

STUDY OF SURFACE WATER QUALITY AND ITS TREATMENT USING BIO COAGULANTS

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Abstract

This study aims in understanding the physical, chemical and biological conditions of Kattigenahalli Lake. This Lake is situated in Kattigenahalli, Yelahanka. This is not being used by residents due to unknown reasons. This work aims in treating the lake water using organic purification which consists of three bio coagulants, which are Moringa oleifera, Tamarind seeds and activated charcoal using rice husk. These were used as locally available natural coagulants in this study to reduce turbidity and other parameters.

Optimum dosage of Moringa oleifera seeds Powder, Tamarind seed powder and activated charcoal of rice husk was found to be 0.4g/l, 1g/l and 3.5 g/l respectively. The percentage reduction in turbidity after treating the lake water with Moringa Oleifera Seeds Powder, Tamarind Seeds Powder and Activated Charcoal from rice husk was found to be 24.07%, 65.82% and 78.14% respectively. Among the three Biocoagulants used, activated charcoal was found to be the best as it reduced 78.14% of turbidity of the lake water.

Keywords—lake, surface water, bio coagulants, Moringa oleifera, rice husk, tamarind seeds

1. INTRODUCTION

Healthy Lakes are needed to maintain the ecological balance of the nature and they augment our bio diversity. Lakes store huge amount of water and helps during droughts and shortages as well as acts a sink during floods. Lakes also help in groundwater recharge, and also influence the water quality of downstream watercourses.

Most of the major surface water bodies in Bangalore have been heavily polluted. This led to over exploitation of existing groundwater supplies. Inconsiderate disposal of solid and hazardous waste has polluted these aquifers to the extent that they are not able to meet the drinking water standards. Over pumping of groundwater has resulted in lowering of the groundwater level in most parts of Bangalore.

Yelahanka is a small sub urban place of Bangalore in the state of Karnataka which is now a part of the Bruhat Bangalore Mahanagara Palike (BBMP). Yelahanka has several lakes and Kattigenahalli Lake is situated at a longitude of 37°30" and latitude of 7°30. Construction work is going on in the lake premises by the BBMP authority to make the lake as a point for social activities. ". This lake was also found to be polluted due to sewage discharge.

Coagulation of water using alum as the coagulant is a regular practice in all water works since long time. Coagulation helps in removing the colloidal particles as well

as pathogens that are attached to the particles. However, the cost of these chemicals and its side effects in long run has caused to consider the natural coagulants as an encouraging alternative. In the present study, Moringa Oleifera, tamarind seeds and activated charcoal made from rice husk was selected as coagulants. Earlier studies had shown that most of these bio-coagulants can reduce turbidity better than alum. Tamarind seeds are also said to reduce turbidity and fluoride content. Activated charcoal derived from rice husk is found to be an excellent medium to remove turbidity, colour and few heavy metals.

2. METHODOLOGY

- A. **Collection of samples:** The lake water was collected in thoroughly washed, five litre capacity plastic cans during morning time (8:30-9:30) on the sampling days. Water samples were collected near the bank of the lake as well as from the lake interiors to maintain an average and a uniform quality for the sample.
- B. **Preservation of the samples:** The samples collected were preserved at optimum temperature of about 4°C.
- C. **Analysis:** The samples collected were analysed to find out the physical, chemical and biological contents, based on the analysis the samples were treated by using organic methods as given below;

D. Moringa Oleifera Seeds Powder (MOSP): Moringa Oleifera Seeds which was ripened and not edible was preferred for the study. It was collected and deseeded and then dried properly in sunlight until all the moisture was evaporated. The dry seeds were then ground to get fine powder. The MOSP was sieved and used for the analysis.

E. Tamarind Seed Powder (TSP): Tamarind seed used in this study was first soaked in water to remove the pulp; it was washed well with tap water. Further the tamarind seeds were properly dried in the sunlight. The seeds were first crushed in mortar and pestle and the outer covering was removed as much possible, further it was powdered finely and sieved under 150 micron and was used for the test.

F. Activated charcoal from Rice Husk (ACRH): Rice Husk was obtained from local rice mills. In the first step, (Carbonization) 15 gram of Rice Husk was heated gradually at a temperature rate (250-300⁰ C) for fifteen minutes in a muffle furnace. It was activated at 105⁰ C for 20 mins. The product was cooled giving desired pure adsorbent.

G. Jar test: The analysis of optimum dosage of coagulant was conducted in jar test apparatus. Jar test was conducted with varying quantities of MOSP, TSP and ACRH at uniform pH and temperature.

3. RESULTS AND DISCUSSIONS

3.1 Initial Water Quality of the Lake

The initial analysis of lake water sample had given the following results:

Table 1: Initial Water Quality Parameters

Parameters	Average values
Turbidity (NTU)	18
pH	8.06
Colour	Not agreeable
Odour	Objectionable
Total Hardness (mg/l as CaCO ₃)	189.8
Calcium Hardness (mg/l as CaCO ₃)	64
Magnesium Hardness (mg/l as CaCO ₃)	125.8
DO content (mg/l)	8.1
Chloride content (mg/l)	92.5
Total Coliforms (MPN/100 ml)	161

Most of the physical and chemical parameters were well within the permissible limits prescribed by Indian Standards, but colour and odour were disagreeable. The sample had high content of total Coliforms also. Turbidity of the lake water was 18 NTU. As per the Indian Standards, 5-10 NTU is acceptable for drinking water. Therefore the lake water required purification before domestic usage.

3.2 Jar Test to Find the Optimum Dosage

3.2.1 Tamarind Seed Powder (TSP)

Jar test was conducted to find the optimum dosage of tamarind seed powder by varying the dosages. The optimum dosage was found to be 1g/l which was efficient in removing 65.82% of turbidity. The results are tabulated below:

Table 2: Optimum dosage of TSP

Trial no.	Dosage g/l	Initial turbidity (NTU)	Final turbidity (NTU)	% reduction in turbidity
1	0.2	16	10	37.5%
2	0.4	16	10	37.5%
3	0.6	16	12	25%
4	0.8	16	12	25%
5	1	19.9	6.8	65.82%
6	2	19.9	7.6	61.8%
7	3	19.9	8.6	56.78%
8	4	19.9	8.2	58.79%

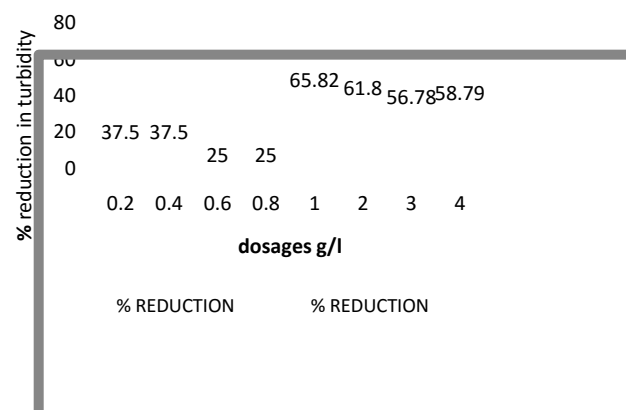


Fig 1: Percentage reduction in Turbidity of sample versus TSP dosage

3.2.2 Moringa Oleifera Seed Powder (MOSP)

Jar test was conducted to find the optimum dosage of MOSP by varying the dosages. The optimum dosage was found to be 2g/l which was efficient in removing 24.07%. The results are tabulated below:

Table 3: Optimum dosage of MOSP

Trial no.	Dosage g/l	Initial turbidity	Final turbidity	% reduction
1	2	16.2	12.3	24.07%
2	4	16.2	13.4	17.28%
3	6	16.2	27.3	-
4	8	16.2	58	-

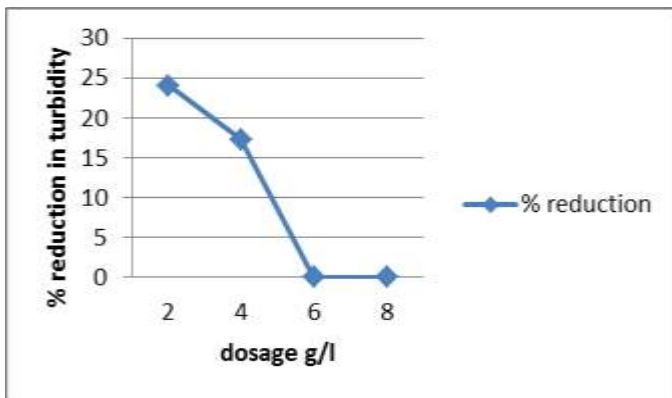


Fig 2: Percentage reduction in Turbidity of sample versus MOSP dosage

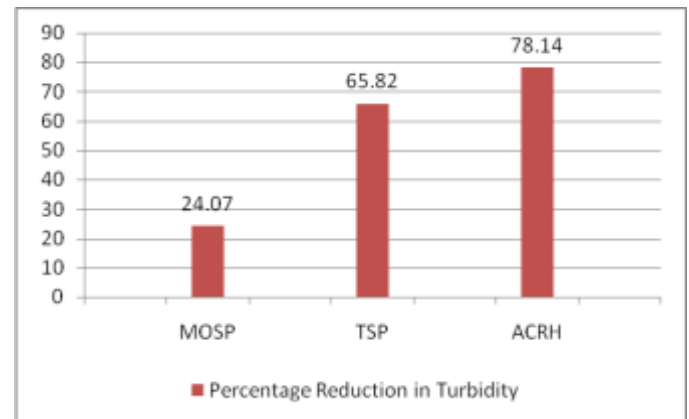


Fig 4: Comparison between MOSP, TSP and ACRH in reduction of turbidity

3.2.3 Activated Charcoal using Rice Husk (ACRH)

Jar test was conducted to find the optimum dosage of activated charcoal from rice husk by varying the dosages. The optimum dosage was found to be 3.5g/l which was efficient in removing 78.14% of turbidity. The results are tabulated below:

Table 4: Optimum dosage of ACRH

Trial no.	Dosage g/l	Initial turbidity	Final turbidity	% reduction
1	1	16	6.2	61.25%
2	2	16	4.9	69.37%
3	3	16	6.2	61.25%
4	3.5	16	3.5	78.14%

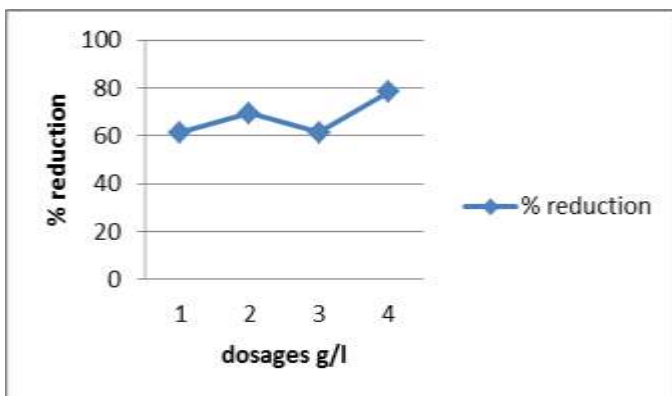


Fig 3: Percentage reduction in Turbidity of sample versus ACRH dosage

3.3 Comparison between all the Three Biocoagulants

The three Biocoagulants used for the study, viz MOSP, TSP and ACRH was found to be good coagulants as the turbidity of sample was reduced considerably. But ACRH was the best among the three, as there was a turbidity reduction of 78.14%.

4. CONCLUSION

By conduction of jar test for the bio coagulants such as Moringa oliefera, tamarind seeds and activated charcoal using rice husk, it is clearly seen that activated charcoal is a better coagulant in removing turbidity. It has extensively developed internal pore structure. Due to activation, internal pore network is created and thus carbon gets its unique characteristics leading to high surface area, porosity and greater strength.

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