Aloe Vera Juice Treatment on Water by Coagulation Flocculation Process

Tejaswinee Anil Pawar
PG Student, Anantrao Pawar College of Engineering, Parvati, Pune, India.

Sagar M. Gawande
PG Coordinator, Anantrao Pawar College of Engineering, Parvati, Pune, India.

Abstract –There are various treatments to treat the water efficiently. Among these processes coagulation is the best process to remove colloidal particles from the water. Alum is the most widely used coagulant in developing countries. In this paper natural coagulant has been used as a coagulant to treat the water. Raw water sample collected from Mutha River in Pune, India. By five different Methods natural coagulant has been used in the treatment of water.

Index Terms – Alum, Natural coagulant, turbidity, Aloe juice, removal of turbidity

1. INTRODUCTION

Safe drinking water is one of the biggest problems in front of all over the world. In highly rural areas treated drinking water cannot be reach. There are two types of coagulants inorganic coagulants and organic coagulants. All the metallic coagulants like Alum, ferric sulphate, ferric chloride, lime, chlorinated copper etc. and organic coagulants include polyelectrolytes like polyaluminum chloride, Poly Diallydimethyl ammonium chloride. It has been proved from previous research that all the metallic coagulants are carcinogenic. Alum is used worldwide in the developing countries to treat the water in the process of coagulation and flocculation. Continuous use of Alum in the treatment of water can cause neurological diseases like Alzheimer's disease. Alum also left some unreacted monomers in the treated water which are harmful.

Also some countries cannot afford metallic coagulant because of their high cost. In case of organic coagulants like polyelectrolyte, according to author while making of polyelectrolytes there are some contaminants in raw material of coagulant only. These polyelectrolytes are also not affordable to developing countries because of their high cost. Polyelectrolytes are also left some unreacted monomers in the treated water.

Therefore it has become a need to treat the water by using some natural coagulants. Natural coagulants are the coagulants which extracted from natural plants or animals. There are various types of plants which can be used as natural coagulants like Cactus, Aloe Vera, water melon seeds, seeds of peanut, tamarind seeds, seeds of Nirmali trees, Moringa Oleifera, some aquatic plants, cabbage, cauliflower etc. From previous research natural coagulants are found to be very much effective to treat the water. Here in this paper juice of Aloe Vera plant leave has been used to treat the raw water sample from river.

Sampling

Raw water samples were taken from the river named Mutha River in city Pune, India.Sample station selected is Vitthalwadi approximately 3-4 kilometer from the starting point of river that is Khadakwasla dam. Sampling was done as per the procedure included in the Indian Standard IS: 3025 (Part 1) • 1987 with the help of bucket and string.

2. PREPARATION OF COAGULANT

Natural coagulant that is Aloe Vera juice was extracted from Aloe leaves. First well grown Aloe leaves were cut from the bottom and kept it inclined for some minutes so that yellow liquid known as Aloin could be drained off. Whole leave then cut into various pieces and gel part of the leave were scoop out form the leave. Gel part then grinded in the regular mixer grinder. Prepared was the oure Aloe Vera juice.

99ml of distilled water were added to 1ml of Aloe Vera juice to make 1% Aloe solution.

98ml of distilled water were added to 2ml of Aloe Vera juice to make 2% Aloe solution.

95ml of distilled water were added to 5ml of Aloe Vera juice to make 5% Aloe solution.

3. METHODOLOGY

The Whole Experimentation work was divided into various six groups. Aloe Vera juice used was done by five different methods.

Group 1: - Alum as a primary coagulant

In this group of experimentation Alum which is a metallic coagulant was used as a primary coagulant to treat the water sample. Doses given were 5mg/l, 10mg/l, 15mg/l, and 20mg/l.

Group 2: - Aloe Vera as a primary coagulant

Pure Aloe Vera juice made as per the above explained procedure used as a primary coagulant in this group. Doses applied were 5ml/l, 10ml/l, 15ml/l, and 20ml/l.

Group 3: - Alum replaced with pure Aloe Vera juice

Optimum dose of Alum were replaced with Aloe Vera juice. Replacements were done by percentage like 20% to 90%.

Group 4: - Alum replaced with 5% Aloe solution

Optimum dose of Alum were replaced with 5% Aloe solution. Replacements were done by percentage like 20% to 90%.

Group 5: - Alum replaced with 2% Aloe solution

Optimum dose of Alum were replaced with 2% Aloe solution. Replacements were done by percentage like 20% to 90%.

Group 6: - Alum replaced with 1% Aloe solution

Optimum dose of Alum were replaced with 1% Aloe solution. Replacements were done by percentage like 20% to 90%.

All the Aloe solutions are added as a flocculation aid during the jar tests.

Table 1 Analysis of sampled water

Sr no	Date	Turbidity	pH	Colour
1.	09 Feb 2016	17	7.2	Objectionable
2.	13 Feb 2016	14.5	7.45	Yellowish
3.	17 Feb 2016	20.5	7.13	Yellowish
4.	29 Feb2016	29.7	7.24	Muddy
5.	01Mar 2016	32	7.45	Muddy
6.	02 Mar 2016	25.8	7.22	Muddy
7.	09 Mar 2016	24.7	7.25	Muddy
8.	26 Mar 2016	21.6	7.5	Muddy

4. RESULTS AND DISCUSSIONS

Group 1: - Alum as a primary coagulant

Alum is good turbidity removal. More than 90% turbidity was removed at optimum dose of Alum. But as the dose of Alum increased pH of the water decreased and goes below the range selected by the Indian Standard 10500.

Group 2: - Aloe Vera as primary

Aloe Vera as a primary coagulant can remove turbidity up to 40% only. Also the value of turbidity is not fall in the range given by Indian Standard 10500. Also the pH value of water sample is within the range given by Indian Standard 10500.

Table 2 Results of Aloe Vera as a primary coagulant

Jar no.	Aloe Vera dose (ml/0.5l)	Turbidity (NTU)	pH	% Turbidity removed	Colour
1	2.5	15.2	7	10.59	Greenish
2	5	12.9	6.9	24.12	Greenish
3	7.5	13.2	6.88	22.35	Greenish
4	10	10.3	6.7	39.41	Greenish

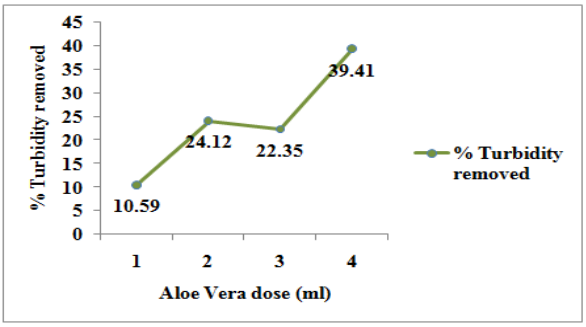


Figure 1 Resultant Graph of Aloe Vera as a primary coagulant

Group 3: - Alum replaced with pure Aloe Vera juice

Table No. 3 Showing the results of Alum partially replaced with Aloe Vera juice

% Aloe Vera replaced.	Alum (mg/0.5l)	Aloe Vera dose (ml/0.5l)	pH	Turbidity (NTU)	% Turbidity removed	Colour
20	2.4	0.6	1.0	7.13	94.12	Crystal Clear
40	1.8	1.2	2.2	7.8	87	Crystal Clear
60	1.2	1.8	2.3	8.1	86	Crystal Clear
80	0.6	2.4	3.2	12.9	81	Crystal Clear
30	1.84	0.46	1.8	6.76	87.59	Crystal clear
50	1.38	0.92	5.8	6.56	60.00	Crystal clear
70	0.92	1.38	1.6	6.80	88.97	Crystal clear
90	0.46	1.84	5.6	7.1	61.38	Crystal clear

Here from the Table No. 3 we can see that as the Aloe Vera percentage increased turbidity removal also increased. It can also see from the table that as the percentage Aloe Vera increased pH of the water increased up to desirable level.

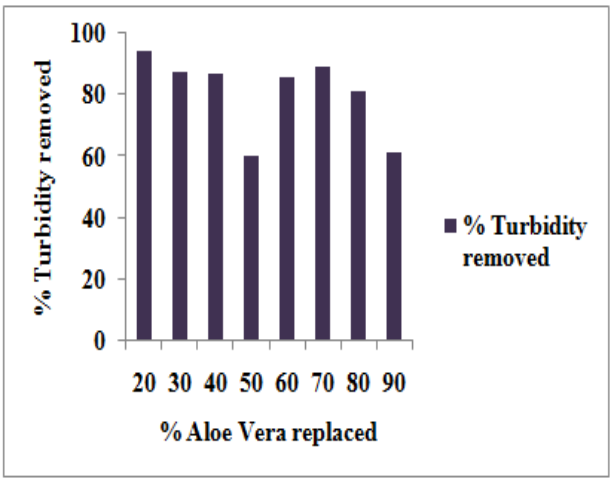


Figure 2 Resultant Graph of Alum replaced with Aloe juice

Group 4: - Alum replaced with 5% Aloe solution

20-40% replacement of Alum with 5% Aloe solution gave more than 80% removal of the turbidity. pH of all combination was also within the range.

Table No. 4 showing the results of 5% Aloe solution

% Aloe Vera replaced	Alum (mg/0.5l)	Aloe Vera dose (ml/0.5l)	pH	Turbidity (NTU)	% Turbidity removed	Colour
20	3.5	1.5	5.21	6.23	82.46	Crystal clear
40	2.5	2.5	4.32	6.49	85.45	Crystal clear
60	1.5	3.5	5.2	6.68	82.49	Crystal clear
80	0.5	4.5	7.6	7.24	74.41	Crystal clear
30	4	1	4.4	6.59	81.97	Crystal clear
50	3	2	4.8	6.69	80.33	Crystal clear
70	2	3	7.4	6.76	69.67	Crystal clear
90	1	4	8.2	6.78	66.39	Crystal clear

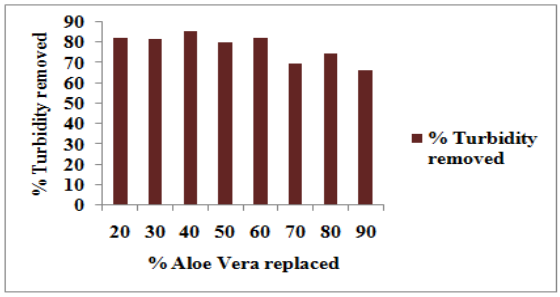


Figure 3 Resultant Graph of Alum replaced with 5% Aloe solution

Group 5: - Alum replaced with 2% Aloe solution

20-40% replacement of Alum with 2% Aloe solution gave more than 80% removal of the turbidity. Same as per the above all groups pH of the water increased with increased in the percentage of Aloe solution.

Table No 5 showing the results of 2% Aloe solution

% Aloe Vera replaced	Alum (mg/0.5l)	Aloe Vera dose (ml/0.5l)	pH	Turbidity (NTU)	% Turbidity removed	Colour
20	4	1	4.4	6.59	81.97	Crystal clear
40	3	2	4.8	6.69	80.33	Crystal clear
60	2	3	7.4	6.76	69.67	Crystal clear
80	1	4	8.2	6.78	66.39	Crystal clear
30	3.5	1.5	4.8	6.62	80.33	Crystal clear
50	2.5	2.5	6.5	6.69	73.36	Crystal clear
70	1.5	3.5	7.1	6.73	70.90	Crystal clear
90	0.5	4.5	7.8	6.76	68.03	Crystal clear

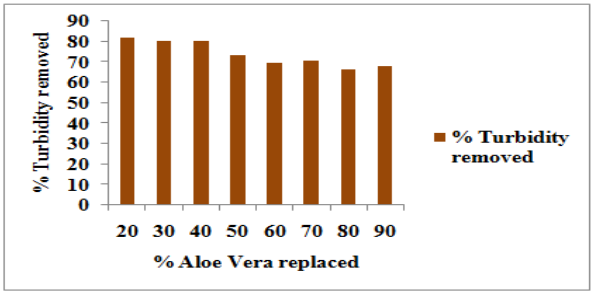


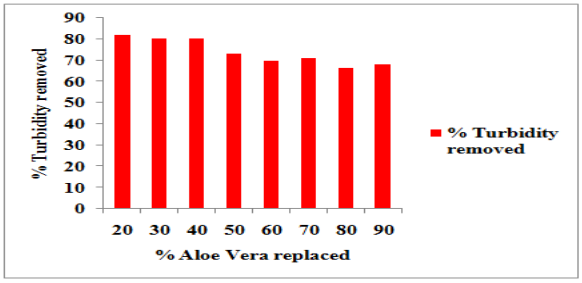
Figure 4 Resultant Graph of Alum replaced with 2% Aloe solution

Group 6: - Alum replaced with 1% Aloe solution

According to results mentioned in the Table No.6 20% replacement of Alum with 1% Aloe solution gave results more than 80% and the value is within the range desirable for drinkable water.

Table No. 6 showing the results of 1% Aloe solution

% Aloe Vera replaced	Alum (mg/0.5l)	Aloe Vera dose (ml/0.5l)	pH	Turbidity (NTU)	% Turbidity removed	Colour
20	4	1	4.4	6.59	81.97	Crystal clear
40	3	2	4.8	6.69	80.33	Crystal clear
60	2	3	7.4	6.76	69.67	Crystal clear
80	1	4	8.2	6.78	66.39	Crystal clear
30	3.5	1.5	4.8	6.62	80.33	Crystal clear
50	2.5	2.5	6.5	6.69	73.36	Crystal clear
70	1.5	3.5	7.1	6.73	70.90	Crystal clear
90	0.5	4.5	7.8	6.76	68.03	Crystal clear



5. CONCLUSION

Metallic coagulant Alum which is widely used in the treatment of water in developing countries have some carcinogenic effects on human being and hazardous to public health. Therefore natural coagulants have to be used in the treatment of water. Natural coagulant Aloe Vera juice as a primary coagulant is not as efficient as Alum. Pure Aloe juice when replaced by 60-80% are the good combinations for effectively removal of turbidity. But by considering various constraints like unavailability of Aloe Vera plants, difficulties in preparation of Aloe juice etc. various solutions of Aloe Vera was prepared.

From these solutions all the solutions were good to treat the water but by considering requirement of Aloe juice, 1% solution at 20% replacement is the technically sound and effective combination to treat the raw turbid water.

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Authors

Er.Tejaswinee Anil Pawar is currently a PG student in Anantrao Pawar College of Engineering from Pune University, Pune. She has completed her BE in Civil Engineering from VIIT, Pune. She has published two international papers on environmental engineering. Her BE project topic was Use of Tyre rubber in concrete. Her area of interest is water treatment and solid waste management.

Prof. S.M. Gawande is working at Anantrao Pawar College of Engineering and Research, Pune India. He completed his degree in Civil Engineering and Masters Degree in Environmental Engineering from Amravati University. In 2007, he joined the Birla Ready Mix Concrete division, as a Quality Officer and in since 2009 became a Asst. Prof in 2009 at RDTC, Pune to focus on environmental issues and respective research. Since 2013, he has been with the Department of Civil Engineering, APCOER, Pune, where he was an Assistant Professor and Head of Department. His main research interests include Air Pollution, Solid waste Management, Climate change. Sagar Gawande is a Life Member of the Indian Water Works Association (IWWA), Life Member of the Indian Society for Technical Education (ISTE), and Life Member of Institution of Public Health Engineering, Kolkata. He was the coordinator of the NCTR National Conference on Recent Trends and Revolution in Engineering, 2015. He effectively contributed in the environmental issues through National and International journals since 2007.