ISSN No:-2456-2165

Study of Surface Water Bodies and its Treatment Using Biocoagulants

Deepak Kumar Maurya, Devanshu Singh, Mukul Kashyap, and Sadique Ansari
Galgotias University. Address: Kerakat, Jaunpur, Uttar Pradesh
Galgotias University. Address: Allahabad, Uttar Pradesh
Galgotias University. Address: Meerut, Uttar Pradesh
Galgotias University. Address: Kopa, Jaunpur, Uttar Pradesh

Abstract:- This study aims in understanding the physical, chemical and biological conditions of Yamuna River, which flows through Noida, Uttar Pradesh. The water from this river is not being used by residents due to its highly polluted contents which leads to high Turbidity. This work aims in treating the river 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 river 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 river water.

Keywords:- *Bio Coagulants; Turbidity; Eco-Friendly; Optimum Dosage; Jar Test.*

I. INTRODUCTION

Healthy Rivers and Lakes are needed to maintain the ecological balance of the nature and they augment our bio diversity. Rivers and Lakes store huge amount of water and helps during droughts and shortages and act as a sink during floods. Rivers and Lakes also help in groundwater recharge, and also influence the water quality of downstream watercourses. Most of the major surface water bodies in Uttar Pradesh 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 the state.

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 were selected as coagulants. Earlier studies had shown that most of these bio-coagulants can reduce turbidity better than alum. Tamarind seeds are also are 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.

Water is essential for human survival. It has been reported that the total amount of water in the world is about 1400 million cubic km and remains constant. Apparently, more than 97.5% of this total volume is seawater of the rest 2.5% is ground water and ice locked away in the glaciers and the polar ice cap.

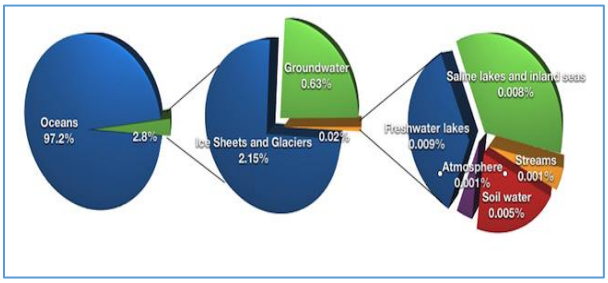

Fig 1. Distribution of Water available on Earth Surface

II. MATERIALS AND METHODOLOGY/STUDY AREA AND METHODS

Coagulants and its Types:

A coagulant is a chemical which in solution furnishes ionic charges opposite to those of the colloidal turbid particles in water. Coagulants neutralize repelling charges on the colloidal particles and produces a jellylike spongy mass called a floc. Flocculation causes considerable increase in the size and density of coagulated particles resulting in a faster rate of settling of the particles in a solution or in the wastewater.

Alum a metallic coagulant has been a suitable coagulant in water and wastewater treatment for many years now. It has been in use and is still in use in the form of powder dispensed by one of the several forms of mechanical dry feeder units. This unit automatically controls the amount of alum fed and

measures the time of coagulation as well. The early treatment plant added lime directly to water flow, this was inefficient as it did not assume mixing.

Today, the dry alum bag is dropped into a solution which is then transported to the mixing and flocculation basin of the plant. There also exists the polymeric polyelectrolyte coagulant which is long chain high molecular weight molecules which bear a large number of charged molecules with their net charge either positive, negative and/or neutral. The chemical groups on the cationic polymer are thought to combine with active sides of colloids; such interaction of a single molecule with a large number of particles produces a bridging effect binding them together into a large particle which settles under the action of gravity.

Historical Development of Biocoagulants:

Some previous studies have screened a number of plants as disinfectant for water treatment. Native plants have traditionally been used to improve quality of water in many countries in Africa and Latin America viz. Seeds of Moringa used in Guatemala, peach and bean seeds are used in Bolivia as coagulant aids clarify water. It has been reported that dried beans and peach seeds have been used in Bolivia and other countries of water treatment. Similarly, *Schoenoplectus tatora*, an aquatic plant has been used in Bolivia and Peru for Water Quality treatment.

Seeds of Moringa Oleifera

The seeds of *Moringa oleifera* tree have been found to be of great importance and most widely studied. Oil extracted from the seed is used to treat goitre and acute rheumatism and also applied as remedy for hysteria scurvy. The oil is also used in cosmetics production and as lubricants in delicate machines like watches. The seed is, today, used in water treatment as a coagulant and disinfectant. The seed contains fixed oils, fatty acids such as palmitic acids, oleic acids, behinic acids, stearic acids and pterygospermin, an unstable substance with low melting point which decomposes readily to benzylisothionate.

Chemical Constituents of Moringa Oleifera (lam)

Moringa Oleifera Lam contains several phytochemicals, some of which are of high interest because of their medicinal value. In particular, Moringa Oleifera or Moringaceae family is rich in a fairly unique group of glycoside compounds called glucosinolates and isothiocyanates. The effectiveness of the Moringa plant in treating ovarian cancer has been linked to the ability benzyl isothiocyanate (BITC) and phenethyl isothiocyanate (PEITC) to induce apoptosis in ovarian cancer cells in vitro. There is even evidence supporting the antitumour activity of isothiocyanates in cancers of the lung, breast, skin, esophagus and pancreas. The root bark of Moringa Olefera contains two alkaloids; total alkaloids 0.1%, which are Moringine known to be identical to benylamine and Moringinine known to belong to the sympathomimetric group of bases. Many other Minors phytochemicals in traces such as; essential oil with pungent smell, phytosterol, waxes, and resins are found in the entire plant. Furthermore, a rich and rare combination of zeatin, qurcetin, betasitosterol, caffeoy/quinic acid, pteygospermin and kaempferol have been identified in the plant as well.

These components are also found in other Moringa species except for varying quantities, but studies are still inadequate on the other species. In some parts of Northern Nigeria in the early days some indigenous people walk with crushed seeds of *Moringa* when going to the farm, and would use it to treat any suspicious water they came across, before drinking, especially while on farms that are far away from homes with difficulty of getting potable water.

It is worth noting that as much as some communities still remember and practice their traditional knowledge especially in water management, many still do not have or might have forgotten these old methods and now abandoned and lost. A number of communities in rural Africa do not treat their drinking water at all yet. The implication of this has invariably tantamount to increase in the rates of infectious diseases.

Methodology

1. Collection of samples:

The river 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 river as well as from the river interiors to maintain an average and a uniform quality for the sample.

2. Preservation of the samples:

The samples collected were preserved at optimum temperature of about 40C.

3. 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.

4. 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.

5. 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.

6. 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 105 0 C for 20 mins. The product was cooled giving desired pure adsorbent.

7. 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.

III. RESULTS

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

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

Table 1. Initial Water Quality Parameters

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 river water was 18 NTU. As per the Indian Standards, 5-10 NTU is acceptable for drinking water. Therefore the river water required purification before domestic usage.

Jar Test to Find the Optimum Dosage:

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:

Trial No.	Dosage (g/l)	Initial NTU	Final 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	1.0	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

Table 2. Optimum Dosage of TSP

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 NTU	Final NTU	% reduction in Turbidity
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	-

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:

Trial No.	Dosage (g/l)	Initial NTU	Final NTU	% reduction in Turbidity
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

Table 4. Optimum dosage of ARCH

IV. DISCUSSION

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%.

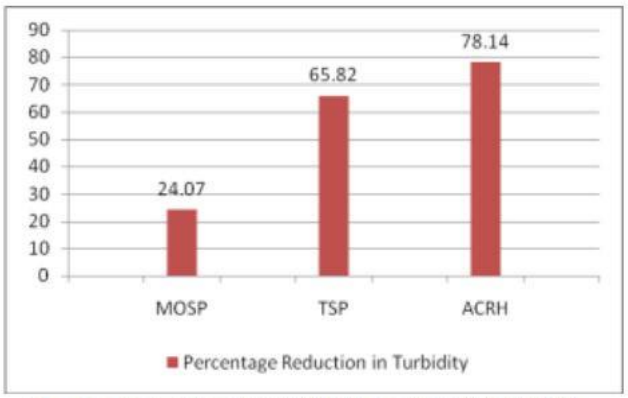

Fig 2. Comparison between MOSP, TSP, ARCH in reduction of Turbidity

V. CONCLUSIONS

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.

The conclusion is drawn that biocoagulants have been used in many African indigenous communities from antiquity with great benefits and we can use these biocoagulants in INDIA as well for water purification purposes.. In an era of increasing environmental concerns, water scarcity ad-mist the draw backs of chemical coagulants and poor sanitary facilities in most low income earning countries, the need to further develop natural coagulants as alternative environmentally favourable water purifying chemicals is exigent.

ACKNOWLEDGEMENTS

This project was approved by Galgotias University. We would like to express our special thanks of gratitude to our Guide Mohd Aamir Jafri Sir as well as the dean of department of civil engineering Deepak Soni who gave us the golden opportunity to do this wonderful project on the topic Study of Surface water bodies and its Treatment using Biocoagulants, which also helped us in doing a lot of Research and i came to know about so many new things I am really thankful to them.

Secondly i would also like to thank my parents and friends who helped me a lot in finalizing this project within the limited time frame.

REFERENCES

[1]. Shaasana Parishodhane by Dr. M...G. Manjunaatha, Dept. of Kannada, Mysuru University
[2]. Dr. Syed Eqbal Hasan, Water and Ecological Balance, Islamic Research Foundation International, Inc.
[3]. T.Phani Madhavi1, R. RajKumar, International Journal of ChemTech Research International Journal of ChemTech Research
[4]. Smrutirekha Das, characterization of activated carbon of coconut shell, rice husk and karanja oil cake, Department of Chemical Engineering National Institute of Technology Rourkela-769008 2014
[5]. Mangale S. M., Chonde S. G., Jadhav A. S., and Raut P. D. Study of Moringa Oleifera seed as natural Absorbent and Antimicrobial agent for River water treatment. Nat. Prod. Plant Resource, 2012, 2 (1):89- 100.
[6]. K. A. Yongabi, Biocoagulants for Water and Waste Water Purification, International Review of Chemical Engineering, Vol. 2 N. 3 May 2010.
[7]. Aldom, J.E. and Chagla, A.H (1995) Recovery of Cryptosporidium oocysts from water by a Membrane filter dissolution method. *Letters in Applied Microbiology*