

Application of Affluent Alfresco Plants as an Affordable Aid in the Treatment of Acquainted Effluents

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Abstract

This study focused on the evaluation of natural flocculants and by using activated carbon in waste water. Aloe vera and opuntia are prepared for the primary treatment of wastewater through coagulation and activated process. One of the major sources, which affects the environment is the wastewater produced from the human activity. Therefore, to safeguard environment, Natural Coagulation and activated carbon are the methods that widely used in the treatment of wastewater. Furthermore, these hazards chemicals result in increase in turbidity, pH and TDS in waste water. These chemicals also attack the cellulose which leading to pollution. The net result is low quality control and polluted environment with high usage of energy, time, chemical and dilute water. Aloe vera and opuntia presents the finest commercial opportunity in various industrial sectors among the various plants. Also, most of the countries are gifted with the unique geographical features that are essential for cultivation of Aloe vera and opuntia. Activated carbon is a non-graphite form of carbon which could be produced from any carbonaceous material. Activated carbons are increasingly used as the economic and stable mass separation agent for the removal of surfactants to raise the final product quality many industrial processes. Activated carbons also play an important role in many areas of modern science and technology such as purification of liquids and gases, separation of mixtures and catalysis. The Aloe vera plant at various concentrations (2%, 4%, 6%, 8% and 10%) at various temperatures (25°C- 32°C) for a period of 30 DAYS.

Keywords: Aloe vera, opuntia, turbidity, pH, activated carbon, opuntia stem, waste water

I. INTRODUCTION

Water pollution is a major problem to the environment and can negatively affect the sustainability of water resources. Coagulation-flocculation is an important unit operation for the primary treatment of wastewater whereas activated carbon is a secondary treatment for waste water. Coagulation removes dissolved and colloidal substances in wastewater by overcoming the inter particle repulsive energy barrier by simply increasing the ionic strength and destabilizes colloids by neutralizing the forces that keep them apart. Flocculation occurs through the bridging between particles to form larger flocs for sedimentation to take place natural coagulants have been proven to be effective in treating wastewater. Today, the prime concern of the environmental engineers is how to lower the coagulants and flocculants cost and to improve the characteristics of the produced sludge for safe utilizing. Aloe vera can be promoted as a good natural flocculants in surface water for the removal of turbidity. Activated carbons also play an important role in many areas of modern science and technology such as purification of liquids and gases, separation of mixtures and catalysis. Adsorption of activated Carbon is governed by the chemical nature of the aqueous phase, the solid phase and the chemical nature of the absorbing organic. The activated carbon process which combines the functions of physical-chemical absorption and biological-oxidation degradation will become the conventional process widely used in potable water treatment plan. Natural organic polymers have been used for more than 2000 years in India, Africa, and China as effective coagulants and coagulant aids at high water turbidities. Natural coagulants and natural activated carbon have bright future and are concerned by many researchers because of their abundant source, low price, environment friendly, multifunction, and biodegradable nature in water purification.

II. THEME OF DISSERTATION

The aims of the present study were

To reduce the level of turbidity from water using locally available natural coagulant

To make the treatment process easier and environmental friendly for household applications.

The object of coagulation is to alter these particles in such a way as to allow them to adhere to each other. To reduce the usage of chemicals and amount of sludge generated in the treatment of acquainted effluents by affluent alfresco-plants.

III. MATERIALS AND METHODS

To investigate the effectiveness of turbidity removal from waste water by using aloe vera leaf gel as a natural coagulant, the following materials and methods were used in the present study.

IV. INSTRUMENTS

Instruments used for present work are, turbidity was measured using turbidity meter. pH was measured using pH meter (Systronic, model 324), electronic Balance (Meter, AJ1000, Accuracy 0.1 mg), hot air oven (Tempo-T1-130FAD), Desiccators (Borosil, model 3078) .

V. TEST CONDUCTED

We conducted various test by collecting of water sample

- Determination of pH
- Determination of turbidity
- Estimation of optimum coagulant dosage
- Determination of total solids, suspended solids and dissolved solids
- Estimation of hardness
- Estimation of dissolved oxygen

A. Experimental Methodology

1) Jar Test Apparatus

All coagulation experiments were carried out by using a conventional jar test apparatus.

Jar test is the most widely used experimental methods for coagulation-flocculation. A conventional jar test apparatus was used in the experiments to coagulate sample of turbid water using natural coagulant. It was carried out as a batch test, accommodating a series of six beakers together with four-spindle steel paddles. Before operating the jar test, the sample was mixed homogenously. Then, the samples ought to be measured for sludge, for representing an initial concentration. Coagulants of varying concentrations were added in the beakers. The whole procedures in the jar test were conducted in different rotating speed as shown in Fig.1



Fig. 1: Jar Test Apparatus

B. Preparation of Aloe vera Gel

50 ml of gel were introduced into 500 ml of distilled water and stirred using a magnetic stirrer, then strained through a sieve of 25 mm mesh. The filtrate collected was stored in refrigerator until the use which not exceeding one week as shown in Fig.2.



Fig. 2: Aloe vera Gel

C. Procedure of Coagulation Process

Take 1 liter of sample in each of the 4 beakers. Add varying doses of natural coagulant i.e. from 10 mg/l to 500mg/l to different beakers simultaneously. Switch on the motor and adjust the speed of paddles to about 100rpm, and thus rapid mixing is done for 1-2 minutes. Reduce the speed of paddles to about 30 to 40 rpm and continue slow mixing for 20 minutes.

This corresponds to process of flocculation. Switch off the motors and allow it to settle for 20-60minutes. This corresponds to sedimentation or settling of impurities. Collect the supernatant from each beaker with the help of pipette, without disturbing the sediment and measure the percentage of sludge.

VI. RESULTS

Table – 1

Optimum Coagulant Dosage of Alum in Effluent Waste Water

S.No	Coagulant usage in %	Amount of sludge in ml
1	4	23.5
2	6	41.7
3	8	59.2
4	10	76.1

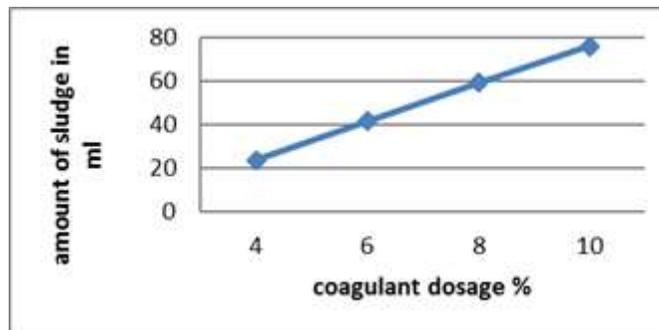


Fig. 3: Optimum Coagulant Dosage of Alum

Table – 2

Optimum Coagulant Dosage of Aloe Vera in Effluent Waste Water

S.No	Coagulant usage in %	Amount of sludge in ml
1	4	16.5
2	6	32
3	8	45
4	10	37.5

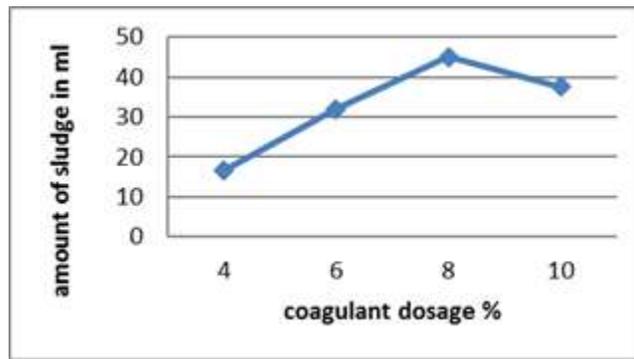


Fig. 4: Optimum Coagulant Dosage of Aloe Vera

D. pH and Turbidity Evolution Depending on the Quantity of Aloe Vera Added

The pH and the turbidity evolution of the treated water according to the quantity of Aloe vera added to raw water. There was a slight decrease in pH after water treatment with this natural flocculent. Indeed, the pH decreases from 10.11 to 6.97 to the raw water for the water treated with 8 % of Aloe vera. This decrease shows that Aloe vera solution is acidic. The same observations are made with regard to the turbidity of the treated water. Indeed, the turbidity of the treated water decreases gradually according to the quantity of Aloe vera added to the raw water. The turbidity decreases as the volume of aloe vera increase This initial value 222NTU decreased to 109NTU quantity of added Aloe vera is 8 %. We can therefore deduce that Aloe vera solution can reduce water turbidity and,

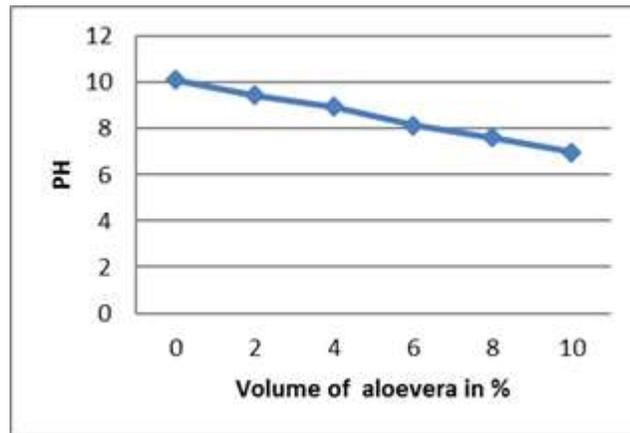


Fig. 5: Determination of pH

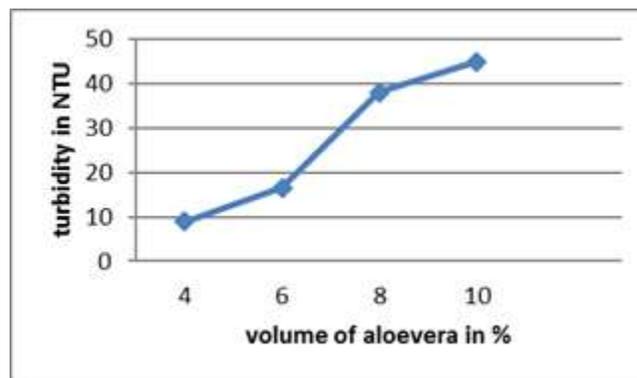


Fig. 6: Determination of Turbidity

E. Production of Activated Carbon

Carbonization of the precursor was carried out at a temperature of 650°C, the carbonization was achieved in a Muffle furnace for 2hrs. The method is as follows:

- The opuntia stem was cleaned from spines.
- It was then sun dried.
- The dried stem was burned in the furnace at 450°C for 1hours.

- The carbonized stem was then crushed and separated into different mesh sizes (0.42 mm -2.0 mm).
- The charcoal was soaked in chemical solution of ZnCl₂ for 8 hours, to become activated carbon.
- The activated carbon was further treated by HCl(0.1M) and NaOH (1M) and Ammonia solution.
- Then the moist activated carbon was kept in the furnace at 500°C (activated temperature) to increase the porosity of the activated carbon.
- The resulting activated carbon was washed with distilled water and dried in the furnace at 110°C for 2hrs.
- It was then packed in the dry container.



Fig. 6: Activated Carbon

VII. CONCLUSIONS

At the end of our study, Aloe vera can be used as natural flocculent for water treatment and opuntia can be used as activated carbon. It was also found that the use of this plant even in low doses can rid the highly charged water of their suspended materials therefore their turbidity. For optimal doses, the percentages of reduction are high, for turbidity and 91% for suspended matter, but this reduction is low for the apparent color. The use of Aloe vera, whose pharmacological properties have been significant, would be a possible alternative to chemical flocculants for the same treatment of drinking water in rural areas, only that it could increase the organic matter in the water account given its high levels in this element through activated carbon of opuntia colour and also remove some metals, chlorine and radon. As with any treatment system, it cannot remove all possible drinking water contaminants. Because activated carbon systems are limited in the types of Prospects will therefore be considered regarding the extraction and identification of elements responsible for this process.

Table – 3
Water Sample Analysis Result

TYPES OF IMPURITIES	PERMISSIBLE LIMIT	SAMPLE WATER	TREATED WATER
<i>odor</i>	<i>Desirable</i>	<i>undesirable</i>	<i>desirable</i>
<i>pH value</i>	6-8.5	10.11	6.97
<i>Hardness</i>	75ppm-110ppm	60.775ppm	85ppm
<i>Turbidity</i>	<150NTU	222NTU	109NTU
<i>Total solids</i>	500ppm-2000ppm	3600ppm	1890ppm
<i>Dissolved oxygen</i>	5ppm-8ppm	4.358ppm	6.376Ppm
<i>Alkalinity</i>	200-600ppm	722ppm	520ppm
<i>Chloride</i>	250ppm-1000ppm	1150ppm	825.33ppm

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