The Effect of Detergent on the Physico-Chemical Characteristics and Plankton Diversity of Some Ponds in Balrampur, U.P. 271201

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Abstract- **The physicochemical properties and plankton diversity were studied in Balrampur from November 2021 to April 2022. Surface water and plankton samples were collected from three sampling stations. The high value of Biochemical Oxygen Demand of 8.68mg/L and low value of Dissolved Oxygen of 1.23mg/L at the point of entry than at the upper flow of the stream indicate pollution stress. Also, the presence of a high abundance of *Anabaena* and *Oscillatoria* sp. which are pollution indicator species shows the negative effect the effluent from the detergent factory has on the stream, thus posing a potential threat to the people who live around and depend on the stream for daily use, hence the need for proper management of the stream.**

Keywords: **Physico-chemical characteristic, Plankton, and Diversity**

INTRODUCTION:

Water is very important in the daily activities of man. Pielou (1998) asserted that freshwater makes up less than 3 percent of the earth's water and is the source of virtually all drinking water. Some 55 percent of that water comes from reservoirs, rivers, streams, and lakes and these sources are vulnerable to pollution. Water applications in human life include; drinking, bathing, cooking, washing, farm and garden irrigation, livestock production, industrial raw materials, transportation, recreation and sport, hydroelectric power generation, building construction, fishery, and agriculture (Simmons, 1999; Igbozurike, 1998). Unfortunately, our rivers and streams have been faced with various human activities, which are capable of destroying the quality of water and the organisms in them (Igbozurike, 1998; Simmons, 1999).

Plankton constitutes the foundation of the food web in aquatic ecosystems and represents one of the most direct and profound responses to pollution entering water bodies (Onyema, 2010). These microscopic plants and animals are conveniently qualified as suitable indicators because they are simple, capable of quantifying changes in water quality, applicable over large geographic areas, and can also furnish data on background conditions and natural variability (Soberan et al, 2000; King and Jonathan, 2003; Abowei and Sikoki, 2005).

The bio-assessment of surface waters is a long practice and involves an analysis of the physicochemical and biological parameters of a particular water body and comparing such data with known standards (Sharma, 2003). There is a household wastes which release some detergent directly into the stream or surface water. This study provides baseline information on the effect of municipal wastes on Physico-chemical characteristics and plankton abundance of surface water of Balrampur.

MATERIALS AND METHODS

Study Area: This study was carried out in Balrampur whose latitude is 27.4307°N and longitude is 82.1805°E. In Balrampur, there are many surface water from them we selected only three station where the detergent release is much more from household. But at Purainia talab and mewalal talab it is the main source of water for most domestic and household wastes discharged in it within which is caused eutrophication and also some people collect fishes for selling purposes.

Samples Collection: Water samples were collected from three points, namely; the upstream, point of entry of industrial effluent, and downstream from November 2021 to April 2022. Water samples collected were analysed to determine Dissolved Oxygen (DO), Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Alkalinity, pH, Nitrate, Phosphate, Sulphate, Chloride, and hardness. All physicochemical analyses were carried out using standard methods followed by APHA/AWWA/WEF (1998). Plankton samples were collected using a plankton net (55µm) mesh size, just below the surface water. Samples collected were immediately preserved and tightly pack with 4% formalin. The preserved plankton samples were allowed to settle first and 0.1mL of the sample was released using a pipette and observed under the microscope. Keys provided by Needham and Needham (1962), Jeje and Fernando (1986; 1991), and APHA/AWWA/WEF (2018) were used for the identification of the plankton species. The total number of organisms per milliliter for each sample was determined after counting the number in the 0.1mL sub-sample examined. Cells of phytoplankton were counted.

RESULTS AND DISCUSSION

The results of the physico-chemical parameters measured are shown in Table 1.

Table 1: Mean and standard error of the physico-chemical parameters measured

Parameter	Upstream	Point of entry	Downstream
Temperature (°C)	23.25±0.62	23.50±0.64	22.75±0.75
pH	6.80±0.12	7.15±0.23	7.19±0.23
DO	2.24±2.84	1.23±1.75	2.42±3.20
BOD	3.58±3.16	8.68±0.91	4.64±3.02
COD	5.17±0.17	4.25±0.09	3.65±0.09
Alkalinity	31.67±2.39	43.90±3.54	45.00±0.06
Phosphate	0.70±0.80	1.32±0.10	1.47±0.06
Sulphate	631.25±83.15	1669.50±57.12	1899±22.29
Nitrate	2.72±0.11	3.95±0.09	4.35±0.09
Chloride	1.98±0.60	2.00±0.54	1.98±0.50

Water temperature was within range as mentioned for aquatic organisms. The slightly alkaline values in pH may be caused by the industrial and municipal effluent which dumped into the water body. Low dissolved oxygen, while Biological oxygen demand values were very high at the point of entry and likely pointers to pollution contamination in the stream. High organic content from industrial wastes may be responsible for low dissolved oxygen at the point of entry. Similar reports on organic pollution with a reduction in Dissolved Oxygen level include Ogidiaka et al. (2012) in Ogunpa River caused by organic-rich domestic waste. Nitrate, phosphate, and especially sulphate were high, probably a reflection of the high amount of bio-degradable waste discharges into the stream.

The abundance and diversity of phytoplankton and zooplankton encountered during the study period are shown in Tables 2 and 3. Plankton abundance in Purainia talab varied remarkably. In the upstream, the Cyanophyceae are present in large amount i.e., 50.74% which is followed by Chlorophyceae 29.75% while Protozoa was less than 10%. At the point of entry, the most abundant was Cyanophyceae 44% which is followed by Chlorophyceae 34% and Protozoa is 10%. In the downstream, Cyanophyceae accounted for 45.97% followed by Chlorophyceae 32.25% while Protozoa was 10.75% (Table 2).

Blue-green algae primarily Anabaena circularis dominated the stream. Anabaena, a filamentous form of blue-green algae was reported to dominate flora in Lake Rudolf, Kenya (Fish, 1955). It's additionally reported that *Anabaena* sp. is found in non-polluted water (Cander-Lund and Lund, 1995). However, the presence of this species in areas wherever they are not expected may well be a sign of the enrichment of the water, a term remarked as eutrophication. This aquatic community structure probably amended with the onset of eutrophication, perhaps altering water quality and rendering the stream unsuitable for human uses as they currently stand. One particular risk of the Cyanophyceae group is the fact that most of the species (especially Anabaena sp.) contain deadly substances that can be obvious whenever their blooms occur, especially in hyper-eutrophic ecosystems. They need nitrogen fixing site (heterocysts) and are therefore able to fix nitrogen; which means that they can proliferate rapidly. Anabaena is significantly familiar, to produce neurotoxins that have an effect on the human central nervous system and hepatotoxins that affect the human liver (Cander-Lund and Lund, 1995).

Table 2 : Relative abundance of Phytoplankton species

Point of collection	Plankton taxa	Species	No. of cells/ ml	% Abundance
Upstream	Cyanophyceae	*Anabaena circularis*	1875	13.12
		Coelastrum	750	5.25
		Microcystis	625	4.37
		Nostoc	500	3.50
		Oscillatoria	1500	10.50
		Spirulina	500	3.50
	Chlorophyceae	*Cladophora glomerata*	250	1.75
		Chlosterium	250	1.75
		Oocystis	500	3.50
		Spirogyra sp.	750	5.25
	Bacillariophyceae	*Chaetoceros affine*	750	5.25
		Navicula	625	4.37
		Synedra fasculata	500	3.50
Point of Entry	Cyanophyceae	*Anabaena circularis*	1750	14.00
		Oscillatoria	1000	8.00
		Phormidium mucicola	500	4.00
		Microcystis	500	4.00
		Spirulina	500	4.00
	Chlorophyceae	*Cladophora*	1500	12.00
		Pediastrum duplex	500	4.00
		Spirogyra sp.	750	6.00
	Bacillariophyceae	*Nitzschia sigmoidea*	1250	10.00
		Synedra fasculata	750	6.00
Downstream	Cyanophyceae	*Anabaena circularis*	1250	10.75

		Microcystis	500	4.30
		Spirulina	1500	12.30
	Chlorophyceae	*Chaetophora sp.*	1000	8.60
		Cladophora glomerata	500	4.30
		Spirogyra sp.	500	4.30
		Xanthidium fasciculatum	500	4.30
	Bacillariophyceae	*Navicula*	500	4.30
		Nitzschia sigmoidea	500	4.30
		Synedra faculata	875	7.52

Table3: Relative abundance of Zooplankton species

Position of collection	Plankton group	Species found	No./ml	% Abundance
Upstream	Rotifer	*Keratella tropica*	500	66.7
	Protozoa	*Arcela costata*	375	2.62
		Volvox sps.	750	5.25
		Euglypha tuberculata	250	1.75
Point of Entry	Rotifer	*Lapadella patella*	375	60
	Protozoa	*Didinium bolbianii*	500	4.00
		Epistylis sps.	250	2.00
		Vortecella mayerii	250	2.00
Downstream	Rotifer	*Keratella tropica*	250	33.3
		Lepatella patella	250	33.3
	Protozoa	*Arcela costata*	250	2.15
		Carchesium sps.	250	2.15
		Spirostomum sps.	250	2.15
		Vorticella mayerii	500	4.30

At the point of entry, green algae, *Cladophora glomerata, Ankistrodesmus falcatus* and blue-green algae, *Anabaena circularis* were dominant. Whereas downstream algae, *Spirulina major* and *Anabaena circularis*, green algae, *Chaetophora* sp., diatom Synedra fasculata were dominant. Spirulina sp. and *Phormidium* sp. are indicators of the alkaline nature of the river, its high nutrient standing, and the presence of deadly contaminants (Nwankwo, 2004; Vanlandingham, 1982; Nwankwo and Akinsoji, 1992). According to Patrick (1973), communities affected by toxic pollution have low diversity and a low number of species; whereas, a community is plagued by deadly organic pollutants which have a high number of species but low diversity.

Rotifers and Protozoans were encountered throughout the study period (Table 3). Zooplankton species like *Arcela*, *Didinium*, *Vorticella*, *Epistylis, and Keratella* were recorded however their prevalence was low when compared to those of the phytoplankton. The lower abundance of zooplankton might be explained by the high rate of waste discharges from the surrounding industry into the stream. Probably, this might even be accountable for the absence of fish in the stream. Therefore, the presence of high pollution indicator species of *Anabaena* and *Oscillatoria*, low Dissolved Oxygen, and high Biochemical Oxygen Demand revealed that Purainia talab is polluted.

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