

# TREATMENT OF TEXTILE EFFLUENT BY USING NATURAL COAGULANTS

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**Abstract** - A brief study on the experimental investigation for the treatment of industrial waste water (washing water) has been carried out for the analysis of better treatment of water by using natural coagulants. While treatment, natural coagulant such as *Strychnos potatorum* (nirmali seeds), *Eirchorrnia crassipes* (water hyacinth) are used for waste water treatment. This includes the various parameters such as pH, sulphates, chlorides, total solids, total suspended solids (TSS), total dissolved solids (TDS), acidity, alkalinity, optimum coagulant dosage (jar apparatus), biological oxygen demand (BOD) and chemical oxygen demand (COD). These natural coagulants, when used for treatment of waters with low to medium turbidity range (50–500 NTU), are comparable to their chemical counter parts in terms of treatment efficiency.

**Key Words:** Natural Coagulants, *Eirchorrnia Crassipes*, *Strychnos Potatorum*, Turbidity, Alkalinity.

## 1. INTRODUCTION

Waste water disposal is the major problem being faced by us. In developing countries, like India presently, only about 10% of the waste water generated is treated; the rest is discharged as it into our water bodies. Water bodies have an inherent capability to dilute the pollutants which enter the system. However, indiscriminate dumping of untreated sewage and chemical waste directly into lakes and drains has made these water bodies unable to cope up with the pollutant load. The steady increase in the amount of water used and waste water produced by urban communities and industries throughout the world also poses potential health and environmental problems. The contaminated waters disrupt the aquatic life and reduce their reproductive capability.

The most commonly faced problem in disposal of waste water is the color and turbidity. Finely dispersed suspended and colloidal particles are responsible for the color and turbidity of the waste water. Color in water results from the presence of natural metallic ions, humus and peat material, plankton, weeds, and industrial wastes. Suspended and colloidal matter such as clay, silt, finely divided organic and inorganic matter, and plankton and other microscopic organisms are responsible for water contamination.

## 1.1 COAGULATION AND FLOCCULATION IN WASTEWATER TREATMENT

Coagulation and flocculation are an essential part of drinking water treatment as well as wastewater treatment. This article provides an overview of the processes and looks at the latest thinking. Material for this article was largely taken from reference.

In modern water treatment, coagulation and flocculation are still essential components of the overall suite of treatment processes – understandably, because since 1989 the regulatory limit in the US for treated water turbidity has progressively reduced from 1.0 NTU in 1989 to 0.3 NTU today. Many water utilities are committed to consistently producing treated water turbidities of less than 0.1 NTU to guard against pathogen contamination.

## 1.2 ALUM

There are a variety of primary coagulants which can be used in a water treatment plant. One of the earliest, and still the most extensively used, is aluminium sulphate, also known as alum. Alum can be bought in liquid form with a concentration of 8.3%, or in dry form with a concentration of 17%. When alum is added to water, it reacts with the water and results in positively charged ions.

## 1.3 HUMAN EFFECTS

Adverse effects of aluminum are currently known to be far more chronic (occurring over the long term) than acute (occurring in the short term.) Aluminum has been shown to be a neurotoxin compound if it is allowed to enter the bloodstreams. Long-term exposure of patients to dialysis water high in aluminum may cause encephalopathy (defect of the brain) and / or bone mineralization disorders.

Aluminium is likely to be in a dissolved form in the stomach since aluminum compounds remain in solution at extremely low pH levels. Uptake in the stomach might be a risk if the stomach lining has been damaged from stress or overuse of ethanol or aspirin.

## 2. NATURAL COAGULANT

Generally, coagulants are used for (physical and chemical) purification of turbid raw waters. At very high turbidity the

water can no longer be adequately treated by using filters. Coagulants have to be applied to transform water constituents into forms that can be separated out physically. In large scale treatment plants, Aluminum Sulphates is used as a conventional coagulant. As an alternative to conventional coagulants are

### 2.1. EIRCHORRNIA CRASSIPES (Water hyacinth)

Water hyacinth is a free-floating perennial aquatic plant. Water hyacinth may rise above the surface of the water as much as 1 meter in height. The leaves are 10–20 cm across, and float above the water surface. They have long, spongy and bulbous stalks. The feathery, freely hanging roots are purple-black. Water hyacinth fibers are used as a raw material for paper. Since the plant has abundant nitrogen content, it can be used a substrate for biogas production and the sludge obtained from the biogas. However, due to easy accumulation of toxins, the plant is prone to get contaminated when used as feed.



Fig -1: photo view of Water hyacinth

The plant is extremely tolerant of, and has a high capacity for, the uptake of heavy metals, including Cd, Cr, Co, Ni, Pb and Hg, which could make it suitable for the biocleaning of industrial wastewater. In addition to heavy metals, Eichhornia crassipes can also remove other toxins, such as cyanide, which is environmentally beneficial in areas that have endured gold mining operations. Water hyacinth is also observed to enhance nitrification in waste water treatment cells of living technology. Their root zones are superb micro-sites for bacterial communities.

### 2.2. STRYCHNOS POTATORUM (Nirmali seeds)

Strychnos potatorum (nirmali) is a moderate-sized tree found in Southern and central parts of India. Nirmali seed extracts are anionic polyelectrolytes that destabilize particles in water by means of interparticle bridging. The nuts of this species of Strychnos are very largely used in some parts of India for cleaning muddy water



Fig -2: photo view of Strychnos potatorum seeds

### 2.3. ADVANTAGES OF NATURAL COAGULANTS

- ❖ Eco friendly.
- ❖ The flocculation process more efficient and the cost are reduced.
- ❖ The efficiency is independent of raw water pH.
- ❖ Improve the filtration system.
- ❖ Significant reduction of turbidity

## 3. RESULTS AND DISCUSSION

### 3.1 CHARACTERISTICS OF TEXTILE EFFLUENT

| Parameters             | Units  | Before Treatment |
|------------------------|--------|------------------|
| pH                     | -      | 7.17             |
| turbidity              | NTU    | 12               |
| Chlorides              | (mg/l) | 777.15           |
| Alkalinity             | (mg/l) | 130              |
| Acidity                | (mg/l) | 124              |
| Total dissolved solids | (mg/l) | 1050             |
| Total suspended solids | (mg/l) | 1834.33          |
| BOD                    | (mg/l) | 655              |
| COD                    | (mg/l) | 2000             |
| hardness               | (mg/l) | 343.25           |

### 3.2 COAGULANT DOSAGE USING ALUM

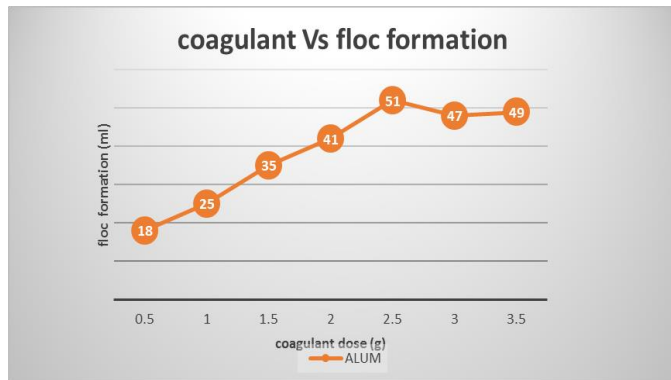


Chart - 1: Optimum Dosage of Alum

### 3.3 COAGULANT DOSAGE USING EIRCHORRNIA CRASSIPES

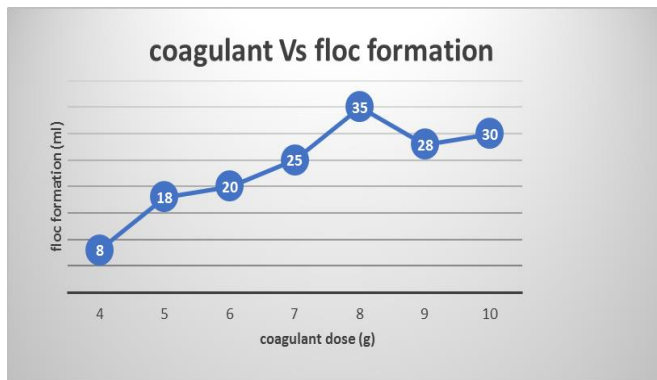


Chart - 2: Optimum Dosage of Eirchorrnia Crassipes

### 3.4 COAGULANT DOSAGE USING STRYCHNOS POTATORUM

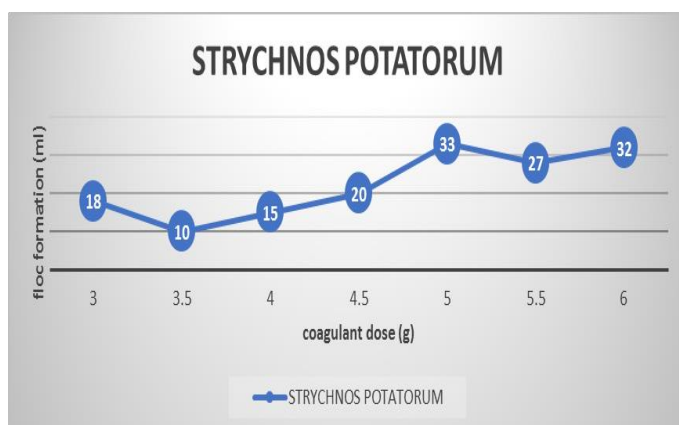


Chart - 3: Optimum Dosage of strychnos potatorum

### 3.5 DISCUSSIONS

By using Eirchorrnia crassip mixture, the floc formation is increased gradually with respect to the amount of coagulant is added from this, maximum floc formed sample is taken for further examination. The test results shows that eirchorrnia crassip dry powder reduce the parameters in the order of pH, turbidity. Chloride, alkalinity, BOD such as 2.35%, 53.75%, 16.19 % , 42.85% and 65.39% .

Next by using strychnos potatorum mixture, the floc formation is increased gradually like Eirchorrnia crassip dry powder. Maximum floc formed sample is taken for further examination. From that result the various parameters like pH, Turbidity, Chlorides, alkalinity was reduced in the order of 1.95%, 23.07%, 41.33% and 43.57%.and BOD is 51.21%.

Finally when using alum the floc formation is increased and decreased with respect to amount of coagulant added. For maximum amount of coagulant maximum floc is obtained. The treated sample is taken for further testing; there is a decrease in the parameters such as alkalinity, dissolved solids, BOD, and COD in the order of 38.57%, 71.63%, 19.66%, and 13%.

Among all these coagulants, natural coagulant gives best results when compared to chemical coagulant alum.

### 4 . CONCLUSIONS

The characteristics of the waste water (washing water) from the industrial effluent is collected and analyzed for the various parameters. The usage of natural coagulants derived from plant based sources represents a vital development in 'grassroots' sustainable environmental technology since it focuses on the improvement of quality of life for underdeveloped communities. However, the practice of the natural coagulants is limited due to the loss of mass plantation of the agro-based plants.

The treated waste water gives better results by using Eichorrnia crassipes as natural coagulant. The best results are obtained by using the natural coagulant in proportions by finding the optimum coagulant dosage.

The use of Eichorrnia crassipes reduces the volume of sludge produced in the treatment of waste water than it is produced in chemical coagulant and it is eco -friendly and biodegradable.

In technical terms, these natural coagulants are highly effectual for treatment of waters with low turbidity but may not be feasible in the case of wastewaters with extreme pH. As such, it is always prudent for water treatment practitioners to circumspectly select the most suitable natural coagulants and tailor them for specific purposes.

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