

Experimental Study on Treating Dairy and Kitchen Waste Water using Pappaya seed powder and Aloevera Gel

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Abstract— The use of natural resources in the process of water treatment, thus constitutes a potential promising ways to reduce on one hand, the high costs and environmental impacts due to the use of synthetic products used previously, and secondly allow as many people as possible access to drinking water. This will constitute therefore a major economic issue for developing countries. In conventional method of coagulation and flocculation alum, ferric chloride and ferrous sulphate were used as coagulant for effective removal of turbidity. But in one of the research it is found that continuous use of alum has caused several problems affecting human health. So this study is mainly focused on decreasing alum dose with use of natural materials. Natural coagulants are natural based coagulants that can be used in coagulation process of waste water treatment for reducing turbidity. The study aimed to, *Carica papaya* L. (papaya seed) powder, *Aloe barbadensis* (Aloe Vera) gel as a coagulant in dairy waste water and kitchen waste water samples collected. The experiments proved that turbidity and chlorides had reduced effectively.

Keywords- *Carica papaya* L. (papaya), *Aloe barbadensis* (Aloe Vera), *Arachishypogaea* (Peanut), *Turbidity*, *Dairywaste*, *Kitchen waste*.

I. INTRODUCTION

Water is a precious and essential natural resource, unevenly distributed on our planet. Freshwater represents only 2.5% of global supplies of water. About 70% of this freshwater quantity are either trapped under ice caps, or disseminated in the form of humidity or steam. Less than 1% of the world's freshwater, about 0.007% of planet's waters, are easily accessible to the various uses for development.

The use of natural resources in the process of water treatment, thus constitutes a potential promising ways to reduce on one hand, the high costs and environmental impacts due to the use of synthetic products used previously, and secondly allow as many people as possible access to drinking water. This will constitute therefore a major economic issue for developing countries. In conventional method of coagulation and flocculation, alum, ferric chloride, and ferrous sulphate were used as coagulant for effective removal of turbidity. But in one of the research it is found

that continuous use of alum has caused several problems affecting human health. It is found that aluminium is one of the causes for Alzheimer's syndrome. So this study is mainly focused on decreasing alum dose with use of natural materials. Natural coagulants are natural based coagulants that can be used in coagulation process of waste water treatment for reducing turbidity.. The study aimed to evaluate the efficiency of *Artocarpus Heterophyllus* (Jackfruit seed) powder, *Carica papaya* L. (papaya seed) powder, *Aloe barbadensis* (Aloe Vera) gel and *Arachishypogaea* (Peanut) powder as coagulants in dairy waste water and kitchen waste water samples collected.

II. MATERIALS REQUIRED

A. *Carica papaya* L. (papaya seed powder)

Papaya is a tall herbaceous plant in genus *carica* with edible fruits. These plants are grown in all parts of world.

B. *aloe barbadensis* (aloe vera gel)

It belongs to *Asphodelaceae* famiy, and is a shrubby or arborescent, perennial, xerophytic, succulent, pea green colour plant.

III. LITERATURE REVIEW

Hemraj S.R et al (2019) made the experiment on dairy industry which is one of the major source of food processing. These industries produce a huge amount of wastewater .Such wastewater is to be treated by using naturally and easily available coagulants and then tests are to be carried to check the water different characteristics of waste water before and after coagulation process. Natural coagulants used are Jack fruit seeds and Aloevera gel. The mixed proportion of jackfruit seed powder and Aloevera gel are used as adsorbents. The maximum percentage reduction of various parameters can be observed at a dosage of 0.8 gm of Jack Fruit seed. The maximum percentage reduction of various parameters can be observed at a dosage 4% of Alovera Gel.

The maximum percentage reduction of various parameters can be observed at a proportion of (20:80) of Alovera gel + Jack Fruit seed. (1)

Prof. T D Raju et al (2018) made an attempt to evaluate the comparative effectiveness of chemical coagulant Alum with Natural Coagulant such as Moringa Oleifera and tamarind seed powder. The maximum turbidity reduction of alum, moringa oleifera, tamarind and combined use of moringa oleifera tamarind seed were found as 97.5%, 98.12%, 98.12% and 98.75% with optimum dosage of 300, 250, 300 and 250mg/l. The pH, alkalinity, acidity and total chlorides was determined in treated sample of coagulants and maximum reduction efficiency was found in the combined use of moringa oleifera and tamarind seed powder. The Utilisation of locally available natural coagulant was found to be suitable, easier, cost effective and environment friendly for water treatment. (2)

Aneesu Rahman et al (2018) evaluated the efficiency of Artocarpus Heterophyllus (Jackfruit seed) powder as a coagulant in dairy waste water and kitchen waste water samples collected. Jar Test was conducted and the treated samples were evaluated for pH, turbidity and COD. The result showed 82% reduction in turbidity at an optimum dosage of 1600 mg/l for dairy waste water and 88.4% reduction in kitchen waste water at an optimum dosage of 600 mg/l. The reduction in COD was obtained as 57% for dairy waste water and 53% for canteen waste water. Jackfruit seeds could be used as an effective natural coagulant since it is eco-friendly and of low cost when compared with chemical coagulant. (3)

Venkata Maruti Prasad S et al (2017) made assessment of three different natural coagulants namely seeds of Moringa Oleifera, Arachis Hypogaea (Peanut), Zea mays (Corn). After treatment the water samples were analyzed for different parameters like pH, Turbidity, TDS and Electrical conductivity. Turbidity removal efficiency was 86%, 83%, 21%, after the treatment at optimum dosage of 20mg/l and speed of mixing of 200rpm respectively for synthetic water of 100 NTU. Finally, it can be concluded that Moringa Oleifera and Arachis Hypogaea (Peanuts) are the most efficient natural coagulants. (4)

IV. METHODOLOGY

The standard methods were used for sample collection and storage. First we characterise the collected water samples. Then treat collected samples by Natural coagulants and investigate the optimum dosage separately in order to reduce turbidity of wastewater. Also we study their effect on turbidity, chloride etc

A. Alovera gel preparation:

Aloevera leaves were washed under the tap water to remove the dirt. Thick green cover or epidermis was carefully separated from the gel part. Then the gel part was blended in mixer to form liquid and preserved in glass bottles in refrigerator. 1% dilution of aloe vera was made by using 1ml aloe vera gel in 100 ml distilled water similarly different percentage of aloe vera solutions were made. The aloe vera

gel is mixed in dosage of 0%, 1%, 3%, 5%, 7% and 9% in case of dairy waste water and 0%, 1%, 2%, 3%, 4% and 5% for kitchen waste water.

B. Papaya seed coagulant:

The fruits were sliced open using a clean knife. The seeds were washed severally with distilled water. Then seeds were dried under sunlight for a period of 7 days before crushing. The seed were made into fine powder using home grinder and powder was collected in sterile bottle with air tight cap. Then the seed powder was sieved through 0.45 mm sieve and finer particles were then used as coagulant. Dosages are 0.0, 0.1, 0.2, 0.3, 0.4 and 0.5 g/500ml in case of both dairy waste and kitchen waste water.

C. Dairy waste water:

Dairy waste was collected from Milma Milks Kottayam Dairy, Vadavathoor. The samples were collected in sterilised bottles and were preserved in the refrigerator during storage.

Table 1 Initial characteristics of dairy waste water

PARAMETERS	VALUE
pH	7.1
Turbidity	210 NTU
Chloride	322.09 mg/l
Total Alkalinity	208 mg/l
Total Acidity	105 mg/l

D. Kitchen waste water

Kitchen waste water was collected from the canteen outlet of Mangalam College of Engineering, Ettumanoor. Sufficient care was taken to obtain a sample that was true representative of existing condition and to handle it in such a way that it do not deteriorate or become contaminated before it reached the laboratory.

Table 2. Initial characteristics of kitchen waste water

PARAMETERS	VALUE
pH	7.3
Turbidity	424 NTU
Chloride	386.62 mg/l
Total Alkalinity	415 mg/l
Total Acidity	80 mg/l

V. RESULTS AND DISCUSSIONS

A. Effect of Alovera gel on Turbidity

The tests were conducted on dairy waste water and kitchen waste water. The initial turbidity values are 424 NTU and 210 NTU for dairy waste water kitchen waste water respectively. The turbidity of the sample was measured by using Nephelometric Turbidity meter. The aloe vera gel is mixed in dosage of 0%, 1%, 3%, 5%, 7% and 9% in case of dairy waste water and 0%, 1%, 2%, 3%,

4% and 5% for kitchen waste water to determine the optimum coagulant dosage.

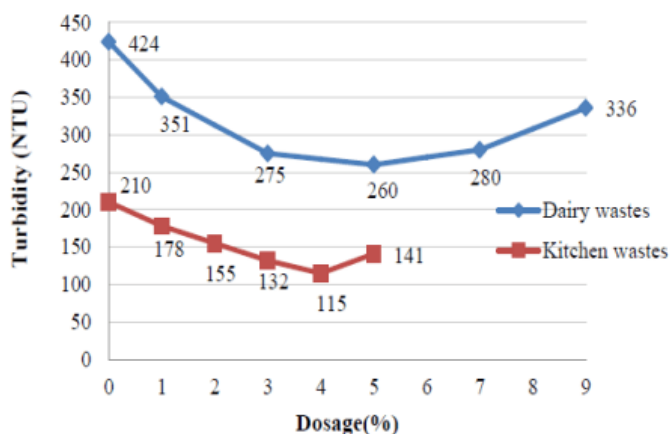


Figure 1 Variation of turbidity with varying dosages Of aloe vera gel

Aloe vera gel reduced turbidity from 424 NTU to 260 NTU with a percentage reduction of 38.68% at optimum dosage of 5% for dairy waste water. Aloe vera gel reduced turbidity from 210 to 115 NTU with a percentage reduction of 45.23% at optimum dosage of 4% for kitchen waste water.

B. Effect of Alovera gel on Chloride

The tests were conducted on dairy waste water and kitchen waste water. The initial Chloride content are 386.62 mg/l of CaCO_3 , 322.09 mg/l of CaCO_3 for dairy waste water kitchen waste water respectively. The chloride content of the sample was measured by Mohr's method. The aloe vera gel is mixed in dosage of 0%, 1%, 3%, 5%, 7% and 9% in case of dairy waste water and 0%, 1%, 2%, 3%, 4% and 5% for kitchen waste water for the test.

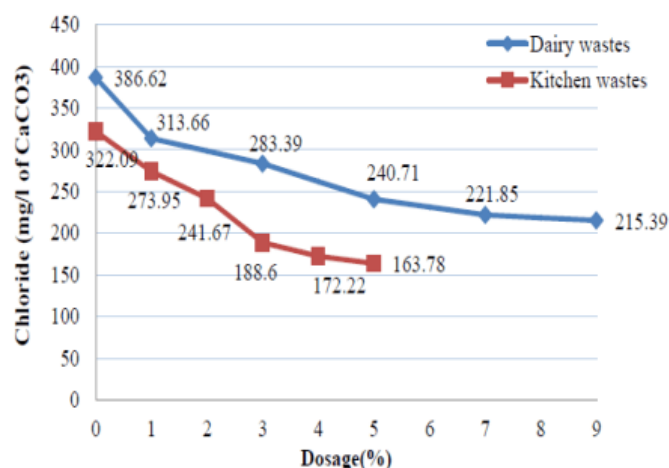


Figure 2 Variation of chloride with varying dosages of aloe vera gel

Here a descending trend is occurred. The maximum reduced chloride is 163.78 mg/l of CaCO_3 at a dosage of 5% for kitchen waste water and 215.39 mg/l of CaCO_3 at 9% for dairy waste water.

C. Effect of Papaya seed powder on Turbidity

Optimum coagulant dosage was determined by varying the dosages as 0.0, 0.1, 0.2, 0.3, 0.4 and 0.5 g/500ml in case of both dairy waste and kitchen waste water.

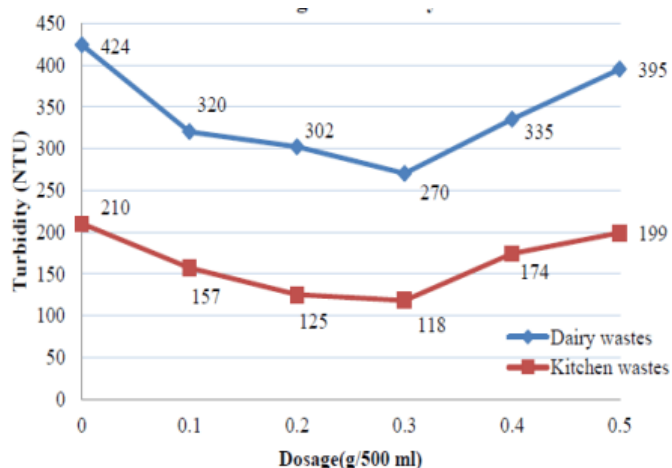


Figure 3 Variation of turbidity with varying dosages of papaya seed powder

Papaya seed powder reduced turbidity from 210 to 118 NTU with a percentage reduction of 43.8% at optimum dosage of 0.3 g/500 ml for kitchen waste water.

D. Effect of Papaya seed powder on Chloride

The chloride content of the sample was measured by varying the dosages as 0.0, 0.1, 0.2, 0.3, 0.4 and 0.5 g/500ml in case of both dairy waste and kitchen waste water.

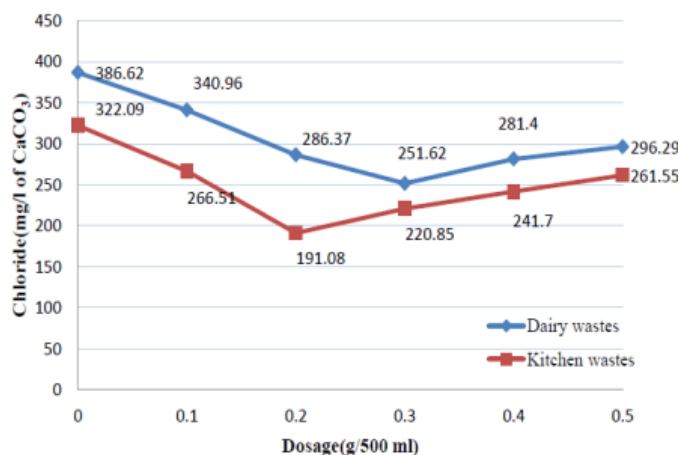


Figure 4 Variation of chloride with varying dosages of papaya seed powder

The maximum reduced chloride is 191.08 mg/l of CaCO_3 at a dosage of 0.2 g/500 ml for kitchen waste water and 251.62 mg/l of CaCO_3 at 0.3 g/500 ml for dairy waste water.

Aloe vera gel reduced turbidity to 260 NTU for dairy waste with a percentage reduction of 38.68% at optimum dosage of 5% and 115 NTU for kitchen waste water with a percentage reduction of 45.23% at optimum dosage of 4%.

At this optimum dosage, the chloride reduction is 38 % for dairy waste water and 46.5 % for kitchen waste water.

Papaya seed powder reduced turbidity to 270 NTU for dairy waste water with a percentage reduction of 36.32% at optimum dosage of 0.3 g/500 ml and 118 NTU for kitchen waste water with a percentage reduction of 43.8% at optimum dosage of 0.3 g/500 ml. At this optimum dosage, the chloride reduction is 35 % for dairy waste water and 31 % for kitchen waste water

VI. CONCLUSIONS

The experimental work aims to determine the activity of *Carica papaya* L. (papaya seed) powder, *Aloe barbadensis* (Aloe Vera) gel on waste water purification. For this dairy waste water and kitchen waste water were collected. Based on the results of experiment carried out under varied experimental conditions and the analysis of the same thereby the following conclusion has been drawn

Aloe vera gel reduced the turbidity by 38.68% in dairy and 45.23% in kitchen waste water. Also chloride reduction is 38 % and 46.5 % respectively. Papaya seed powder reduced the turbidity by 36.32% in dairy and 43.8% in kitchen waste water. Also chloride reduction is 35 % and 31 % respectively. The experiments proved that turbidity and chlorides had reduced effectively.

REFERENCES

- [1] Hemraj S.R, Megha C, Chandhini D, Lathamani C R, Manjunath H S (2019) "Experimental Study on Treating Dairy Waste Water Using Jack Fruit Seeds and Aloe vera Gel", *International Journal of Innovative Research in Science, Engineering and Technology* 8 (5), 5401-5407.
- [2] Prof. T D Raju, Asst Prof. Ahana K Reji, Naji Raheem, Sruthi Sasikumar, Veena Vikraman, Shimil C P, Sneha K M (2018) "Role of Moringa Oleifera and Tamarind Seed in Water Treatment", *International Journal of Engineering Research & Technology* 7 (4), 454-462.
- [3] Aneesu Rahman, Aswathy Ramesh, Ranjitha O R, Suranya T, Jency Nadayil (2018) "Efficiency of Jackfruit Seed Powder as a Natural Coagulant", *International Research Journal of Engineering and Technology* 5 (3), 3060-3062.
- [4] Venkata Maruti Prasad S, H Ramamohan, B Srinivasa Rao (2017) "Assessment of Coagulation Potential of Three different Natural Coagulants in Water Treatment", *International Journal of Research & Scientific Innovation* 4(12) 7-9.
- [5] Arya Chandran J, Duthy George (2018) "Use of Papaya Seed as a Natural Coagulant for Water Purification", *International Journal of Scientific Engineering and Research* 6 (3), 41-46.