PHYSICOCHEMICAL ANALYSIS OF LAKE WATER USING NATURAL COAGULANTS

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ABSTRACT

This paper deals with an effective water filtration method using natural coagulant mediums like Moringa, Alam, Ferric Alam, Lime and Charcoal as absorption medium. The testing work emphasizes the assessment of water quality of water bodies like a lake. Also highlights cost-effective treatment without any health hazards due to the relevant adsorbent products. pH and turbulence levels within allowed limits were mainly focused on this experiment.

Keywords: Turbidity, pH, Natural coagulants, Lake Water

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INTRODUCTION

Water is a basic need of living things and humans. Water is the most essential element of life; it is essential for nutrition. More than a third of all countries will face water shortages by the middle of the 21st century as a result of global warming. It is estimated that 1.2 billion people in the world do not have access to safe drinking water.² Industrial waste is one of the major sources of water pollution. Billions of tons of industrial waste are dumped into water bodies every year. Ways and means are most urgently needed to effectively treat waste and reuse purified water without steam and pollution. Currently, the main goal of environmental engineers is to reduce the cost of treatment and improve the properties of purified water for safe use.⁹ The coagulation-flocculation process can be used as a primary step in the water purification process.⁴ Alam is a commonly used envelope and is easy to handle and produces less sludge than lime.

Coagulation is affected by the type of coagulants used. The number of coagulants used to reduce the pH and the initial turbulence of the sample and the properties of the contaminants.¹ Freezing creates the flock automatically, but flocculation is needed to help the flock accumulate and settle further. The Coagulation-flocculation process removes only about 60% of the natural organic matter and requires further processing for complete water purification.⁷ A certain amount of Physico-chemical waste is also formed, which is usually processed externally. The number of studies that have produced natural coagulants³ as an alternative to metal salts; Some of them are *Moringa oleifera*⁵, corn seeds, rosacea seeds, *strychnos* potato rum and *pheasolus vulgaris*.⁶ This study focused on comparing the coagulant capacity of moringa, alum, ferric alum, lime and charcoal as an absorption medium.⁸ This study was carried out to examine the effectiveness of natural coatings for purifying lake water.

Study Area

Korattur Lake is one of the largest lakes located in the western part of Chennai. It is part of the Chennai Corporation and is located 12 km from Chennai Central on the Chennai-Mumbai railway line. Korattur Lake is one of the chains of three water bodies including Ambattur Lake and Madhavaram Lake, from which excess water is carried from one to another. Survey No. 813 of Korattur Lake. The total area was about 1500 acres a few decades ago. It has been reduced to 900 acres. Currently, it covers an area of 500 acres. The water coming from the lake was used for agricultural purposes in about 7 villages. The water

from this lake served to Korattur including Agraharam, Kasra Kuppam, Kali Kuppam, Matala Kuppam, Dada Kuppam, Kolathur. For many years, however, the lake has been polluted by sewage and surrounding areas such as Pattaravakkam, Adipet and Ambattur.

EXPERIMENTAL

The raw water from the selected source is collected. The collected water is then screened using a perforated cloth. The debris present in the water is removed after screening. For removal of major impurities, four coagulants have been used namely Moringa, Alum, Ferric Alum & lime and charcoal has been adopted. The standard solution was prepared by following the procedure. The required samples of moringa, Alum, Ferric Alum and lime are collected in powder form in appropriate quantities. The powder sample is mixed in a small amount of clean water to form a paste. The paste is mixed in a bottle of 500 ml of clean water and shaken for 1 minute to activate the freezing properties and form a solution. Remove the insoluble material and the solution in the water to be treated is filtered through a fine-mesh screen. Stir the purified water fast for at least 1 minute, then slowly (15-20 cycles per minute) for 15 -10 minutes. Purified water is left uninterrupted for at least 1 -2 hours. As particles and contaminants settle to the bottom, clean water is carefully taken to the treatment system. The materials for the experimentation as specified are taken into the containers as shown in appendices. The apparatus set up by the method of suction for introducing the water to be treated. During the treatment process, the water is allowed to pass through different adsorbed media filled in the container 1 and 2. Finally, the treated water is collected in the collecting bowl. This treated water is further tested for quality confirming to the standards.

Fig.-1: Experimental Setup

Materials Used and Adsorption Media

Pebbles

Pebbles are usually larger than grains (2 to 4 millimeters in diameter) and smaller than cobblestones (64 to 256 millimeters in diameter).

Fig.-2: Pebbles

White Silos

These come from the family of pebbles. On many broken pebbles, large sand-sized grains can be seen. Some of the pebbles crumble to the touch. Some of them are white, and others are stained yellow or brown by small amounts of rust. Most small pebbles are remnants of old large pebbles, and large rocks millions of years old. They become smaller and smaller through natural erosion processes.

Fig.-3: White silos

Coarse and Fine Sand

The water travels through the sand, small impurities and pathogens get trapped in the sand. The slower the water travels, the more impurities are taken out. All the particles in the water get trapped in the sand.

Fig.-4: Coarse sand

Fig.-5: Fine sand

Scrubber

It is one of the filter media used for the filtration process. It consists of porous materials. It has a high absorption capacity. It does not allow the particles to pass through them except water.

Fig.-6: Scrubber

Table-1: Report on the Raw Water Sample

Characteristics	Inference	Permissible Limit (IS 456/2000)
Colour	Greenish	--
Chlorides (mg/lit)	1260	2000
Sulphate	100	400
Iron	0.15	--
pH	9.3	Not less than 6.0
		(Desirable - 6.5
		Permissible - 8.2)
Turbidity (NTU)	95	10

Table-2: Report of the Treated Water

Coagulants	pH Value	Turbidity (NTU)
Moringa	7.68	3.0
Alum	7.54	6.7
Ferric alum and lime	7.48	3.6
Charcoal	7.64	8.8

Charcoal

The high absorption properties of activated charcoal make it a popular choice for water filters. These filters are common in the homes of people who want the taste and health benefits of drinking clean, polluted water. As water passes through the charcoal filter, contaminants get trapped in the deep pits of the charcoal and remain there until the filter is replaced. It is used as a pre-treatment device for reverse osmosis systems and as special filters designed to remove chlorine-resistant cysts. Activated charcoal carbon filters are very effective in removing chloride sediments, volatile organic compounds (VOCs), flavor and odor from water.

Fig.-7: Charcoal

Moringa

The Moringa oleifera tree grows abundantly in many tropical and subtropical regions of the world. It only bears fruit in six months and is already used as a food source in many areas. The seeds, leaves, roots and flowers are all edible and nutritious. The seed of the tree can kill bacteria and clear the water. Moringa seeds in their clay water tanks, and dried powder from crushed seeds have been used as hand washes for many years. Mature Moringa oleifera seed pods are collected and removed from the seed pods. The seed coat is removed and the discolored seeds are discarded to obtain clean seed kernels. Moringa seed powder is also commonly available in the markets. Solutions of moringa seeds for water purification can be prepared from seed kernels or solid residue left after oil extraction (press cake). Moringa seeds, seed kernels, or dried press cake can be stored for a long time, but Moringa solutions for water treatment must be prepared fresh each time. Generally, 1 seed kernel is treated with 1 liter of water.

Alum

Alum is a specific chemical compound and a type of chemical compound. Potassium aluminum sulfate hydrated with $KAl(SO_4)_3 \cdot 12 H_2O$ formula is the specific compound. Alumni are useful for a variety of

industrial processes. They are water-soluble; Have a pleasant taste; Acid reaction to litmus; And crystallize in regular octahedral. Alum, 30 to 40 ppm for domestic sewage, is often added to industrial sewage so that the negatively charged pulp particles stick together as "phlox" and then float on top of the liquid, allowing it to easily drain from the liquid or liquid before further filtration and disinfection of the settling water.

Fig.-8: Moringa Seed Powder

Fig.-9: Alum Powder

Ferric Alum

Ammonium ferrous sulphate, also known as ferric ammonium sulphate (FAS) or ferrous alum, which is a double salt in alum, Contains compounds. It has the appearance of weak violet, octahedral crystals. There has been some debate about the origin of the color of the crystals, with some claiming that it is the cause of the impurities in the mixture and others that it is the property of the crystal. FAS is widely used in wastewater treatment, tanning, manufacturing of dyehouses and an engraving agent in the manufacture of electronic components. It has been used in a wide range of applications including antibiotic refrigeration equipment, biochemical analysis and organic synthesis.

Fig.-10: Ferric Alum Powder

Sand for Filtration

The size of sand particles is specified by the effective size, which is the sieve size in millimeters that permits 10% of sand weight to pass. The selection of the correct effective size is very important because if

very fine sand is used it will clog the filter frequently and reduce the rate of filtration. On the other hand, too large size sand will not filter the desired impurities and will allow fine suspended matters and bacteria to pass through the filter.

Gravel for Filtration

The sand bed is supported on the gravel bed. Gravel bed has several functions, due to which it is provided below the sand bed. It supports the sand and allows the filtered water to move freely towards the bottom drains. This allows the wash water to move evenly across the sand. The gravel is placed in 5 - 6 layers. The gravel used in filtration should be clean, hard, durable and rounded. It should be free from clay, loam, shells and other foreign matters. It should not contain flat, thin or long pieces.

RESULTS AND DISCUSSION

pH value measurements and Turbidity value measurements of the lake water using the different coagulants used are indicated in Table-2. It was observed that the pH value of the lake water treated with moringa, Alum, ferric alum & lime and charcoal are 7.68, 7.54, 7.48 and 7.64 respectively, which are within the permissible limits. Measurement of pH was measured using pH meter. The turbidity value of the lake water treated with moringa, Alum, ferric alum & lime and charcoal are 3.0, 6.7, 3.6 and 8.8 NTU respectively, which are within the permissible limits. The Measurement of Turbidity was taken by using Nephelometric Turbidity meter.

Fig.-11: Comparison of pH Value of Different Coagulants

Fig.-12: Comparison of Turbidity Value Different Coagulants

Fig.-13: pH Values of the Water Before and After Treatment using Different Coagulants

Fig.-14: Turbidity Values of the Water Before and After Treatment using Different Coagulants

CONCLUSION

This study provides information at a provincial level about the possibilities of using the Korattur Lake. This lake is an extremely vast water body and consists of plenty of water. There are encroachments in this

lake and due to these encroachments, the boundaries are decreasing. It is very much necessary to conserve this lake to meet the water demand of the city. The water filtration model used consists of moringa, alum, ferric alum, and charcoal as the coagulants. The moringa seed powder proved to be a good adsorbent media in reducing the turbidity level followed by ferric alum, alum and charcoal. The proposed filtration apparatus can be used at the household level by the people residing in surrounding areas of the lake. The treated water thus obtained can be used by the people for daily purposes. The entry of the effluents is the main reason for the water in the lake is getting polluted. Certain measures are to be taken to put an end to the industrial effluents from the surrounding areas being let into the lake.

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