

Textile Waste Water Colour Reduction Using Cactus

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Abstract—Textile industries generates huge quantites of waste water with complex organic and inorganic substances from various processing units. Mainly these textile waste water constituents are acids and alkalis, dyes, print pigments, surfactants etc. The textile effluents present in waste water can cause change in properties of water bodies such as change in temperature, pH, turbidity, COD, BOD, organic loading. Renewable approaches like the use of natural materials for the removal of pollutants from waste waters can give an effective solution and through that we can achieve sustainability. Cactus is a plant in biological origin can has the potential for the use of textile waste water treatments. Cactus has an ability to reduce the concentration of toxic dyes, COD, BOD, turbidity etc. This paper discuss the textile waste water treatment method using cactus as a coagulant. The initial parameters like pH, turbidity, TDS, colour, BOD and COD of textile waste water are measured as, 9.13, 725 NTU, 6.85 g/l, 510 PCU, 295 mg/l and 826 mg/l respectively. By conducting the natural coagulation using cactus powder as a coagulant in the textile waste water sample the maximum removal in turbidity, BOD, COD, TDS and colour at a dosage value of 1.5 gram is 83.86%, 70.17%, 76.99%, 80.18%, 83.60% respectively.

Keywords— Cactus, Colour, Electro-coagulation, Removal efficiency, Temperature, Textile waste wate, Turbidity.

1 INTRODUCTION

Textile industry is one of the largest industry present in this world. These are the industries that converts raw materials into finished goods. The raw materials used are several dyes, detergents, chemicals, water, fibres, cotton and other clothing materials etc. As a result of using these raw materials textile effluents become more turbulent and polluted. Different methods are used to treat textile effluent at its origin. Selection of each method is based on the characteristics of the materials present in it and the treatment objective. Various methods like coagulation, electro-coagulation, and adsorption are used to treat the textile effluents. These methods provides lower sensitivity to toxic loadings and higher organics amounts, energy saving, easy to operate and maintain. A renewable approach involving application of biomaterials in the removal of pollutants from textile waste water can offer a promising solution. Various natural materials that are off biological origin has a potential for waste water treatment. Intrestingly cactus is an abundant natural product, cost effective, safe for human health and biodegradable, offering various options such as coagulant or flocculant, biosorbent etc for the treatment of waste water. Cactus can improve and minimize the the negative impacts of the treated waste water disposal on human health.

The coagulation/flocculation offers various advantages for the treatment of both industrial and municipal waste waters including the lower sensitivity to toxic loadings and to higher amounts of organics. Some of the coagulants like aluminium salts, acrylamides, alum etc used in coagulation-flocculation process remain in treated water and may include health problems. Various health effects such as neurotoxic, carcinogenic, genotoxic, and carcinogenic properties may happen. The adsorption process is based on the activated carbon also offers various advantages such as eco friendly, higher efficiency, easy operation, simple design etc. But its use is limited due to its high cost and the loss of adsorption efficiency after regeneration. In natural coagulation method the chemicals added for wastewater treatment may react together and generate new products with unknown health effects. Hence there is a need to consider alterantive flocculant or coagulants such as natural materials. The natural material should be cost effective and biodegradable. By choosing cactus as coagulant removal of turbidity, colour and other water parameters can obtain. Through coagulation using cactus we can reduce polluted textile waste water parameters and statisfy stable eco friendly environment [3].

2 MATERIALS AND METHODOLOGY

2.1 Preparation of Cactus Powder

Cactus were brought from local market. The scientific name of the cactus choosened for the completion of natural coagulation process is Optunia Milpa Alta. The selected cactus was washed with tap water and sliced in to pieces for the effective drying. The sliced cactus first sundried and then kept in oven for 24 hours at 60°C.

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The dried cactus were grinded into fine powder using pestle and mortar. The powdered cactus passed through 300micron sieve.



Fig. 1 Cactus Powder

Fine cactus powder was used for the experiments.

2.2 Collection of Textile Waste Water Sample

The sample of textile waste water is collected from an industry in Kannur, kerala.



Fig. 2 Textile Waste water sample

The collected sample is analysed to obtain the textile sample Characteristics.

2.3 Experimental Process

2.3.1 Jar Test

The coagulation and flocculation process was done by jar test experiment. Jar test is a laboratory procedure that stimulates coagulation or flocculation with differing chemical doses. The purpose of the procedure is to estimate the minimum coagulant dose required to achieve certain water quality goals. For the jar test samples of water to be treated are placed in six jars. In this experiment 1 L of Textile waste water samples taken in six beakers, each beakers having capacity of 1 L. Keep the beakers below the paddle and lower the paddle such that each one is about 1cm above the bottom. Different concentrations of dried cactus powder was used. The coagulant dosage used in are 0.5 gram, 1.0 gram, 1.5 gram, 2.0 gram, 2.5 gram and 3.0 gram respectively. Figure 3 shows the jar test apparatus. Rapid mixing was carried out first at 150 rpm speed for 4 minutes and then slow mixing at 40 rpm speed for

20 minutes. The stirrer was then switched off and lift out the paddles and follow up by settling for 1 hours.



Fig. 3 Jar test apparatus

The supernatant is examined for various tests such as pH, turbidity, COD, BOD and TDS and colour.

3 RESULT AND DISCUSSION

Cactus was investigated on its potential to remove various parameters from textile waste water.

TABLE 1
CHARACTERISTICS OF TEXTILE WASTE WATER

Parameters	Initial concentration
pH	9.13
Turbidity	725
TDS	6.85
Colour	510
BOD	295
COD	826

The collected sample is analysed for various parameters to obtain the characteristics of sample.

3.1 Coagulation Using Cactus Powder

Coagulation is the process of destabilization of particles, colloids, and dissolved solids. Destabilisation of colloidal particles brought about by the addition of chemical reagent called coagulant. For this experiment cactus powder is used as the coagulant. Cactus is considered as alternative to conventional synthetic chemical coagulants in aspects such as costs, health effects etc. The coagulation performance of cactus to act as natural macromolecular coagulant was studied by the jar test. The coagulation starts with the dosage of 0.5 gram, 1.0 gram, 1.5 gram, 2.0 gram, 2.5 gram and 3.0 gram.

Table 2 shows the characteristics of textile waste water after treatment with cactus powder.

TABLE 2
CHARACTERISTICS OF TEXTILE WASTE WATER AFTER TREATMENT WITH CACTUS POWDER

Parameters	Dosage (in gram)					
	0.5	1.0	1.5	2.0	2.5	3.0
pH	7.43	7.18	6.75	6.31	6.02	6.14
Turbidity (NTU)	474	318	117	138	153	209
TDS (mg/l)	4237	3150.7	1357	2010	2078	2415
Colour (PCU)	340	211	100	109	117	122
BOD (mg/l)	200.1	143.6	95	104	111.4	125
COD (mg/l)	684	440	190	224.9	256.2	287.5

Table 3 shows the removal efficiency of textile waste water after treatment using cactus powder.

TABLE 3
REMOVAL EFFICIENCY OF TREATMENT USING CACTUS POWDER

Parameters	Removal efficiency (%)					
	0.5 gram	1.0 gram	1.5 gram	2.0 gram	2.5 gram	3.0 gram
Turbidity	34.62	56.13	83.86	80.96	78.89	71.79
TDS	38.14	55.47	80.18	70.65	69.65	64.74
Colour	44.26	65.40	83.60	82.13	80.81	80.03
BOD	29.79	51.32	70.17	64.3	62.5	57.62
COD	17.19	46.73	76.99	72.77	68.91	65.19

From this table, the maximum removal efficiency for turbidity, TDS, Colour, BOD and COD are 83.86%, 80.18%, 83.60%, 70.17% and 76.99% respectively.

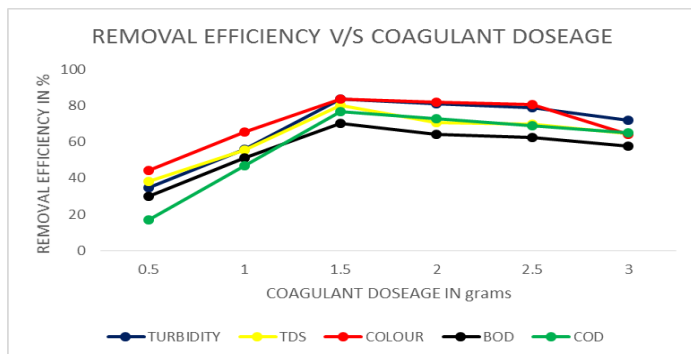


Fig. 4 Removal efficiency of water parameters.

Removal efficiency of turbidity, colour, COD, TDS and BOD in different dosage of cactus powder is shown in figure 4.

4 CONCLUSION

In natural coagulation process the most commonly used chemical coagulants are alum, acrylamides, and aluminium salts. But over usage of these coagulants for the reduction of water parameters can cause several health effects such as genotoxic, alzheimer disease etc. The coagulant used in this work is sun dried and oven dried cactus powder, which is more effective in treatment of water having pH above 8.5. The natural coagulation using cactus powder test results reveals that more than 70% of water parameters like turbidity, TDS, pH, BOD, COD and colour was removed from textile waste water. Being eco-friendly, bio-degradable, inexpensive and safe to human health cactus is a promising alternative to the conventional coagulants that are normally used in the treatment of textile effluents. It can be concluded as the cactus has the potential for textile waste water treatment application effectively in removing pH, colour, turbidity, TDS, BOD and COD.

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