Comparison of efficiency of Natural Coagulants Chickpea and Cactus

[1]Prashik P. Undirwade, [2]Dr.Arif Khan

[1]Student, [2]Principal
Department Environment Engineering,
Nuva College of Engineering and Technology, Nagpur, Maharashtra, India

Abstract : Natural coagulant is a natural occurred plant based coagulant-floculation process of wastewater treatement for reducing turbidity. The objective of this study to compare the natural coagulant chickpea and cactus. Based on experimental result it was conclude that chickpea is more efficient than cactus. Chickpea is found to be 97.33% efficient in reducing turbidity and cactus reduced 77.90% of turbidity.

keywords **– Natural coagulant, chickpea, cactus.**

I. INTRODUCTION

Natural coagulants have been reported to have several other advantages compared to synthetic coagulants such as alum and ferric chloride, in that, they produce much lower sludge volume and are safe to humans. Ghebremichael (2004) investigated that the sludge produced from *Cicer arientinum* coagulated turbid water is only 20–30% that of alum. Litherland, Katayon et al., and Sanghi et al., showed that the residue of alum in water may be carcinogenic. Natural coagulants are biodegradable and cost effective for developing countries since they can be locally grown and have a wider effective dosage range for flocculation of various colloidal suspensions (Sanghi et al., 2006). The objective of the present study is to investigate the coagulation-flocculation potential of coagulants derived from plants, such as Cactus opuntia, Rajma and Cicer arientinum, to remove the turbidity from synthetic turbid water prepared from local clays and to determine the optimal dosages.
Studies on the performance of natural coagulants derived from plants such as nirmali seeds, tamarind tree, guar plant, red sorella plant, fenugreek and lentils have been conducted using raw water with turbidity ranged from 50 to 7500 PPM. The optimum dosage for the nirmali extract was 50 mg/l, which produced a 76% reduction in turbidity. The effective dose for the other plant coagulants extracts ranged from 2 mg/ l to 20 mg/l at pH levels from 4 to 9, and proved to be more economical for turbidity values greater than 300 PPM (Shultz and Okun, 1984).These result indicate that the performance of the natural coagulants are in the acceptable limits of potable water in comparison with the artificial coagulants, also the natural coagulants are economical and can be well u sed for treatment of water practice ally.

II. MATERIALS

1) Chickpea(Cicer Arientinum):

It is a legume belonging to the family Fabaceae reported that turbidity reduced up to 95.89% for highly turbid water which is almost as same as the reduction capacity of alum. Chickpea was also found to possess antimicrobial properties. It has been also reported that it has the ability to absorb heavy metals from water.

2) Cactus opuntia:

Cactus opuntia used in the study was collected and then is washed with tap water and subsequently sliced into small pieces to facilitate drying. The sliced cactus was then dried in oven for 24 hours at 130°C. The dried cactus was ground into fine powders using pestle and mortar and subsequently sieved to sizes 53 – 300 µm. Elemental analysis of the cactus powder to determine its carbon, hydrogen and nitrogen contents was carried out. The pH of cactus powder is determined by mixing the powder in distilled water at dosages of 13, 53, 213 and 853 mg/L and stirred at 130 rpm for 3 minutes prior to measurement.

III. TEST AND APPARATUS

1) Standard Jar Test

The optimum dose of coagulant is determined by jar test apparatus. It essentially consists of four or more large size beakers of one to two litrescapacity. Stirring paddles of non-corrosive metal are placed in each jar, which can be rotated at any desired speed by gear and spindle system. Figure below gives the idea about standard jar test.

Procedure for standard jar test

I. For starting the experiment first of all the sample of water in real amount is taken in every jar.
II. The coagulant is added in each jar in varying amounts.
III. The quantity of coagulant added in each jar is noted.
IV. Then with the help of electric motor all the paddles are rotated at a speed of 30 to 40 rpm about 10 min.
V. After this speed is reduced and paddles are rotated for about 20 to 30 min.
VI. The rotation of paddles is stopped and the flocs formed in each jar are noted.
VII. The dose of coagulant which gives the best floc is the optimum dose of coagulant.

2) Alkalinity

Alkalinity, reported as mg/L CaCO3, is measured as the amount of acid (e.g., sulphuric acid) needed to bring the water sample to a pH of 4.2. At this pH, all the alkaline ompounds of the sample are "used up." Laboratory technicians use a buret (a graduated glass tube with a small opening at its base and stopcock for delivering measured quantities of liquid) to dispense the sulfuric acid drop by drop into the water sample while continuously monitoring the change in pH with a pH meter and electrode or pH "pocket pal." Field kits are also available, but they typically target a higher range of alkalinity than in RI waterways.

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IV. RESULTS AND DISCUSSION

1) **Cactus:** The results after addition of cactus are as follows

Table No. 1 Cactus as coagulant aid

SR. NO	PARAMETER	UNIT	BEFORE ADDING CHICKPEA	DETENTION TIME OF 15 MIN	DETENTION TIME OF 30 MIN	DETENTION TIME OF 90 MIN
1	Turbidity	PPM	150	38	26	4
2	Total alkalinity	Mg/l	332	328	320	316

2) **Chickpea:** The coagulation using chickpea gave following results.

Table No. 2 Chickpea as coagulant aid

Sr.no	Parameter	Unit	Before adding cactus	Detention time of 15 min	Detention time of 30 min	Detention time of 90 min
1	Turbidity	PPM	172	110	74	38
2	Total alkalinity	Mg/l	348	352	328	324

Percentage Turbidity removal after addition of coagulants.

Table No.3 The table shows the cumulative results of turbidity reduction.

Coagulants	After 15mins DT	After 30mins DT	After 90mins DT
Cactus	36.04%	56.97%	77.90%
Chickpea	74.67%	82.67%	**97.33%**

Chickpea shows the maximum removal of 97.33%.

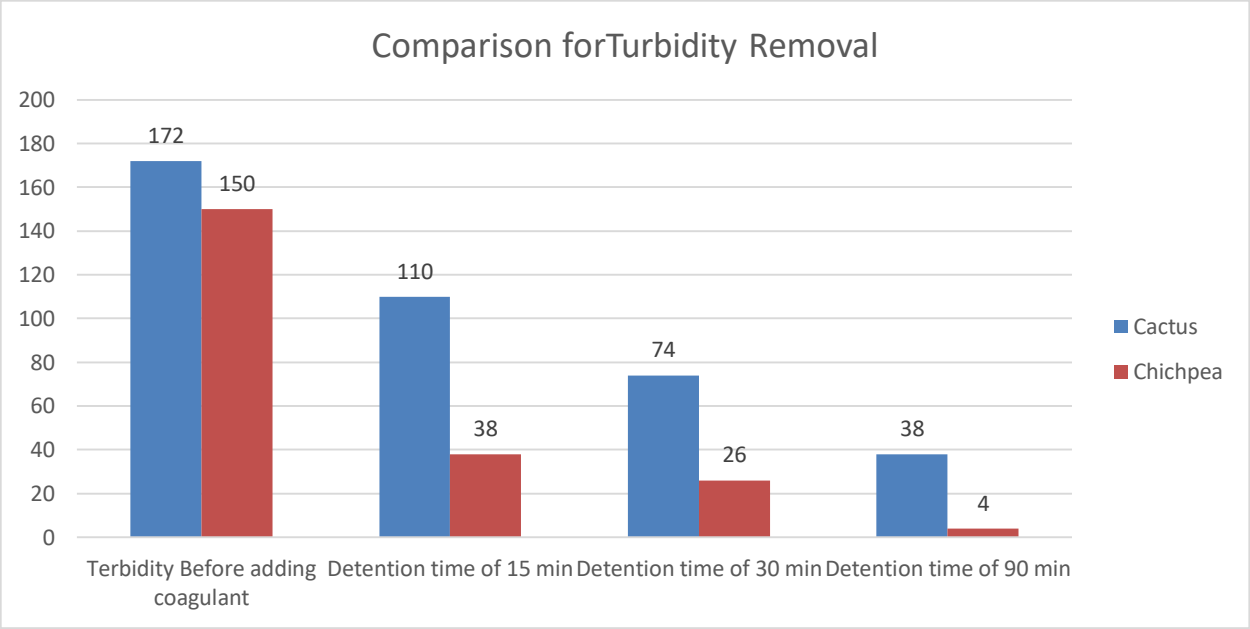
Percentage alkalinity removal by coagulants after different Detention time

Table No.4 The table shows the cumulative results of Alkalinity reduction.

Coagulants	After 15mins DT	After 30mins DT	After 90mins DT
Cactus	1.15%	6.6%	6.89%
Chickpea	1.2%	3.62%	4.82%

Cactus shows the maximum removal of 6.89.

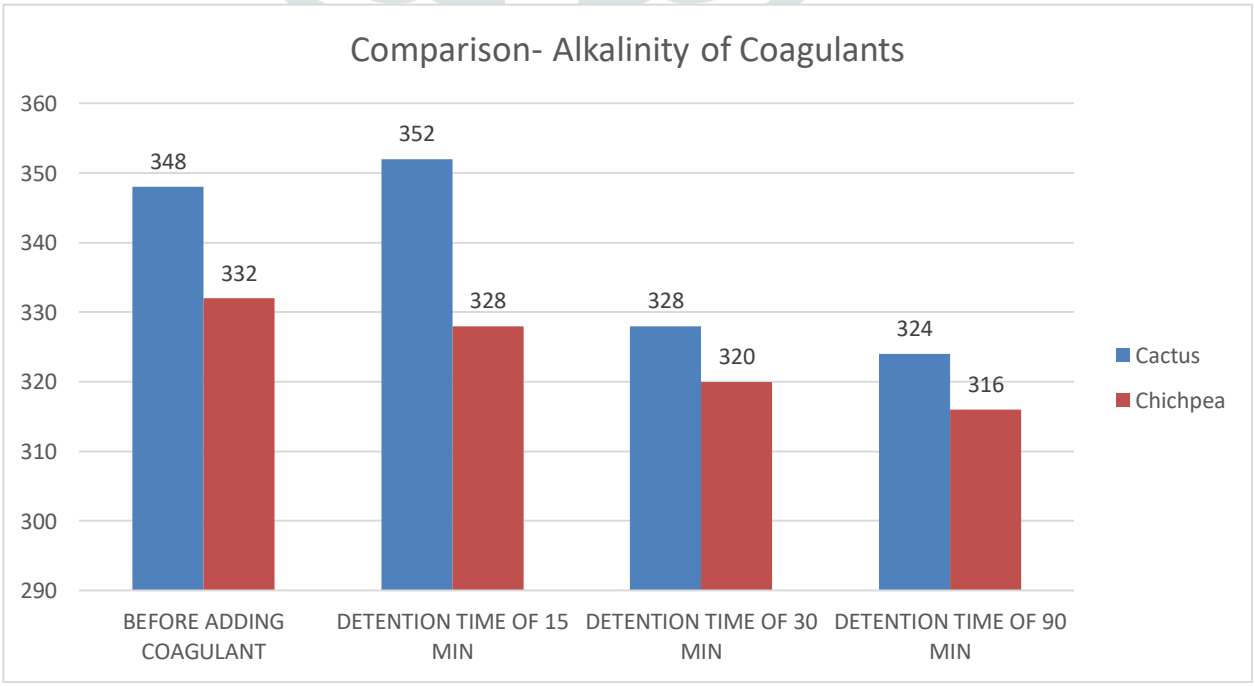
Comparison for turbidty



Graph no.1 comparison for turbidity removal

From this graph, we can conclude that chickpea is more efficient for removing turbidity.

Comparison for alkanity



Graph no.2 comparison of akalinity of coagulate

From this graph, we can conclude that alkalinity of all three coagulants is beyond the permissible limit (200mg/lt).so its taste is unpleasant.

V. CONCLUSION

1. Considering the turbidity reduction the main criteria of coagulation, Chickpea is found to be 97.33% efficient in reducing turbidity from 150 PPM to 4PPM. In 90 minutes.
2. Cactus reduced 77.90% of turbidity from 172 PPM to 38PPM.
3. After comparing all the results Chickpea has proven its efficiency and can be used for treatment of domestic water, or in water treatment plant.

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