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An Experimental Study on Water Treatment using Natural Coagulants

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ABSTRACT: Natural coagulant is a plant based coagulant that can be used in coagulation flocculation process. It helps to reduce turbidity in waste water. Once the coagulant is introduced in water the individual colloids must aggregate and grow bigger thus impurities can be settled at the bottom of the beaker and separated. However, when chemical coagulant is used in water treatment it can cause several bad effects on human health. To overcome such issues natural coagulants were introduced in water treatment. Mainly plant based coagulants are preferred because they are biodegradable and presumed safe. Natural coagulants used for this project are neem, Moringa oleifera, Indian borage and tulsi. These were added in varying dosages 0.25, 0.5, 0.75, 1 grams per 500mL and optimum coagulant dosages were obtained by jar test. The objective of this study is to find the most effective natural coagulant from the selected natural coagulants. Properties like turbidity, pH, acidity or alkalinity, hardness are examined in the test sample from Aluva. Water treated with natural coagulants shows similar characters as when treated with alum. The natural coagulants also outstood from alum in few properties from which it could be concluded that these natural coagulants could be a substitute for alum since alum can cause damage to human health. All forms of alum can cause irritation of the skin and mucous membranes. Breathing alum can cause lung damage. Aluminum also may attack lung tissue. Because it's a salt, consuming massive amounts of alum can cause illness. After performing various tests the best effective natural coagulant is ranked, the best one giving the similar result as that of alum.

KEYWORDS: Natural coagulant, Optimum coagulant dosage.

I. INTRODUCTION

Clean, safe water is vital for everyday life. Water is essential for health, hygiene and the productivity of our community. Water is a main source for all day to day purposes. Therefore the available raw water must be treated and purified before they can be supplied to the public for their domestic, industrial and any other uses. The extent of purification depends on the characteristics and the intention of its use. Access to safe and clean drinking water is a major concern. Purpose of waste water treatment is to remove and reduce organic and inorganic substances, toxic substances, to kill pathogenic organisms etc. So that the quality of water is improved. Due to contamination of water bodies, it has now become essential to treat water. Water treatment projects vary according to the location and type of pollutants. But their basic principles are the same. The goal is to produce water fit for specific purpose. In a water treatment plant one of the preliminary treatments given to water is sedimentation. And coagulation is the process that removes turbidity from the waste water and this is the basic step performed in sedimentation. The main objective of coagulation is to remove colloidal impurities and thus to bring down the water turbidity. Turbidity is caused due to the presence of suspended matter, like clay, silt, finely divided organic and inorganic matter, soluble colored organic compounds and plankton and other microscopic organisms.

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II. LITERATURE SURVEY

Turbidity of water was removed through the addition of fava bean seed as natural coagulant, Dragana V. Kukic et al. [1] in this study, turbidity of water was removed through the addition of fava bean seed as natural coagulant. Coagulants were applied in various dosages in synthetic water having different turbidities and PH values. Coagulation activity was determined by jar test. The best coagulation activity was achieved by adding dosage of 0.125ml/l and concluded as this coagulant has great potential.

Sewage waste water is treated using Tulsi as natural coagulant, Dhruva R et al. [2], Sewage waste water is treated using Tulsi as natural coagulant. Holy basil leaves were prepared naturally. Effect of holy basil leaf powder on removal of Ph, removal of turbidity, removal of COD was determined. And they concluded that holy basil leaf powder as natural coagulant reduces turbidity, Ph, COD. Its eco-friendly and cheaper method of water treatment. The sludge obtained can be used as biofertilizers.

III. METHODOLOGY

Periyar is the longest and high potential river in Kerala. The test sample was collected from here. Kochi city, in the vicinity of the river mouth intakes water from Aluva an upstream site sufficient free from sea water intrusion. Water from the river routes are supplied for domestic needs. And large water treatment plants serve this purpose. This water body faces large pollution which is increasing on a day to day basis. The water body receives discharge from domestic, municipal, industrial and other factors like religious. Hence treatment at high standards is mandatory before being supplied to different consumers.

IV. EXPERIMENTAL RESULTS

Table 1. Test result of Aluva

TEST	ALUM	NEEM	TULSI	MORINGA	INDIAN
pH	4.1	6.2	6.6	6.1	6.9
Total hardness as CaO ₃	3550	2280	3560	3500	2400
Chloride as Cl	11000	6800	11000	11000	6800
Alkalinity as CaCO ₃	Acidity*/320	150	95	95	210

As per Indian standards, the pH of potable water is between the range 6.5 to 8.5. From the test conducted it is concluded that Tulsi and Indian Borage gives far better result than other coagulants. And these natural coagulants are more effective than alum in the case of neutralizing water.

This sample is hard water (river water). So there is a need to reduce the hardness of this sample. The hardness of water is reduced by increasing the dosage of coagulant. Tulsi and moringa oleifera are effective in reducing the hardness of water like alum. When using other natural coagulants like neem or Indian borage we cannot achieve this much reduction in hardness.

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Table 2: Test result of Muvattupuzha

TEST	ALUM	NEEM	TULSI	MORINGA	INDIAN
pH	4.9	6.6	6.5	6.5	7.3
Total hardness as CaO ₃	2250	3000	2560	2300	3500
Chloride as Cl	9000	8050	8750	8890	8010
Alkalinity as CaCO ₃	Acidity*/400	100	90	89	125

As per Indian standards, the pH of potable water is between the range 6.5 to 8.5. From the test conducted all the four natural coagulant showed better results than alum. And therefore these natural coagulants are more effective than alum in the case of neutralizing water while alum made the water sample more acidic.

This sample is hard water (river water). So there is a need to reduce the hardness of this sample. The hardness of water is reduced by increasing the dosage of coagulant. Tulsi and moringa oleifera are effective in reducing the hardness of water like alum. When using other natural coagulants like neem or Indian borage we cannot achieve this much reduction in hardness. Natural coagulants Moringa Oleifera and tulsi shows similar results like that of alum with the former being the best when compared with alum.

V. CONCLUSION

From Coagulants are basically of two, one is natural coagulant and the other is chemical or synthetic coagulant. Synthetic coagulants are manufactured chemically at labs and natural coagulants are produced from plant parts through physical means. The treatment through natural coagulants signifies to a vital development in viable environment for better worth of eco system particularly for less urbanised area. The goal of this experimental study is to assess the effectiveness of various natural coagulants for surface water treatment. In this study, samples were collected from Aluva and Muvattupuzha and they were treated with coagulants like neem, tulsi, Moringa oelifera, Indian borage and alum. The properties like turbidity, pH, alkalinity or acidity, chloride hardness and total hardness were examined. These properties were used as parameters to compare the natural coagulants with alum. Ranking is done to determine the best coagulant based on removal efficiency, availability, cost and above all how they can help replace alum. The ranking is as shown. Moringa oelifera > Tulsi > Neem > Indian Borage. The pH of the water sample from Aluva had pH 7.9 (already within range), this pH was taken down to 6.6 and 6.9 by tulsi and Indian borage. The chemical coagulant alum is not much effective in pH variation for potable water. Water treated with natural coagulants showed similar characters as when treated with alum. The natural coagulants also stood out from alum in few properties from which it could be concluded that these natural coagulants could be a substitute for alum since alum can cause damage to human health.

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