



ASSESSMENT OF VARIOUS PHYSICOCHEMICAL PARAMETERS AND MICROBIAL ACTIVITY OF LAKE WATER IN NAGPUR DISTRICT

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Abstract:

In the last decade ever increasing population, urbanization and modernization are posing problems of sewage disposal and contamination of surface waters like lakes. The water gets contaminated due to manmade activities due to which the water becomes unsafe for drinking. In this study, physicochemical parameters of two very important lakes i.e. Gandhisagar lake and Sakkardara lake in Nagpur district were studied. Water samples were collected and various physical and chemical properties like pH, color, temperature, conductivity, total solids, total dissolved solids, dissolved oxygen, alkalinity in water samples were studied and compared with desirable limits. It was found from the analysis that the water of both the lakes situated in Nagpur district was not fit for domestic purpose. It can only be used for general purpose.

Keywords: physicochemical parameters, Gandhisagar lake, Sakkardara lake, alkalinity.

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Introduction:

Water covers 71% of earth's surface. Water of adequate purity which is the life of our species is of vital importance¹. Water is even more important for human beings as they depend on it for food production, industrial and waste disposal as well as cultural requirements². Water is an excellent solvent for wide variety of substances both organic and mineral. We have many sources of water on the earth's surface like surface water and ground water. Due to human activities like discharge of domestic waste in the water sources such as ponds, rivers, etc water gets contaminated³. The water of the ponds, lakes and rivers is polluted mainly due to discharge waste water from residential areas, sewage outlets, solid waste, detergents, automobile oil waste, fishing facilities and agricultural pesticides from farm lands⁴.

In this study surface water sample from two different lakes were analysed. The objective of this work is to determine various physicochemical parameter and to study the probability of microplastics in water. The values of different physicochemical properties changes with seasons and the highest values of pollutants were recorded in winter season⁵. Waste water used for irrigation fields contain considerable amount of potentially toxic substances including dissolved salts and heavy metals⁶. Nowadays water pollution is a serious problem for human and aquatic life. It is a main cause of death due to water borne diseases. Water pollution is measured by analysing water samples. Physical, chemical and biological tests can be conducted. One of the most important reason for water pollution is presence of microplastics in water. Microplastics are wide spread and have been found in marine environments, surface water, soil, The air we breathe and in some food we eat. In the last decade environmental problem caused by microplastics have been the center of scientific interest and studies in this area are rapidly increasing. In this work we have determined various parameters like pH, Water temperature⁷, color, conductivity, TDS, DO, microbial activity and microplastics.

Experimental Methodology:

Collection of Water Samples:

Water samples from Gandhisagar lake and Sakkardara lake were collected in clean and dry bottles and comparatively studied. Both the lakes are in Nagpur District. The two bottles were labelled as sample A (Gandhisagar Lake) and sample B (Sakkardara Lake) respectively for

identification. Various physical and chemical parameters were studied which included

Determination of Colour:

The sample was taken on the watch glass to determine the colour

Determination of Temperature

The temperature was measured at the spot and it was found to be 26°C at Gandhisagar lake and 24°C at Sakkardara lake.

Determination of pH by pH Meter:

- The pH meter was standardized according to the cell constant.
- A standard buffer solution was selected with a pH value close to that of the water to be treated.
- Temperature of the buffer was set.
- Set the meter to the pH of the buffer at that temperature.
- The electrode response was checked by measuring a second standard buffer solution at different pH.
- The electrode was washed thoroughly first with distilled water and then with the sample.
- Set the temperature control to the temperature of the sample.
- The electrode was immersed in the sample and the pH was recorded after stabilizing the system.

Determination of conductivity by conductometer:

The water samples were taken in a beaker. Electrodes were inserted in it and electrical conductivity was measured.

Determination of Total Dissolved Solid (TDS):

The procedure for calculating the TDS in water sample is as follows.

- A clean and dry china dish was taken and weighed.
- 50 ml of water sample was taken and filtered three times to separate macroparticles and water sample was transferred to the china dish
- The china dish containing filtrate was heated on the burner until it became completely dry.
- Weight of the china dish was taken

Determination of Total Hardness:

- 10 ml water sample was taken in a conical flask and half test tube buffer solution was added to it
- 1 – 2 drops of EBT indicator was added when wine red colour developed
- It was titrated against EDTA till wine red colour changed to blue

Determination of Permanent Hardness:

- 100 ml of water sample was taken in a borosil beaker and heated for 30 minutes till it was reduced to half.
- The water sample was cooled at room temperature and filtered.
- It was transferred to 100 ml volumetric flask and volume was made up.
- 25 ml of water sample was taken from the volumetric flask into conical flask and half test tube of buffer solution was added.
- 1 to 2 drops of EBT indicator was added and titrated with standard EDTA solution. The end point was obtained from wine red to blue.
- The titration was repeated to get concurrent reading.

Determination of Dissolved Oxygen:

To find normality of hypo solution:

- 25 ml of standard $K_2Cr_2O_7$ solution was taken in a conical flask and 10 ml KI solution, half test tube H_2SO_4 and pinch of $NaHCO_3$ was added. Cork the flask and wait for 5 minute.
- It was titrated with sodium thiosulphate using starch as indicator.
- At the end point colour changed from dark blue to faint blue.

Determination of Dissolved Oxygen:

- 300 ml of water sample was taken in BOD bottle with the help of measuring cylinder and 2 ml of alkaline iodide azide solution was added with the help of graduated pipette.
- The content were shaken well. Brown coloured ppt was formed and the ppt was allowed to settle down.
- 25 to 50 ml supernatant liquid was taken out with the help of pipette.
- Some space was created in the bottle for performing titration.
- few ml of conc. H_2SO_4 was added to dissolve the ppt.
- The content was titrated with hypo solution using starch as a indicator. At end point colour changes from dark blue to colourless or light blue.

Determination of Microbial Activity:

For E Coli:

- 36 g of EMB agar in 1000 ml distilled water (deionised water) was added.
- Heated to dissolve the medium completely.
- Sterile by autoclaving at 15 lbs pressure ($121^\circ C$) for 15 min.

- The liquid agar was poured to the sterile petriplates in warm condition.
- It was Allowed to cool at room temperature.
- Then the agar gets solidified and the plates were ready for further procedure.
- After that the inoculating loop was sterilized by placing it over the burner until it became red hot.
- Little amount of water samples was transferred into the EMB agar plates and labelled them as sample A and sample B.
- The inoculation was done using four way striking with the help of inoculating loop.
- The plates were inverted and placed inside the incubator for 24 to 48 hrs.

MFT for E. Coli:

- The samples collected were diluted
- Appropriate nutrient or culture medium was selected. Dispense the broth into a sterile Petri dish, evenly saturating the absorbent pad.
- The forceps were flamed, and the membrane was removed from the sterile package.
- The membrane filter was placed into the funnel assembly.
- The funnel was rinsed with sterile buffered water and the vacuum was Turned on and the liquid was allowed to draw completely through the filter.
- The forceps were flamed and the membrane filter was removed from the funnel.
- The membrane filter was placed into the prepared Petri dish and Incubated at the proper temperature and for the appropriate time period.
- The colonies were counted and confirmed and results were reported.

Determination of Micro plastic in Water Sample:

- First the Sample residues were prepared.
- 1000 ml of each water sample was taken in clean and dry beakers separately.
- The two beakers were placed in water bath for boiling.
- The beakers were heated until the water gets completely dry.
- The residue was collected from beakers.

RESULT AND DISCUSSION

The physicochemical parameters of water samples collected from **Gandhisagar lake (Sample A)** and **Sakkardara Lake (Sample B)** are given in Table 1

Table 1

Sr. No.	Permissible Limit	Parameters	Sample A	Sample B
1	6.5 to 8.5	pH	7.25	6.97
2	Colourless	Colou	Light yellow	Light Yellow
3	No guidance	Conductivity	1.05 at 20 ms	0.64 at 20 ms
4	500 mg/l	Total Dissolved Solid	780 mg/l	560 mg/l
5	200 mg/l	Hardness	4800 mg/l	5600 mg/l
6	20 mg/l	Dissolved Oxygen	22 mg/l	16.26 mg/l
7	0	Microbial Activity: Fecal Coliform No. of colonies / 1000 ml	36	33

The physicochemical and toxicological parameters are important for assessing the water quality. The main purpose of analysing the physical, chemical and toxicological characteristics of water is to determine its pollution status. In fact, the final status of water body is conditioned by these factors and status of the water is really the result of interaction of these factors. Steady change in the atmospheric temperature with the change in the season results in the corresponding change in the water temperature and other pollutant.

From the above observations it was found that some values of the parameters have more difference so it is considered that the water is highly polluted and it cannot be used for domestic purpose. The water should not be very hard. If the water is too hard then it is not easy for digestion. From our above result the permissible limit of hardness of water must be in between 200 mg/l but, it was found that the value of hardness of sample A is 4800 mg/l and that of sample B is 5600 mg/l which was found to be very high. Thus from these values we can say that both the water samples are too much hard. The fecal coliforms count was also very high hence both the water samples are highly contaminated with the presence of E. Coli.

Due to day to day life activities and rituals like Ganpati visarjans etc are responsible for various types of pollutants which were found to be present in both the water samples. Even trace amount of microplastic was found in the both water sample.

Some peaks were observed when both the samples were studied under FTIR. Out of which three peaks showed the probability of microplastic as polypropylene in water sample at the range of 717.55, 1473.67, 2914.56 for sample A and 717.55, 1473.67, 2914.56 for sample B. This microplastic can damage the aquatic life as some aquatic animal ingest the microplastic during its feeding, It is very difficult for animals to digest the plastic. The little amount of microplastic that is daily added to the water as a pollutant, forms a thin layer above the surface of water which contaminate the water.

Thus from above discussion it is clear that both the water samples are contaminated.

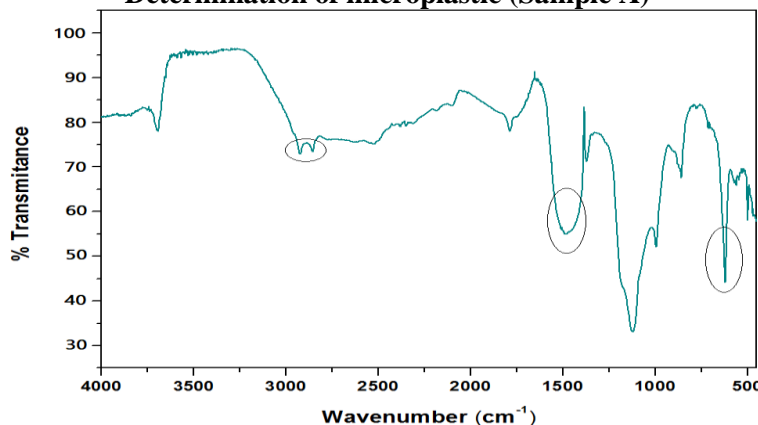
CONCLUSION

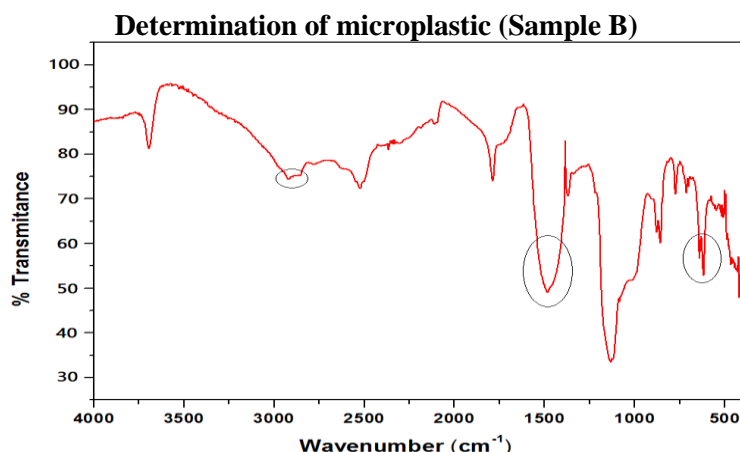
From the above observations the present study indicates that both the lakes situated in Nagpur are not fit for domestic purpose. The water analysis was done in winter season hence it contains more amount of pollutant and thus the water is contaminated. The analysis of water quality parameters of Gandhi Sagar Lake and Sakkardara lake water are over the permissible limit, therefore it can be used for general purpose.

The analysis of both the water samples were studied and some parameters are present in excess amount like TDS, hardness, ecoli and probability of microplastic. Hence it is suggested that both the water samples are not suitable for drinking purpose

Graphs

Determination of microplastic (Sample A)





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