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Evaluating Coagulation Efficiency of Natural Coagulant for Dairy Wastewater Treatment

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Abstract: ***Water is undoubtedly the most important resource from the all natural resources. One of the major source, which pollute the environment is waste water produced from the dairy industry. Dairy industry is one of the biggest users of water during various processing stages. Wastewater Produce from this processes contain high turbidity, total solids, COD, total dissolve solid. There are variety of coagulation methods for wastewater, which are very costly and those methods are not effective for common people. In this study the attempt is made to find the efficiency of natural coagulant and compare it with chemical coagulant for removal of turbidity. Moringa oleifera is used as natural coagulant and Alum is used as chemical coagulant. The removal of COD, Turbidity, total solids are respectively 56.25%, 98.70%, 12.83% at pH 9 at a coagulant dose of 6.5 gm/L for Moringa oleifera and 62.5%, 99.75%, 12.6% at pH 10 at constant dose of 3.5 gm/L for alum.***

Keywords: Coagulation, Natural Coagulant, Dairy wastewater, Turbidity

1. Introduction

Water is a surely key substance in all natural and human activities [14]. Water is a tasteless, odourless, and nearly colourless chemical substance, which is the main constituent of Earth's streams, lakes, and oceans. Water is an important component for human life's and other life forms. The use may be drinking, industrial water supply, irrigation, water recreation or many other uses, including being safely returned to the environment. The continuous use of water makes it impure, so at the end of use, purification of water is essential. This purification is proceeding by different treatment given to the water. It has been found that in the developing countries more than 1.6 million people are using the unhygienic water & among them most of the people suffers from diarrhoea and other water related diseases. Water treatment removes contaminants and undesirable components, or reduces their concentration so that the water becomes fit for its desired work. Major reason for pollution is industrialization and rapid urbanization [4]. Water treatment takes place in two ways, one is natural and other is conventional method. In natural way, it happens by itself only. Ex. self-cleaning of the river. Another way is conventional method of water treatment. In this method water treatment is carried out in different unit operations like sedimentation, flocculation, coagulation, filtration etc. Turbidity is generally cloudy or haziness appearance of water, and aesthetically unattractive. Turbidity imparts vital problems, in the direct use of water from a natural resource. At that time coagulation is very effective process. So we use various types of coagulants, depending upon their physical and chemical uses in treatment of raw water. Alum is use as a chemical coagulant. Use of high level of alum in water treatment is hazardous for human health. Use of natural coagulants in water treatment may help in reducing the health effect and cost of chemical coagulant also [10].

2. Sample Collection

The raw water sample was collected from a collection tank of Dairy Industry which is shown in figure. The water of this Dairy effluent is very much polluted. This water contains high BOD because of its organic content and high turbidity due to colloidal particles. Due to these reasons, the dairy is selected for this study. The sample was collected two or three time in week from Equalisation tank.

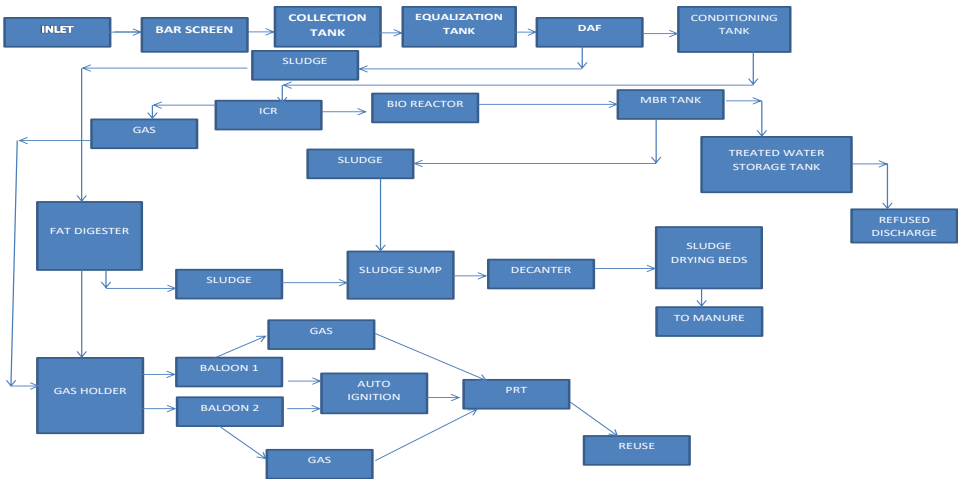

Figure 1: Flow Chart of Dairy Industry

Table 1: Initial Parameters of dairy Industry

Sr. No	Parameters	Initial Value
1	Turbidity	2500-3000 NTU
2	COD	5500-6000 mg/L
3	Total Solids	5000-6500 mg/L
4	Total Dissolved Solids	1200-1300 mg/L
5	pH	8 - 8.8

3. Natural Coagulants Preparation

Moringa oleifera

Moringa oleifera is collected from the Agro agency. The collected pods are then dried in sunlight for 15 days. After drying, the seeds were removed from the pods and further ground to required size. Then ground seeds were further passed through sieve of 600 µm [8]. Sieved powder is use as a coagulant for the study.

Figure 2: Moringa Oleifera Fruit and its seed

4. Experiment

Jar tests were carried out by using a jar tester to evaluate coagulation activity at several dose levels of natural seeds coagulant. five 500-ml beakers were filled with 500 ml of dairy waste water were placed in the slots of the jar tester. The waste waters were agitated at 100 rpm for 2 minutes. The mixing speed was reduced to 40 rpm and was kept for 30 min for slow mixing. After sedimentation for 1 h; The sample was collected from about 1 cm below the surface of the water and different parameters were checked.

Figure 3: Jar Apparatus

5. Results and Discussion

The analysis of different parameters before and after Jar test with optimum Dose of coagulant and for different maintained pH. For Optimum Dose of Moringa Oleifera, dose was taken from 1 gm/L to 10 gm/L. In that experiment Optimum Dose was found between 6 gm/L to 7 gm/L. For more accuracy another experiment conduct from dose 5.5, 5.75, 6, 6.25, 6.5, 6.75 gm/L to find Optimum Dose. Same experiment is done for alum also. Below figure is for optimum Dose of Moringa Oleifera and Alum.

5.1. Optimum Dose of Coagulant for Turbidity

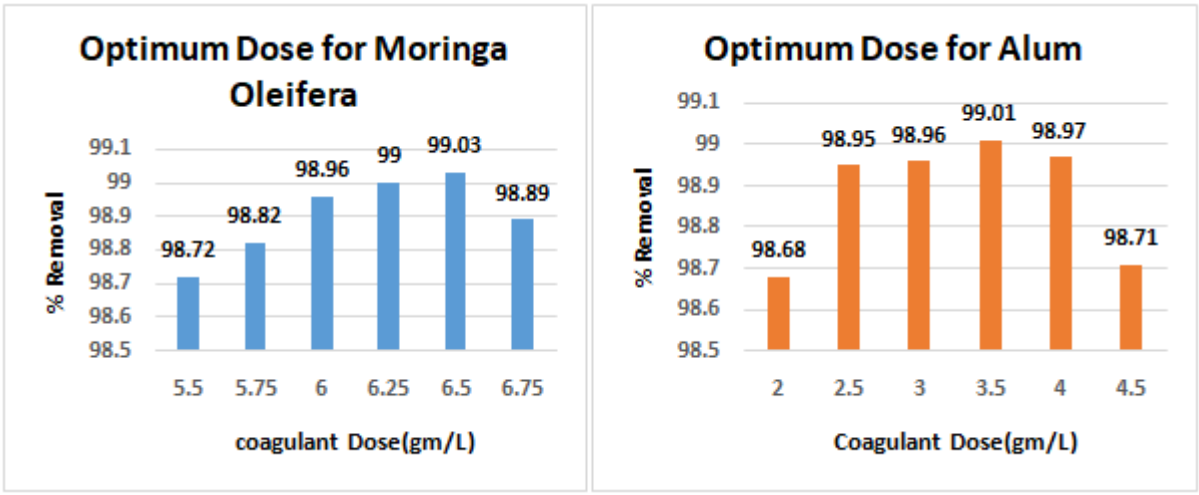

Figure 4: Optimum Dose

From the above experiment result, the optimum dose for Moringa Oleifera and alum is 6.5 gm/L, 3.5 gm/L respectively. This dose are used as a further experiment to find Removal of COD, TDS, TS, Turbidity. For the experiment, Optimum Dose of coagulant is used as a coagulant dose for both Alum and Moringa Oleifera and maintained pH from 4, 5, 6, 7, 8, 9, 10, 11 in 8 different beakers.

5.2. Effect on Turbidity at optimum Dose

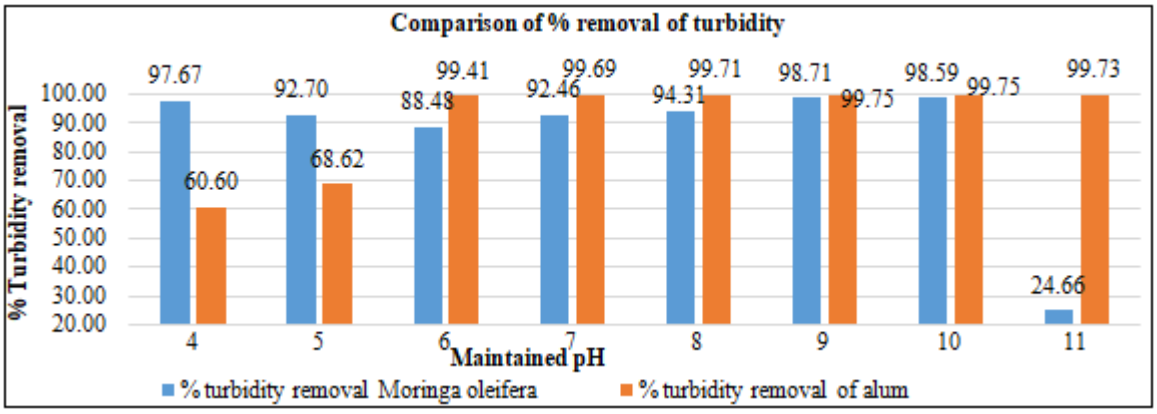

Figure 5: % Turbidity Removal

From the experiment**,** maximum % turbidity removal for Moringa oleifera and Alum is at pH 9 which is 98.71% and 99.75% respectively. In Alum dose, for pH 6, 7, 8, 9, 10, 11 turbidity removal is almost same but it is maximum at pH 9.

5.3. Effect on COD at Optimum Dose

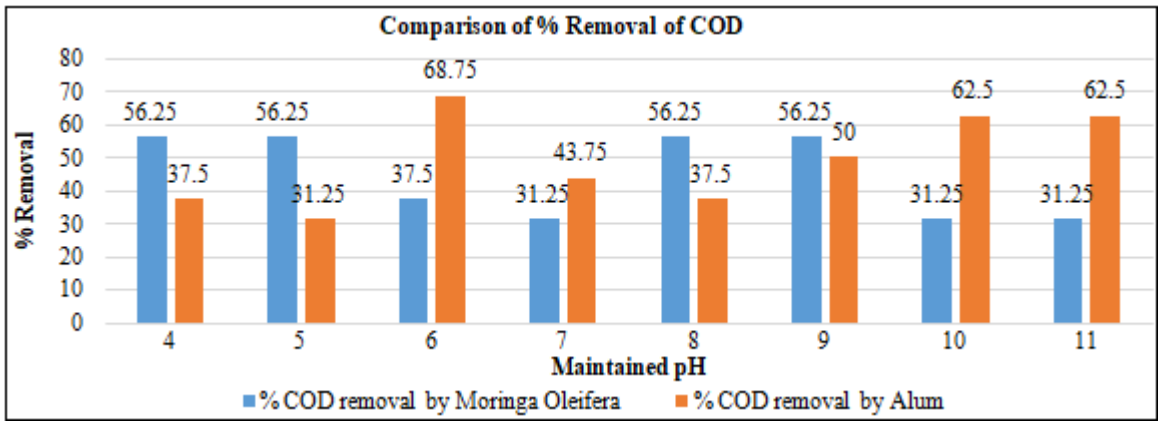

Figure 6: % COD Removal

From the experiment, maximum % COD removal for Moringa oleifera is at pH4, 5, 8, 9 which is 56.25% and for Alum is at pH 6 which is 68.75%.

5.4. Effect on Total solids at Optimum Dose

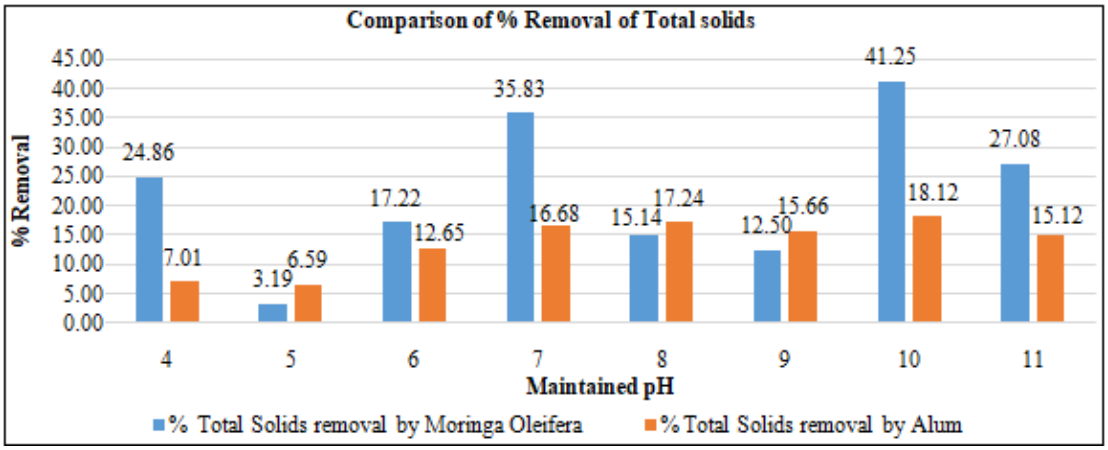

Figure 7: % TS Removal

From the experiment, maximum % Total Solids (TS) removal for Moringa oleifera and Alum is at pH 10 which is 41.25% and 18.12% respectively.

5.5. Effect on Total Dissolved solids at Optimum Dose

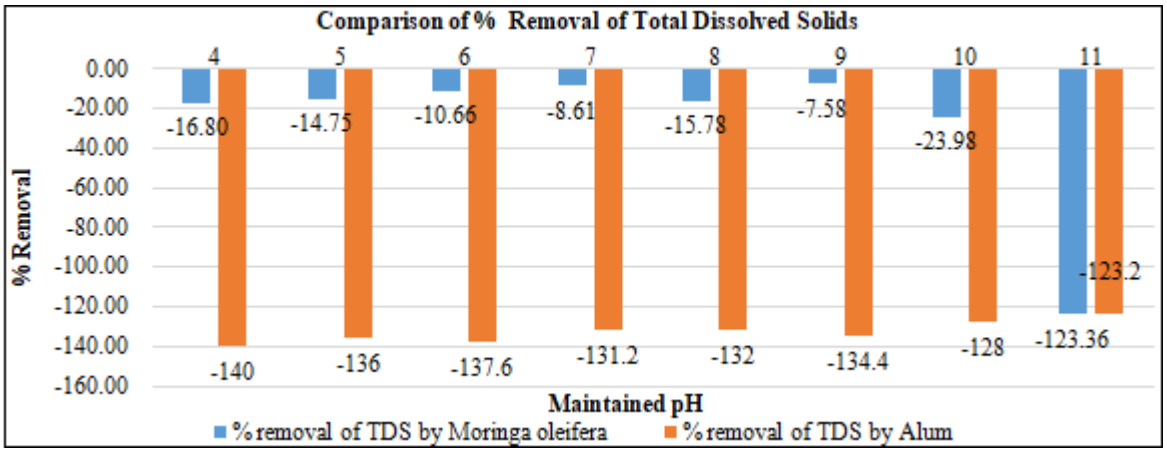

Figure 8: % TDS Removal

From the above result, it is show that Total Dissolved Solid is actually increased after the addition of both Coagulants. Total Dissolved Solids are increased minimum at pH 9 For Moringa Oleifera which is 7.58% and at pH 11 for Alum which is 123.20%.

5.6. Effect on pH at optimum Dose

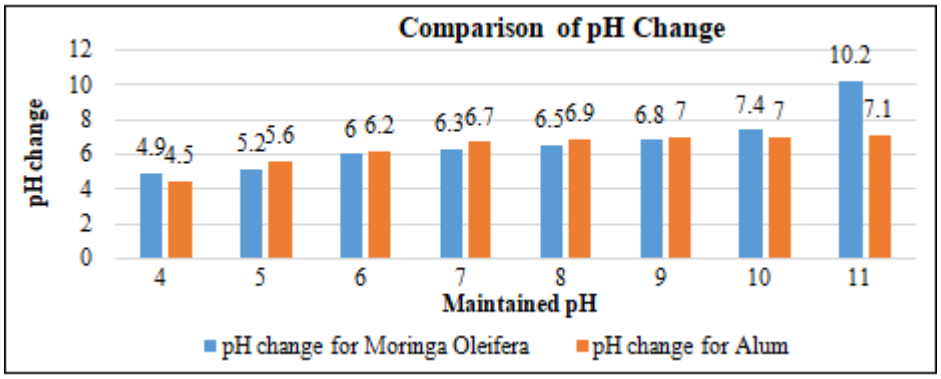

Figure 9: pH Change

From the above graph, pH change is almost same for both coagulants up to pH 10. At pH 11 there is significant difference between both coagulants.

6. Conclusion

From the present study, it can be concluded that:

The Moringa Oleifera seed are very effective coagulant, especially for high turbid dairy waste water. The volume of sludge produce from Moringa Oleifera is comparatively less than Alum. The Optimum Dosage of treatment for Moringa Oleifera is 6.5 gm/L and for Alum is 3.5 gm/L. Percentage Turbidity removal for Moringa Oleifera is 98.71 % and for Alum is 99.75 % at pH 9.From the Comparison, it was found that from both Coagulant, Alum is effective coagulant than Moringa Oleifera but Moringa Oleifera is Economical than Alum. Percentage COD removal for Moringa oleifera is 56.25% and for Alum is 68.75%.

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