

Study on Replacement of Alum with Aloe Vera Gel in Turbidity Removal

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ABSTRACT

The ever increasing population and also in comforts of the people is causing a stress on the availability of fresh water resources on this planet. It requires proper treatment before consumption. The treatment process consist various steps to make the unfit water to useful water. In that process, it is a challenge for us to remove colloidal particles present in water. At present alum is used worldwide to treat the water in the process of coagulation and flocculation. Continuous use of alum in the treatment of water has been reported neurological diseases like Alzheimer's disease and also carcinogenic. So, some natural products are required in the place of these chemical coagulants. Natural coagulants are the coagulants which extracted from natural plants. So this study is mainly focused on decreasing alum dose by replacing with aloe Vera gel. This results in economical treatment and also ensures safety to the consumers. From the past literature, it is reported that naturally available plant products can act as a good coagulant in separation of colloids. Groups of aloe Vera (aloe barbadensis), a plant which belongs to Liliaceae family has been tested with partial replacement of alum. The experimental results are found to give satisfactory results compared to conventional treatment with only alum which are presented in conclusion.

Keywords – Aloe Vera, Turbidity, pH, Natural coagulants, Water Treatment

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I. INTRODUCTION

Water is the one of the basic essential requirement for human beings in daily life. However with rapid development of modern industries, comforts of living and increased population, water pollution turned more serious day by day. Most of the industries such as textile, leather, paper and plastic industries pollute the water by direct discharge of industrial wastewater without proper treatment into the river, sea and land etc. Thus, it contributes water pollution due to discharge of many chemical substances, whose separation from effluents involves increase in unit product cost.

The treatment of waste water combines biological, chemical and physical unit processes to purify large volume of sewage. Coagulation and flocculation by adding chemicals are the methods that are usually used for water treatment. These types of treatment facilities are difficult to operate and also a bit expensive. So there is an increased demand for the low cost methods of water treatment. The present study is concerned with the removal of impurities in waste water by cheaply available plant based coagulants.

1.1 Low cost materials as coagulants:

Although many low cost coagulants have been reported, these are generally well-known within the scientific community, namely, Aloe Vera gel (Aloe barbadensis), Neem powder (Azadirachta Indica), Nirmali seeds (Strychnos potatorum), Moringa Oleifera, Tannin, Orange peel powder and Cactus. M. oleifera is arguably the most studied natural coagulant within the environmental scientific community. It is widely acknowledged as a plant with numerous uses. It is useful in medicine, but utilization of Aloe Vera using in various water and waste water treatments can be used as a low cost adsorbent instead of high cost adsorbent.

1.2 Aloe Vera (Aloe barbadensis):

The Aloe Vera (Aloe barbadensis) of the family Asphodelaceae is native to the Indian sub-continent, and its leaves and gel have been in use since ancient times to treat a number of human ailments. A variety of medicinal and germicidal properties has been attributed to its gel.

1.3 Objectives:

1. To study the performance of abundantly available plant products such as aloe vera gel and alum mixture in water treatment.
2. To study turbidity removal for raw water with different dosages of aloe vera and alum
3. Also to study the pH changes with addition of alum

II. LITERATURE REVIEW

S. Ramesh, A. Amirthashanthi et.al (2018) has done an experimental study on textile wastewater treatment using moringaoleifera & azadirachtaindica. Based on the experimental results, it was concluded that natural coagulants which have been obtained from Moringaoleifera, Azadirachtaindica have shown improved performance of coagulation comparing to commercial alum. Dhruva R, Suresh R et.al (2016) investigated the effect of natural coagulant (Tulsi) for reduction of pH, Turbidity and COD from sewage water. In this project holly basil are used as natural coagulant. Using this coagulant turbidity of wastewater is to be reduced.

III. MATERIALS AND METHODOLOGY

3.1 Materials

Water sample was collected from Hussain Sagar Lake which is regarded as one of the polluted lake in the Hyderabad city. Aloe vera leaves were collected and the green cover is scrapped and made in the form of gel. The Aloe Vera gel was diluted to various percentages (1%, 4%, 5%, and 7% up to 13%) and then suitable Aloe Vera dose was given. For example 1% Aloe Vera solution was prepared by diluting 1ml of Aloe Vera gel in 100ml of distilled water. The coagulation and flocculation processes were performed using the jar test apparatus. Initially jar tests were carried out by using alum as a coagulant for high and low turbid water. Then by using Aloe Vera gel as coagulant aid with alum was used for the turbidity removal. Along with turbidity pH, electrical conductivity, hardness these water parameters were also analyzed. Aluminum sulfate is a chemical compound with the formula $Al_2(SO_4)_3$. It is soluble in water and is mainly used as a coagulating agent (promoting particle collision by neutralizing charge) in the purification of drinking water and waste water treatment plants, and also in paper manufacturing. The alum used for experiment was aluminum sulphate $Al_2(SO_4)_3 \cdot 18H_2O$. 5% strength alum in liquid form was used. It was prepared by dissolving 50gm of alum in 500 ml of distilled water.

Preparation of alum and aloe vera gel: Based on the initial turbidity of raw sample we consider the different ratios of aloe Vera and alum (M1, M2, M3,

M4, M5, and M6) as shown in Table 1. We get the optimum coagulant dosage at 30ppm with alum as a only coagulant.



Fig.1 Aloe Vera Gel

Mix Proportion	ALUM DOSE(ppm)	ALOE VERA DOSE(ppm)
M1	26	4
M2	22	8
M3	18	12
M4	14	16
M5	10	20
M6	6	24

Table1. Alum and Aloe Vera mix

3.2 Methodology

Initially the optimum dosage of alum dose was found with Jar test by adding different proportions of alum dose. pH adjustment was done to raw sample to 7.6. By taking the various dosages of alum as 5, 10, 15, up to 50ppm in 1liter of diluted raw water sample, the optimum dose of alum dose was found to be 20ppm for the test water sample. Turbidity was measured for each sample using Nepheloturbidimeter. Aloe Vera solutions of various percentages of 1%, 2%, 3%, up to 14% were prepared. By taking above table as reference the mix proportions of alum and aloe vera solutions for each percentage of aloe vera solution were prepared and tested for turbidity removal using Jar test as shown in Fig 2. pH changes were also monitored during the study.



Fig. 2. Jar Test Experimentation

IV. RESULTS AND DISCUSSIONS

By dissolving 10grams alum in 100ml of distilled water and various doses are taken as coagulant in treating of natural water body sample. Initial Turbidity of the sample was 3.8 NTU. The optimum dosage of alum for the test sample was found to be 30ppm from Jar Test experimentation.(Fig 2)

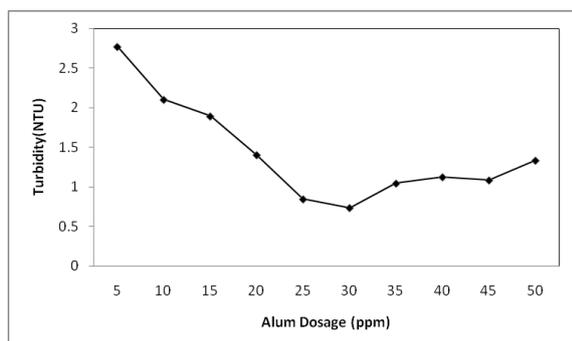


Fig 2: Optimum coagulant dosage using only Alum

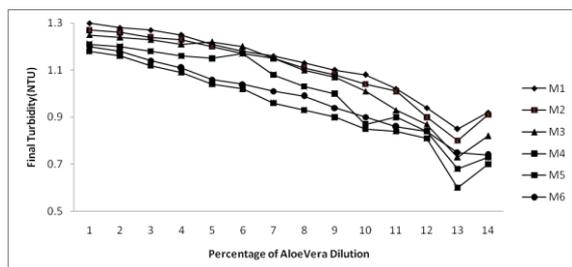


Fig 3: Final turbidity with different mix proportions

Based on the experimental results, it is observed that M2 mix was giving satisfactory reduction of turbidity(Fig 3). The maximum removal of turbidity is occurring at 13% dilution in all the cases after which the mix is again imparting turbidity to water. The pH of the water is found to increase slightly which is attributed to increase organic content(Fig.4).

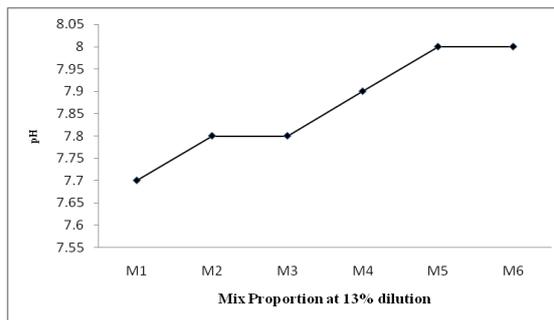


Fig 4. Variation of pH with addition of Aloe Vera Gel

V. CONCLUSIONS

1. The turbidity of raw samples is reduced by 82% with only alum as the only coagulant.
2. The turbidity of raw sample is reduced by 84% with the combined dosage of alum 10ppm and aloe vera 20ppm.
3. The alum content is reduced from 30ppm to 10ppm by replacing with Aloe Vera gel as coagulant and it efficiently removed the turbidity than the alum.
4. The results showed that the amount of alum required was high for effective removal of turbidity. Aloe Vera can be used as natural flocculent for water treatment. Use of Aloe Vera gel coagulant aid with alum can effectively reduce the amount of alum required. Owing to various problems associated to alum, use of Aloe Vera gel with alum as coagulant aid can be new alternative for drinking water treatment.
5. Use of Aloe Vera gel as coagulant is found to slightly increase the pH of the water which can be ignored.

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