

TREATMENT OF DAIRY WASTE WATER BY MORINGA OLEIFERA AS NATURAL COAGULANT

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ABSTRACT

The dairy industry 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 like BOD, COD, pH and turbidity, etc. before and after coagulation process. Natural coagulant used is Moringa Oleifera. Firstly the dairy waste water is subjected to sedimentation process. Then for variation of doses of Moringa Oleifera the solid reduction takes place. The optimum coagulant dosage obtained is 0.3g/ml. There is not much change in pH and conductivity due to usage of natural coagulant. The reduction of turbidity is 78.49%, reduction in BOD₃ is 79.64%, reduction in COD is 85.81%, reduction in total dissolved solids is 8.59% and reduction in total suspended solids is 95.45%. The efficiency of Moringa Oleifera mainly depends upon the protein content which is present in the Moringa Oleifera. The increase of dosage causes the increase of turbidity.

Keyword: - COD, Moringa Oleifera, BOD, Total Dissolved Solids , Total Suspended Solids.

1. INTRODUCTION

Moringa Oleifera (MO) is a tropical plant from the family of Moringaceae, a single family of shrubs with 14 known species. MO is native from India but is now found throughout the world. MO is non-toxic natural organic polymer, a medicinal plant. It is drought tolerant and has nutritional, medicinal, and water-cleaning attributes the mechanism of suspended solids removal by the coagulation active component in M.O has been described. MO is finely powdered and used as coagulant in treatment The purpose of dairy waste water treatment using natural coagulants is to find out the parameters such as colour, turbidity, pH, BOD, COD, total dissolved solids, total suspended solids.

2. MATERIALS

The coagulant which is used is Moringa Oleifera and Phaseolus vulgaris for the treatment of dairy wastewater. The natural coagulants is collected from the Perinjanam local market.

3. METHODS

The *Moringa Oleifera* and *Phaseolus vulgaris* seed pods are collected, and dried at a hot air oven for 70°C. The dried seeds were grounded to a fine powder by mechanical grinder. This powder was sieved through 600µm sieve. This powder is used as coagulants for dairy waste water treatment.

4. EXPERIMENTAL SET UP

Firstly the dairy waste water is subjected to sedimentation process. The suspended particles are trapped down due to this process. The study of coagulation jar apparatus has been used. The jar apparatus has the six beakers and six steel paddles which help in the agitation process. The initial speed of agitation is 100rpm for 2 min, followed by 40rpm for 30min. The settling time applied for coagulation process is 60 min. Color, Turbidity, pH, COD, BOD, Total dissolved solids, Total suspended solids are used to determine the initial characteristics of dairy waste water. After treating dairy waste water with natural coagulant *Moringa Oleifera*, the optimum dosage for the coagulant is determined by reduction in turbidity. Then treated dairy waste water with optimum coagulant dosage water is taken and the same tests are repeated such as Color, optimum pH, COD, BOD, Total dissolved solids, Total suspended solids.

4.1 Color

A 10ml of distilled water is taken in a cuvette and is placed in the position for blank. Another 10ml of sample is taken in another cuvette. A color disc corresponding to this is inserted into the comparator and the disc rotated such that the two circles indicate identical colors.



Fig- 1: Color of dairy waste water

4.2 Turbidity

Jar test has been used to determine the reduction of turbidity. The optimum dosage of coagulant *Moringa Oleifera* can be determined by varying the degree of dosage of coagulant as 0.05gm, 0.1gm, 0.2gm, 0.3gm, 0.4gm, 0.5gm. The jar apparatus has the six beakers and six steel paddles which help in the agitation process. The dairy waste water of 800ml is taken in each beaker. The initial speed of agitation is 100rpm for 2 min, followed by 40rpm for 30min. The settling time applied for this coagulation process is 60 min.



Fig -2: Jar test

4.3 Optimum pH

Jar test has been used to determine the optimum pH. The optimum dosage of coagulant *Moringa Oleifera* is 0.4gm. The pH values provided in the range of 6.5, 7, 7.5, 8, 8.5. The jar apparatus has the six beakers and six steel paddles which helps in the agitation process. The dairy waste water of 800ml is taken in each beaker. The initial speed of agitation is 100rpm for 2 min, followed by 40rpm for 30min. The settling time applied for this coagulation process is 60 min. The pH is determined by pH meter.



Fig- 3: Jar test

4.4 Chemical oxygen demand (COD)

Place 20ml of sample in a 500ml of refluxing flask. Add 0.4gm mercuric sulphate and a few glass beads. Add 30ml sulphuric acid to dissolve the mercuric sulphate and cool. Add 10ml of 0.25N potassium dichromate solution and mix well. Attach the flask to the condenser and start cooling water. Apply heat and reflux for 2 hours. Cool and wash down the condenser with 90ml distilled water. Titrate the excess dichromate with saturated 0.1N ferrous ammonium sulphate using ferroin indicator (1 to 3 drops). The color changes from blue green to reddish indicates the end point. Reflux in the same manner a blank consisting of distilled water of equal volume as that of sample.

4.5 Biochemical oxygen demand (BOD)

Distilled water is aerated at 20°C. Take sample amount of this water and add 1ml each of phosphate buffer, MgSO_4 , CaCl_2 and FeCl_3 solution per liter of water. Seed the sample with 2-5ml of domestic settled sewage per liter of diluting water. Neutralize the sample with 1N NaOH or H_2SO_4 to pH 7.0. If residual chlorine present that is destroyed by adding $\text{Na}_2\text{S}_2\text{O}_3$ solution. Make several dilutions of prepared samples to obtain the required dilution 0.1-1% dilution for strong trade waste, 1-5% for raw and settled sewage, 5-25% for oxidized effluents and 25-100%

for polluted waters. Make initial DO determination. Determine the oxygen depletion of dilution water by keeping another two BOD bottles with dilution water, one for initial DO determination and the other for third day determination. Water seal the tops of BOD Bottles by pouring distilled water and incubated at 27°C for 3days.

4.6 Total dissolved solids

Wash the filter paper. Dry the evaporating dish & weigh the sample. Pipette out 50 ml of sample while stirring. Filter through the filter paper and wash it three times. Transfer the filtrate to evaporating dish & dry. Then Cool & weigh it.

4.7 Total suspended solids

Wash the filter paper & dry it. Cool & weigh the filter paper. Assemble filtration apparatus. Wet the filter paper with distilled water, and stir the sample. Pipette out 50ml of sample while stirring it. Filter it and wash three times. Transfer the filter to evaporating dish & dry it. Then cool & weigh it. Repeat the steps with 10 ml aliquot

5. RESULTS

Diary waste water was treated with natural coagulant, and finally initial and treated diary waste water characteristics was analyzed.

Table 5.1 Initial characteristics of diary waste water

Parameters	Unit	Initial value
pH	-	5.5
Turbidity	NTU	465.0
BOD ₃	mg/l	3400.0
COD	mg/l	8800.0
Total dissolved solids	mg/l	605.0
Total suspended solids	mg/l	24663.3

The coagulant *Moringa Oleifera* is used at various dosages and corresponding values of turbidity and optimum pH is being analyzed in table 5.2

Table 5.2 Values of turbidity and optimum pH for corresponding coagulant dosage

Coagulant dosage (gm/l)	Turbidity (NTU)	pH value
0.05	120.0	6.8
0.1	118.5	7.0
0.2	108.4	7.2
0.3	100	7.2
0.4	128.2	7.3

4.1 Optimum dosage

The optimum dosage of coagulants are determined by varying the dosage of coagulant are 0.05gm, 0.1gm, 0.2gm, 0.3gm, 0.4gm, 0.5gm at original pH of dairy wastewater (pH =5.5). The optimum coagulant dosage adopted for natural coagulant *Moringa oleifera* is 0.3gm/l.

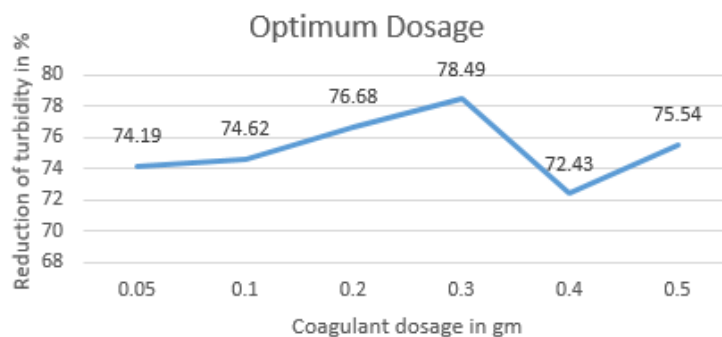


Fig-4: Optimum Dosage

4.2 Optimum pH

Optimum pH is the pH at which the maximum reduction of turbidity takes place. Optimum pH can be determined by varying the pH value as 6.8, 7.0, 7.2, 7.2, 7.3 and 7.3. The optimum pH adopted for natural coagulant *Moringa oleifera* is 7.2.



Fig-5: Optimum pH

Dairy waste water is being treated with coagulant *Moringa Oleifera* with optimum coagulant dosage of 0.3g/ l and final characteristics of treated dairy waste water is being analyzed in Table 5.3

Table 5.3 Final characteristic value of treated dairy waste water

Parameters	Unit	Final value
pH	-	7.2
Turbidity	NTU	100.0
BOD ₃	mg/l	692.0
COD	mg/l	1248.0

Total dissolved solids	mg/l	553.0
Total suspended solids	mg/l	1120.0

4.3 Efficiency of Moringa Oleifera

To determine the efficiency of Moringa Oleifera, the optimum dosage and optimum pH can be maintained. Optimum dosage is 0.3gm/l and optimum pH is 7.2. The reduction in turbidity for the dairy wastewater is 78.49%, reduction in BOD₃ is 79.64%, reduction in COD is 85.81%, reduction in total dissolved solids is 8.59% and reduction in total suspended solids is 95.45% by the influence of the natural coagulant Moringa Oleifera.

6. CONCLUSIONS

The characteristics of untreated dairy wastewater are pH is 5.5, COD is 8800.0mg/l, BOD₃ is 3400.0mg/l, total dissolved solids is 605.0mg/L, total suspended solids is 24663.3.mg/l, turbidity is 465NTU. The optimum dosage of Moringa Oleifera seed powder as a coagulant is found to be 0.3mg/l. The optimum pH of Moringa Oleifera is found to be 7.2. The reduction of turbidity is 78.49%, reduction in BOD₃ is 79.64%, reduction in COD is 85.81%, reduction in total dissolved solids is 8.59% and reduction in total suspended solids is 95.45%. Hence the Moringa Oleifera as a natural coagulant is effective for treatment of dairy wastewater, and the treated dairy waste water can be used for irrigational purposes. Comparing the result with Phaseolus vulgaris as natural coagulant, the Moringa Oleifera gives a better result

7. REFERENCES

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