

Water Treatment Using Natural Coagulants At Futalalake ,Nagpur

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Abstract- Nagpur city with coordinates of 21°8'55" and 79°4'46"E is second capital of Maharashtra state. Nagpur city is popularly known as orange city, also city of lakes. The city had 10 lakes in the past, but unfortunately only 7 of them are there now. The Futala Lake with a coordinate of 21°8'44"N and 79°03' 48"E is closed water body. The Futalalake is spread over 60 acres. The Futala Lake is located at the western side of the Nagpur city. The catchment area of dam is 6.475 sq. km. The length of west weir is 8.0m. Futalalake is having capacity to irrigate an area of 34.42 hectares of cultivated agriculture land and Telenkhedi Garden. The initial purpose for irrigating nearby agricultural land was prominent amongst the utilization of Futalalake.

Lakes in urban expanses are ecologically very important. Those inland water bodies play a major role in sustainable urban development. As a result of the swelling land use and effluent disposal from domestic and industrial activities, water bodies in the urban regions have been suffering in recent times. The present study aims in understanding the physical, chemical and biological conditions of the Futala Lake. This Lake is situated in Nagpur, Maharashtra. This is not being used by the residents due to unknown reasons.

This paper is based on treating Lake water using organic purification unit which consists of three bio coagulants, which are *Moringaoleifera*, Tamarind seeds and activated charcoal using rice husk which are locally available. Studies conclusively demonstrate that bio coagulants are as efficient alum in purifying water at low cost and also have antimicrobial properties. These were locally available natural coagulants in this study to reduce turbidity and other parameters.

Keywords- Water, lake, Biocoagulants, Coagulation, Physical, Alum, *Moringaoleifera*, *Caesalpiniaspinosa*

I. INTRODUCTION

Lakes are important feature of the Earth's landscapes. They are not only a significant source of precious water but provide valuable habitat to plants and animals, enhance the

aesthetic beauty of the landscape and offer many recreational opportunities. Lakes are the hub of socio-economic activities of the country. These are dynamic ecosystem that reflects their specific characteristics, variations in climate and biological component.

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 Nagpur 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 Nagpur.

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, *MoringaOleifera*, 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.

The tests were carried out, using Futala Lake water with conventional jar test apparatus and samples were sent to laboratory for further test. The percentage reduction in turbidity was found to be 24.07%, 65.82%, 78.14% respectively. Among the three, activated charcoal was found to be the best in removing turbidity as it was efficient in

removing 78.14% of turbidity. The treatment unit was efficient in removing total coliforms and fluoride content too. The laboratory results of bore well samples showed that it is absolutely safe and potable and availability of water from bore wells are also quite sufficient for taking care of water requirements of this area.

1.1 Moringaoleifera

Moringaoleifera (MO) seed is a natural plant with active bio-coagulate compounds that can be used for water clarification since it reduces the use of chemical-based coagulants.

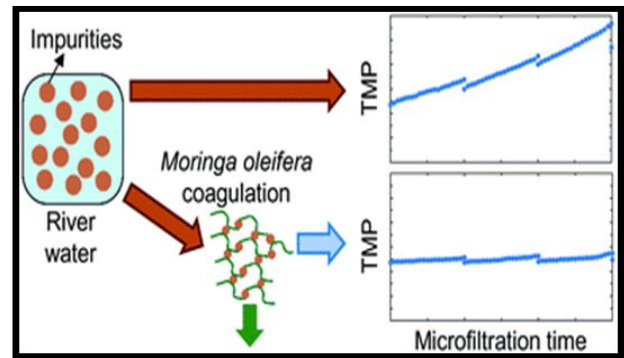
CRUSHEDSEEDS of the tree Moringaoleifera Lam. (M.oleifera) are a viable replacement coagulant for proprietary chemicals such as aluminium sulphate (alum) in developing countries. The tree is a multi-provider that grows pantropically and its uses, global distribution and some vernacular names are given.

Results of full scale treatment trials using M.oleifera as the sole coagulant are presented. The study was conducted in February 1994 at the Thyolo treatment works in southern Malawi under the auspices of the Ministry of Works Water Department. The works comprises flocculator-clarifiers, rapid gravity filters followed by chlorination. Imported alum and soda ash are the coagulants normally used on the works. When replaced by M.oleifera seed solution comparable treatment performance was achieved. This is the first time that any naturally derived material has been successfully used as a primary coagulant on such a scale (works flow 60 m³/hour) with the treated water entering supply. Inlet turbidities during the trials ranged between 270 and 380 NTU. Finished water turbidity was consistently below 4 NTU.

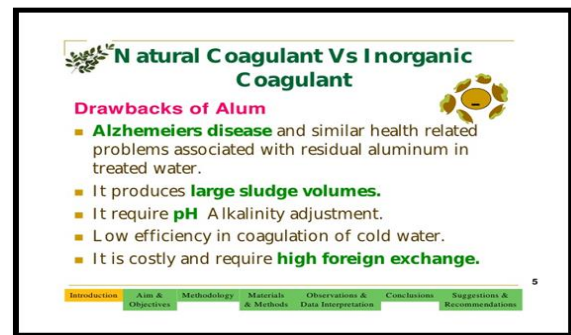
M.oleifera seeds yield a vegetable oil high in oleic acid and thus of high market value for cooking and soap manufacture. The presscake remaining after oil extraction contains the active components effecting coagulation.



(Figure:1Moringaoleifera)



(Figure: 2 Moringaoleifera as alternative Coagulants)



1.2 Caesalpiniaspinosa–

Tara spinosa, commonly known as tara (Quechua), is a small leguminous tree or thorny shrub native to Peru. T. spinosa is cultivated as a source of tannins based on a galloylatedquinic acid structure. This chemical structure has been confirmed also by LC-MS. It is also grown as an ornamental plant because of its large colorful flowers and pods.

T. spinosa typically grows 2–5 m tall; its bark is dark gray with scattered prickles and hairy twigs. Leaves are alternate, evergreen, lacking stipules, bipinnate, and lacking petiolar and rachis glands. Leaves consist of three to 10 pairs of primary leaflets under 8 cm in length, and five to seven pairs of subsessile elliptic secondary leaflets, each about 1.5–4 cm long. Inflorescences are 15–20 cm long terminal racemes, many flowered and covered in tiny hairs. Flowers are yellow to orange with 6- to 7-mm petals; the lowest sepal is boat-shaped with many long marginal teeth; stamens are yellow, irregular in length and barely protruding. The fruit is a flat, oblong indehiscent pod, about 6–12 cm long and 2.5 cm wide, containing four to seven round black seeds, which redden when mature.



(Figure:3Caesalpiniaspinose)

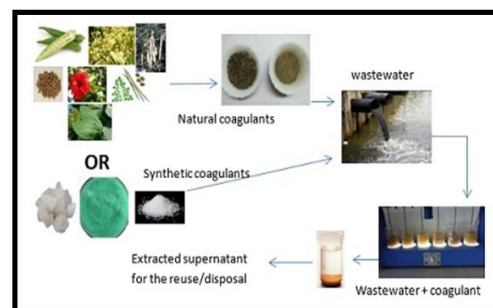
II. FUTALA LAKE SCENARIO

Lake pollution is one of the serious environment problems in development and pollutant discharge increase from industry, agriculture. The health of lakes and their biological diversity are directly related to health or almost every component of the ecosystem. According to WHO organization [1], about 80% of all diseases in human beings are caused by water. Once the groundwater and surface water quality is contaminated, its quality can't be restored by stopping the pollutants from the source. It therefore becomes imperative to regularly monitor quality of groundwater and surface water resources and to devise ways and mean to protect it. Hence, periodic monitoring and assessment of water quality helps to develop management strategies to control surface water pollution [2] in spite of increasing urbanization and anthropogenic pressure on them. Water quality index (WQI) is one of the most effective tools [3- 5] to communicate information on the quality of water to the concerned citizens and policy makers as it is an important parameter for the assessment and management of surface/ground waters. Hence, the present work has been carried out with a focus to evaluate comparatively the prevailing water quality and potability of Futala lake (rainfed lake) by analyzing physico-chemical parameters by estimating WQI.

1. To characterise the physical, chemical and biological parameters of the Lake water in Futala Lake and from bore well samples around the lake.
2. Based on the analysis of water, it is purified using organic treatment unit which consists of various bio coagulants.
3. To study the properties of Moringaoleifera seeds, Tamarind seeds and activated charcoal using rice husk in treating Lake water.
4. This study aims in finding remedial solutions for the Futala Lake and making it into beneficial use.

III. PROPOSED METHODOLOGY

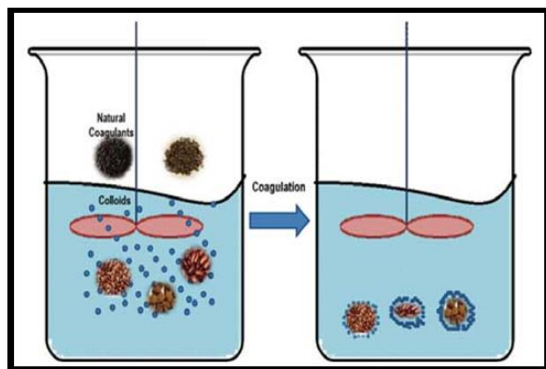
The Futala lake water is unpotable and now-a-days used for irrigation purpose and for commercial fisheries. It doesn't have self cleaning capacity; hence continuous addition of nutrients through many polluting sources is leading. The watershed of Futalalake is a part of Nag river watershed. Nag River is completely polluted on account of incoming sewage into it. The Four streams are prominent within catchment. The Futala Lake and its environs near Telankhedhi Garden on Amravati road, Nagpur, is a picnic spot. It is rainwater impoundment with an area of 26.3 hecters and 5-6 meters deep during monsoon. Futala Lake, too, is facing the threat of eutrophication with weeds covering almost half the lake area already. The sewage is released into Futala Lake without treatment therefore the Futala lake water is polluted at moderate level. In Futala Lake, eutrophication was first seen in some portion towards west, but, almost half of the lake area is covered by weeds, especially on south and north side. Species inside the water start to diminish due to lack of sunlight, even oxygen level in lake water already drastically dropped. Another worry for the lake was, collapse of large portion of embankment towards the bund embankment, constructed with black stone in some time ago, raising the needs for inspection of remaining portion of the embankment. Futala Lake was chosen in this study, since it is heavily influence by human actions leading to domestic and partially agricultural pollution sources. The basic objective of present study is to forearm people by creating awareness also to evolve future strategies for the benefit of mankind and to highlight the basic issues regarding water pollution prevention as well as conservation and management of surface water bodies (Lakes).



(Figure 4: Use of Natural Coagulants)

1. Collection of samples: Samples are to be collected from various points in and around the lake.
2. Preservation of the samples: The samples collected are to be preserved at optimum temperature of about 4C.
3. Analysis: The samples collected are to be analysed to find out the physical, chemical and biological

- contents, based on the analysis the samples are treated by using organic methods as suggested below,
4. *Moringaoleifera*: Ripened MO is taken and its seeds are to be collected, dried in sunlight. The dried seeds are powdered finely and sieved by using a 150 micron sieve. The seed powder passing through the 150 micron sieve is collected and thus the obtained seed powder is taken for further analysis.
 5. Tamarind seed powder: Tamarind seed used in this study was collected from the kitchen as waste material. It was soaked in water for an hour to remove the adhering pulp, washed well with tap water. The seeds are first crushed in the mortar and pestle to remove the outer cover as much as possible and the cotyledons were powdered finely. The powdered material is taken for further analysis..
 6. Preparation of Rice Husk: Rice husk was obtained from a local rice mill. In the first step, 25 grams of rice husk was heated gradually at a temperature of about 300 deg C for fifteen minutes and is then activated in a muffle furnace at 105 deg C for about 15 minutes. The product was cooled giving a desired pure adsorbent.
 7. Jar test: The analysis of optimum dosage of coagulant is to be done using jar test. Jar test is to be conducted with varying quantities of MO powder, tamarind seeds powder and activated charcoal using rice husk.
 8. Analysis of treated samples: After jar test the samples needs to be again analysed to find the pH, turbidity, DO,BOD, chloride content, fluoride content, iron, copper etc., to find the change in the parameter.
 9. Comparison of results before and after treatment: Comparisons are made by analysing the test results obtained after the completion of test to that of the initial condition.



(Figure 5 : Natural Coagulants Process)

V. EXPECTED RESULTS

Rainfall, slope and land use pattern influence the level of soil erosion and release nutrients into lake water bodies. Total nitrogen fluctuation may be due to microbial utilization as well as due to the varying agricultural inflows. Electrical conductivity classified Futalalake to be medium salinity class. In the present study, it is found that water quality problems associated with Futala Lake includes severe dissolved oxygen depletion, poor water clarity, and high level of algae growth, blue green algae blooms and dense beds of aquatic microphytes. The quality of Futala Lake water is no longer good to support micro flora and fauna also in terms of fish productivity. The present study revealed that Futala lake water is polluted (due to surface run-off, washing activities, agriculture run-off, effluents from upstream from surrounding residential area, immersion of idols of God and Goddess during festival season, discharge of domestic sewage (poor) and dumping of garbage) and unsuitable for human consumption also for the survival of life forms unless treated properly. Therefore pollution parameters must be regularly monitored and evaluated according to aquatic living and local regulations. The suggested measures to improve the lake water quality includes total ban on the activities (including idols immersion) that causes pollution. Awareness, proper understanding, planning and management of environmental resources is essential to prevent environment degradation of these resources.

1. The optimum dosage of *MoringaOleifera* seed powder for treating lake water is 2g/L as it has brought a reduction of turbidity of 24.07%.
2. The optimum dosage of Tamarind seed powder for treating lake water is 1g/L as it has brought a reduction of turbidity of 65.82%.
3. The optimum dosage of activated Charcoal of rice husk powder is 3.5g/l as it has brought a reduction of turbidity 78.14%.
4. The best bio coagulant among MOP, TP and RHAC is RHAC as the percentage reduction in turbidity using this bio-coagulant was 78.14%.
5. All the three bio coagulant were used one after the other in the order of Tamarind seed powder, MO seed powder & activated charcoal using rice husk respectively. The water collected after the entire treatment is sent to laboratory for analysis. The results obtained had shown a decrease in Total Coliform and Fluoride content.
6. But the sample had shown rise in BOD & total nitrogen and phosphate content. The results might have occurred owing the organic nature of the bio coagulant.

7. Earlier studies had shown that bio coagulant like MO will work well when the initial turbidity of the water sample is more and in this work also it was evident that when initial turbidity of sample was more, effectiveness of MOP was comparatively higher.
8. Bore well samples from nearby points of Zilpi Lake was also studied. The analysis showed that all parameters of bore well water were well within the limits prescribed by KSPCB standards. Therefore groundwater condition is supposed to be good and availability of water from bore wells are also quite sufficient for taking care of water requirements of this area.
9. From this study, it can be concluded that the bio coagulants selected for this study are quite efficient in treatment of lake water. Even though some of the results were not very encouraging, the usage of these bio coagulants can improve the quality of lake water, so that people around the lake can use it for their day to day activities.

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