PURIFICATION OF TEXTILE DYE WASTE WATER USING NATURAL COAGULANT (MORINGA SEEDS)

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Abstract

Industrial pollutants are most harmful to the both environment and mankind. Treatment and disposal of industrial pollutants seems to be great risk for various industries due to its high pollutant concentration. The present study was carried out to confirm the effectiveness of seed powder extracted from mature-dried Moringa Oleifera seeds which are commonly available in most rural communities. The main objective of this work is to evaluate the antimicrobial activity and efficiency of a natural absorbent from Moringa Oleifera seeds in treating textile dye waste water. During this study textile dye waste water samples were collected for treatment by Moringa seeds in powdered form, resulting in an effective natural clarification agent for highly turbid and untreated pathogenic water. Various doses of Moringa seed powder viz. 50, 100 and 150 mg/l were taken and checked for the efficiency dose on raw water. After treatment of seed powder with water samples were analyzed for different parameter like pH, Turbidity, TDS, TS, Hardness, Jar test, Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD). All parameters were reduced with increasing dose of 50, 100 and 150 mg/l seed powder respectively.

Keywords: *Moringa oleifera, water treatment, natural absorbent, Textile dye waste water*

Introduction

Textile Waste Water

Water pollution has many sources. The most polluting of them are the city sewage and industrial waste discharged into the rivers. Industrial waste is defined as waste generated by manufacturing all industrial processes. The textile industry is very water intensive. Water is used for cleaning the raw material and many flushing steps during the whole production. Produced waste water has to be cleaned from fat, oil, color and other chemicals, which are used during the several production steps. The cleaning process is depending on the kind of waste water and also on the amount of used water.

Textile and Dye Industry

Dyes and textile industry are one of the most important and continuously developing industrial sector especially in India. The textile is classified into three main categories: cellulose fibres (cotton, rayon, linen, ramie and hemp), protein fibres (wool, angora, mohair, cashmere and silk) and synthetic fibres (polyester, nylon, spandex, acetate, acrylic, ingeo and polypropylene). In this study to evaluate the antimicrobial activity and efficiency of a natural adsorbent from MO seeds in treating

textile dye waste water by physico-chemical methods and to establish the best dose of MO seeds powder that best removes different parameters from textile dye waste water.

Methodology

Material Collection

Collection of Sample Water

The sample textile dye waste water was collected from the Textile Industry in near melur, Tamilnadu. The collected waste water was kept as stock solution in the refrigerator and the sample used for studies was prepared by diluting the stock solution for avoiding fault results.

Figure 1 Textile Dye Waste Water

Selection of Adsorbents

Naturally occurring coagulants are usually presumed safe for human health. Some studies on natural coagulants have been carried out and various natural coagulants were produced or extracted from microorganisms, animals or plants. One of these alternatives is Moringa oleifera seeds.

Figure 2 Moringa Oleifera Seeds

Collection of Adsorbents

The Moringa Oleifera seed (drumstick) was collected from local market at Melur, Madurai.

Coagulants Preparation

Preparation of Moringa Oleifera Powder

Moringa oleifera seeds pods are allowed to mature and dry naturally to a brown colour on the tree. The seeds were removed from the pods, kept for sun dry for 5-6 days and external shells were removed. For the removal of moisture content completely dried sample were finally dried in a hot air oven at 80°c for 2 h Using grinder, fine powder was prepared and sieved.

Figure 3 Moringa Oleifera Powder

Coagulation Test

Jar test is most widely used experimental methods for coagulation-flocculation. A conventional jar test apparatus will be used in experiments to coagulate sample of water using MO.

Figure 4 Schematic view of Conventional Jar Test Apparatus

Determination of Turbidity

Turbidity measurements performed using proprietary nephelometric instruments are expressed as Nephelometric Turbidity Units (NTU). The nephelometric apparatus is designed to measure forward scattering of light at 90^{o} to the path of an incandescent light beam.

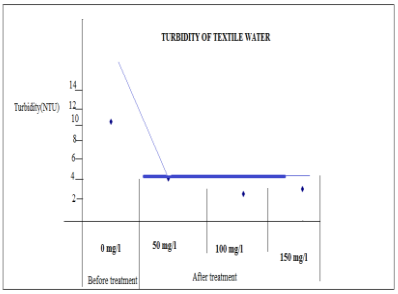

Figure 5 Turbidity of Textile Water

Determination of Total Solids

Total Solids is the term applied to the material residue left in the vessel after evaporation of a sample and its subsequent drying in an oven at a defined temperature.

Determination of Total Dissolved Solids

Calculate Total Dissolved solids (TS) as follows:

Dissolved solids, TDS (mg/l) = mg of solids in the beaker / (volume of sample) x 1000

Also total solid (TS) = Suspended Solids + Total dissolved Solids (TDS)

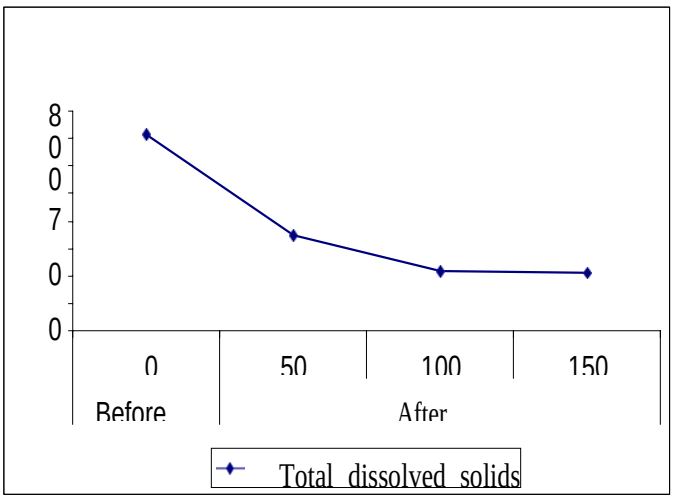

Figure 6 Total Dissolved Solids of Textile Dye Waste Water before and After Treatment of Seed Powder

Hardness

Hard waters are generally considered to be those waters that require considerable amounts of soap to produce foam or lather and that also produce scale in water pipes, heaters, boilers, and other units in which the temperature of water is increased materially. Originally, water hardness is considered as a measure of the capacity of water to precipitate soap. Hardness is caused by multivalent metallic actions from sedimentary rocks, seepage, and runoff from soils.

COD (Chemical Oxygen Demand)

The chemical oxygen demand (COD) determines the amount of oxygen required for chemical oxidation of organic matter using a strong chemical oxidant, such as, potassium dichromate under reflux conditions.

BOD (Biochemical Oxygen Demand)

BOD is determined by measuring the loss in dissolved oxygen of the samples after incubating it for 5 days at 20°C. Biochemical oxygen demand or biological oxygen demand is a chemical

procedure for determining is the amount of dissolved oxygen needed by aerobic biological organisms in a body of water to break down organic material present in a given water sample at certain temperature over a specific time period. It is not a precise quantitative test, although it is widely used as an indication of the quality of water

Results and Discussion

Characterization of Textile Dye Waste Water

The collected textile dye waste water was characterized to determine pH, Turbidity, Total Solids, Total Dissolved Solids, Hardness, COD, and BOD as per the standard methods. Permissible limits of different parameters for textile dye waste water by different firms, i.e., Central Pollution Control Board (CPCB), US Environmental Protection Agency, and World Bank Group.

Table 1 Characterization of Textile Dye Waste Water

Sl. No.	Parameters	Before treatment ± SD	After treatment of water sample at various doses of Moringa seed powder ± SD			CPCB/US EPA / BG Standards
		0 mg/l	50 mg/l	100 mg/l	150 mg/l	
1	pH	8	7 ±0.11	7±0.05	7.2±0.05	6.0-9.0
2	Turbidity (NTU)	12.4	3.5±0.57	3.2±0.57	3.1±0.57	5
3	TS (mg/l)	3482	3315±0.15	2230±0.28	2280±0.5	2200-3330
4	TDS (mg/l)	3254	2675 ±0.15	2150±0.57	2447±0.28	1950-2925
5	Hardness (mg/l)	190	110±0.57	105±0.28	100±0.57	500
6	COD (mg/l)	1250	850±0.28	736±0.68	657±0.35	950-1000
7	BOD (mg/l)	678	454±0.56	385±0.55	478±0.05	350-500

Conclusion

Moringa Oleifera seeds acts as a natural coagulant, flocculent, absorbent for the treatment of textile dye waste water. MO seed is not giving toxic effect. It is eco-friendly and cheaper method of water treatment. Thus, it proves to be a cost effective method. The physio-chemical parameters of waste water before and after the treatment of textile dye waste water and to evaluate the removal efficiency on the major pollutants of concerned in waste water treatment, such as pH, Turbidity, Total Solids, Total Dissolved Solids, Hardness, COD, BOD are examined and its results are presented.

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