3.50	0.66	193.00	6.00	58.00	4.58	18.67	1.53	0.66	0.07	0.53	0.09
Nov. 20	17.03	0.71	8.13	0.49	7.67	1.54	3.47	0.59	108.00	9.54	84.00	13.45	14.00	3.61	0.55	0.09	0.52	0.08
Dec. 20	12.90	1.49	8.17	0.45	7.63	0.70	3.27	0.31	84.00	7.00	65.33	7.51	15.00	3.00	0.49	0.05	0.42	0.07
Jan. 21	11.10	0.92	7.97	0.31	7.07	0.25	3.17	0.35	53.33	5.13	56.33	8.02	21.00	3.00	0.81	0.09	0.76	0.04
Feb. 21	13.23	0.55	8.07	0.29	7.67	0.91	4.03	0.12	69.67	9.45	70.33	2.08	20.67	2.52	0.68	0.07	0.44	0.08
Mar. 21	20.27	1.80	8.13	0.55	7.30	0.26	4.27	0.12	76.33	6.66	76.33	5.51	26.33	2.08	0.37	0.06	0.29	0.08
Apr. 21	24.30	1.05	7.85	0.27	6.87	0.35	4.67	0.64	90.00	8.54	77.67	9.07	62.67	4.04	0.45	0.07	0.38	0.08
May 21	30.33	1.33	7.87	0.38	6.67	0.51	4.73	0.38	158.67	13.50	71.00	3.00	71.00	6.24	0.32	0.08	0.26	0.06
Jun. 21	31.03	1.53	7.53	0.21	6.53	0.40	3.83	0.35	262.33	17.39	117.67	8.50	84.00	7.81	0.34	0.06	0.28	0.07

5. CONCLUSION

In this study, three fish ponds, namely Padumpur, Oyster, and Hakaripur, located

within the geographical boundaries of District Jaunpur (28°98' N longitude to 77°07' E latitude), were chosen as the research sites. The objective of the study was to investigate the impact of cyanobacterial toxins on fish populations for a period of two years, spanning from July 2019 to June 2021. Fish serves as the primary source of animal protein for the inhabitants residing in the Jaunpur area. In recent times, there has been a notable proliferation of aquaculture within this geographical area. Most fish culture ponds are reliant on rainfall and serve numerous purposes, including laundry, household activities, agricultural irrigation, animal water supply, and bathing. Cyanobacterial blooms often occur in these ponds. Nevertheless, the toxicity of these blooms has not been well investigated.

Eutrophication refers to the process through which primary production in aquatic ecosystems is increased due to the introduction of high levels of nutrients, such as phosphorus and nitrogen compounds. This influx of nutrients typically results in the overgrowth of some hazardous cyanobacteria. The issue is becoming prevalent on a worldwide scale, affecting several bodies of water. One prevalent indication of pond eutrophication is the emergence of cyanobacterial taxa, including Microcystis, Anabaena, Oscillatoria, Nodularia, Nostoc, and others. The presence of cyanobacterial blooms in fish ponds is considered unfavorable due to their disruption of the diurnal oxygen balance and their potential to obstruct the gills of some surface feeding fish species. Nevertheless, despite the availability of technological interventions to address eutrophication in stagnant water bodies, their implementation remains limited. In recent times, there has been a growing recognition of the impact of cyanobacterial toxins on human health, which is mostly attributed to the process of eutrophication. The significance of these poisons can now only be approximated. A significant part of cyanobacteria can synthesize many powerful poisons. The ingestion of water with elevated levels of toxic cyanobacteria or their toxins may result in detrimental effects on several organs, hence impacting the health of both animals and humans.

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