An Experimental Study of Waste Water Treatment by Using Natural Coagulants

R Manju[1], Dr. S Thilagavathi[2]

[1,2] Department of Civil Engineering, Sri Bharathi Engineering College for Women

Abstract: Coagulation is an important waste water treatment process used to reduce water turbidity. In this study, the effectiveness of a natural coagulant derived from aazadirachtaindica for turbidity removal from textile industry effluent. Other parameters such as p^H, Turbidity, Total suspended Solids, Total dissolved solids, and calcium contents are 9(Alkaline), 10.4 NTU, 270 mg/l, 2352 mg/l, 62.4 mg/l respectively. Based on the experimental results, it was concluded that natural coagulants which have been obtained from dolichas lablab, Azadirachtaindica, Cactus, Cicerarietinum have showed an merely equalant coagulants comparing to commercial alum. The turbidity removel efficiency for Dolichas lablab, Azadirachtaindica, Cactus, Cicerarietinum respectively were 37.5%, 63.2%, 31.47%, 34.49% against 59.46% obtained from alum.

KEYWORDS: Coagulation,Turbidity, Dolichas lablab, Azadirachtaindica, Cactus, Cicerarietinum

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INTRODUCTION

Water is an universal solvent and is known as "tonic of life".It is one of the most important elements on earth. Every living being needs water for its survival. Water of high quality is essential for all living beings and water of acceptable quality is essential for agriculture, industrial, domestic, and commercial uses.

The increase in utilization of fresh water requirements in industries leads to release their wastewater in nearby streams and other water bodies.Which contributes to contaminating the fresh water available in nature, depletion of the fresh water and increasing the water pollution. The requirement of the fresh water in various sectors such as domestic, irrigation, industry, energy and others increases significantly all over the world. Thus water availability, both in terms of quality and quantity, has declined to such an extent owing to the rapid increase in the population and industrialization.

STRUCTURE OF PAPER

The paper is organized as follows: In Section 1, the introduction of the paper is provided along with the structure, important terms, objectives and overall description. In Section 2 we discuss related work. In Section 3 tells us about the methodology and the process description. Section 4 Result and discussions Section 5 tells us about the future scope and concludes the paper with acknowledgement and references.

OBJECTIVES

- To treat the wastewater using natural coagulants and to compare the removal efficiencies of each natural coagulants thereby interpreting the most efficient coagulant for the effective treatment.
- To achieve purification of water even in remote rural areas using easily available natural coagulants.
- To purify the domestic wastewater by using natural coagulants.
- To reduce the cost of treatment.
- To remove the pollutants that causes pollution.
- To achieve most efficient result.

RELATED WORK

There are numerous works that have been done related to waste water treatment using natural coagulants

M. Narmatha[1] has investigated the quality of the treated raw water were and analyzed and compared with each other. The experiments were conducted for various dosages of the crude extracts of the cotton seed and castor oilcakes using flocculate. The optimum dosage of these natural coagulants was identified. Various parameters such as pH, Total Solids (TS), Total Dissolved Solids(TDS), sulphates, chlorides, Chemical Oxygen Demand (COD), Biochemical Oxygen Demand(BOD) etc were determined. Results showed that the use of cottonseed oil cake was more efficient for the treatment of the sago effluent when compared to the castor oilcake. The alkalinity, sulphates and Total Suspended Solids of sago effluent after treated with the cotton seed oil cake were highly reduced.

Yin Chun Yang[2]have concluded that the powdered and dried cactus opuntia was very effective in removing turbidity from both estuarinee and river waters as evident by the high removalefficiencies. It was also proven that the cactus powder did not have a significant effect on final pH of the waters as compared to chemical-based coagulants. Increased cactus dosages correlated with decreased pH of surface water. It can be concluded that cactus opuntia has the potential to be utilized for surface water treatment applications.

Patil[3]reported that the efficiency of reduction of turbidity *by M. oleifera, Dolichos lablab, T. foenum-graecum and Cicerarietinum*are 61.60%, 71.74%, 58.20% and 78.33% respectively. The efficiency of reduction of COD from *M. oleifera, Dolichos lablab, T. foenum-graecum and Cicerarietinum*are 65.0%, 75%, 62.5% and 83% respectively. In his study not, much change in pH and conductivity due to natural coagulants were found. He also stated that efficiency of *Cicerarietinum*is more compared to other three, this depends on the protein content which is present in the natural coagulant, and the increase of dosage causes the increase of turbidity.

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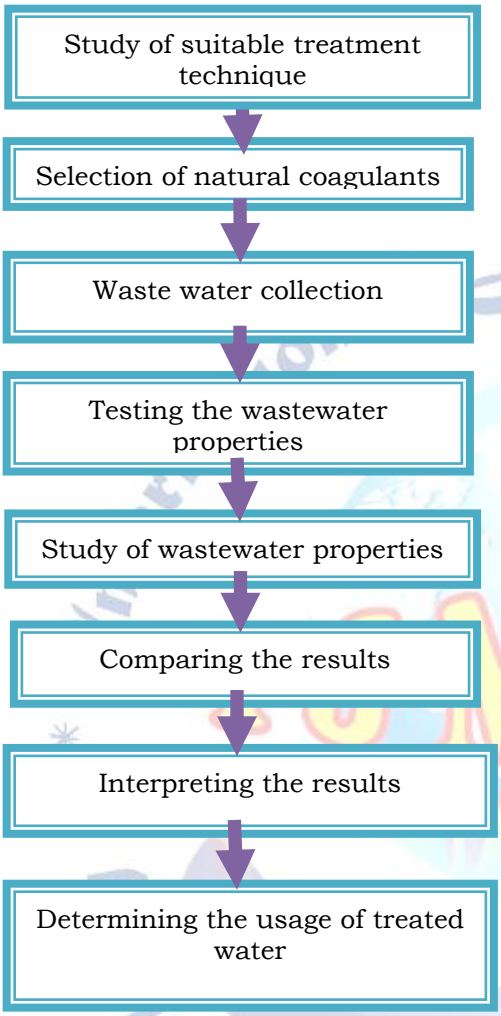
METHODOLOGY

Process Description

The following diagram makes it easier to understand how we proceed.



TYPES OF COAGULANTS

1. Organic coagulants (Natural)
   - Cactus
   - Neem
   - Gram
   - Dolichas lablab

2. In- organic coagulants (Synthetic)
   - Alum

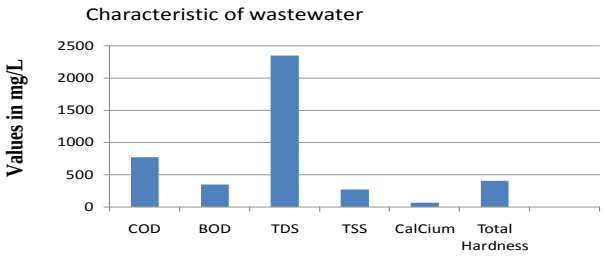
JAR TEST

Jar Test was carried out to evaluate the initial and final turbidity values (in NTU) before and after the coagulation process using natural coagulation. We have conducted 3 tests to take the average turbidity value for every coagulant dosage. The jar test is used to identify the most adapted mix of chemical compounds and concentrations for coagulation-flocculation. It is batch test consisting of using several identical jars containing the same volume and concentration of feed, which are charged simultaneously with three different doses of a potentially effective coagulant. The three jars can be stirred simultaneously at known speeds. The treated feed samples are mixed rapidly and then slowly and then allowed to settle. At the end of settling period, test samples are drawn from the jars and turbidity of supernatant liquid is measured.

Fig 1.Jar Test Apparatus

CHARACTERISTICS OF WASTE WATER

S. No.	Parameters	Textile Waste Water	Standard (ISI 2490 – 1981)
1.	Colour	Brownish –Black	
2	Odour	Unpleasant	
3	Ph	9	5.5 to 9
4	BOD mg/L	350	100
5	COD mg/L	770	41-2430
6	TDS mg/L	2352	2100
7	TSS mg/L	270	200
8	Calcium as Ca mg/L	62.4	200
9	Total Hardness as $CaCO_3$ mg/L	408	600



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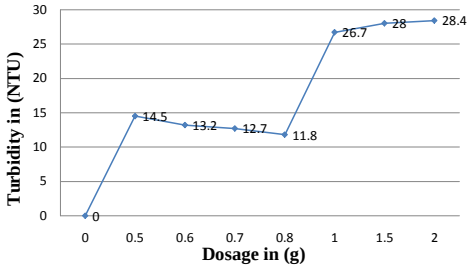
RESULT AND DISCUSSIONS

Wastewater Vs Alum

Initial Turbidity of wastewater = 28.9 NTU			
Dosage	Turbidity	Dosage	Turbidity
BATCH 1			
0.5g	14.5 NTU	1g	26.7 NTU
1.5g	28NTU	2.0g	28.4 NTU
BATCH 2			
0.5g	14.5 NTU	0.6g	13.2NTU
0.7g	12.7 NTU	0.8g	11.8 NTU

While using the conventional alum as coagulant, the optimum dosage was 0.8g, which gave 59.16% turbidity removal efficiency.

WasteWater Vs Alum

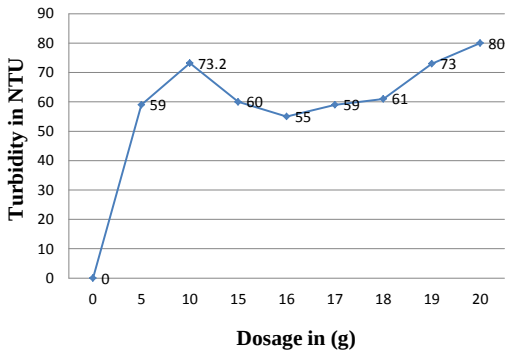


Wastewater Vs Avarai (Dolichas Lablab)

Initial Turbidity of wastewater = 66 NTU			
Dosage	**Turbidity**	**Dosage**	**Turbidity**
BATCH 1			
5g	59 NTU	10g	73.2 NTU
15g	60 NTU	20g	80 NTU
BATCH 2			
15g	60 NTU	16g	55NTU
17g	59 NTU	18g	61 NTU

While using the Avarai (Dolichas lablab) as coagulant, the optimum Dosage was 16g, which gave 37.5% turbidity removal efficiency

Wastewater Vs Avarai (Dolichas Lablab)

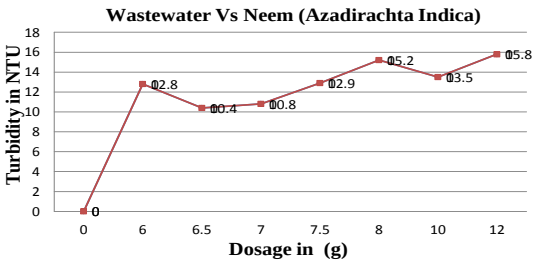


Wastewater Vs Neem seed (Azdirachta indica)

Initial Turbidity of wastewater = 17.6NTU			
Dosage	**Turbidity**	**Dosage**	**Turbidity**
BATCH 1			
6g	12.8NTU	8g	13.2 NTU
10g	13.5 NTU	12g	15.8 NTU
BATCH 2			
6.5g	10.4 NTU	7g	10.8NTU
7.5g	12.9 NTU	8g	15.2 NTU

While using the Neem seed (Azdirachta indica) as coagulant, the optimum Dosage was 6.5g, which gave 63.2% turbidity removal efficiency

Wastewater Vs Neem (Azadirachta Indica)

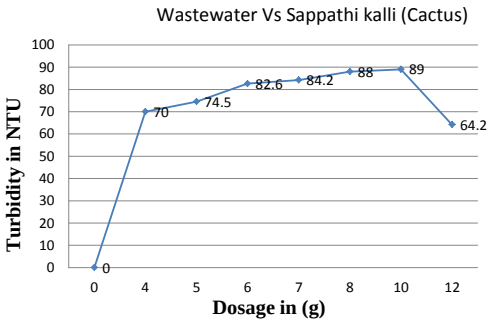


Wastewater Vs Sappathi kalli (Cactus)

Initial Turbidity of wastewater = 80NTU			
Dosage	**Turbidity**	**Dosage**	**Turbidity**
BATCH 1			
4g	70NTU	5g	74.5 NTU
6g	82.6 NTU	7g	84.2 NTU
BATCH 2			
6g	82.6 NTU	8g	88NTU
10g	89 NTU	12g	64.2 NTU

While using the Sappathi Kalli (Cactus) as coagulant, the optimum Dosage was 12g, which gave 31.47% turbidity removal efficiency

Wastewater Vs Sappathi kalli (Cactus)



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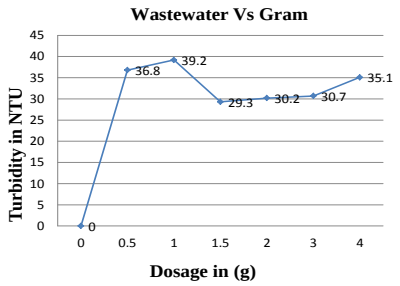
Wastewater Vs Gram (Cicer arietinum)

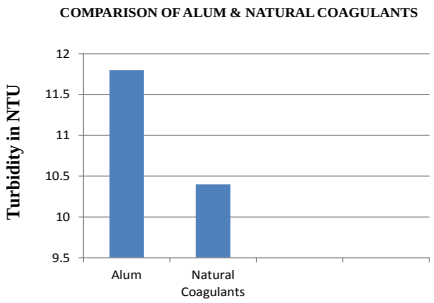
Initial Turbidity of wastewater = 44.8NTU			
Dosage	Turbidity	Dosage	Turbidity
BATCH 1			
1g	39.2NTU	2g	30.2NTU
3g	30.7 NTU	4g	35.1 NTU
BATCH 2			
0.5g	36.8 NTU	1g	39.2NTU
1.5g	29.3 NTU	2g	30.2 NTU

While using the Gram (cicer arietinum) as coagulant, the optimum Dosage was 1.5g, which gave 34.59% turbidity removal efficiency



Turbidity values Comparison

Materials	Turbidity
Alum (Chemical)	11.8 NTU
Natural Coagulants	
Avarai	55 NTU
Neem seed	10.4 NTU
Sappathi kalli	64.2 NTU
Gram	29.3 NTU



CONCLUSION

From the experimental results, we have concluded that among the chosen natural coagulants, azadirachtaindica showed a better coagulation and turbidity removal for given textile waste water. Effect of p^H, temperature can also be experimentally found out with the extension of current study, which may further improve the turbidity removal efficiency of the natural coagulants.Since, we have collected the waste water from a smaller textile, we suggest that, by using azadirachtaindica as a coagulant instead of commercial alum, for sedimentation process, we can restrict the treatment expenses in a significant scale.

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