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Decolourization of Textile Dyes Effluents Using Waste Water Treatment Plant

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Abstract- A treatability study of textile wastewater using coagulation by adding polyelectrolytes ((1-2 ppm) at pH (6.7-7.5) and primary sedimentation followed by aeration and final settling gave a good results. COD decreased from 1835 to 120 ppm, SS decreased from 960 to 120 ppm and sulphate from 1350 to 125 ppm. In the full-scale treatment plant filtration is used to improved results by decreasing COD, from 263 to 55 and SS from 295 to 10 and Sulphate from 158 to 100 ppm respectively.

Keywords: Textile Industrial wastewater, (TIWW) Chemical precipitation, Coagulation, Chemical oxidation, decolourization, degradation.

1. INTRODUCTION:

In the textile industries there is growing interest for the process water. Since the purified wastewater in the textile industry is required to satisfy strict quality standards before reuse becomes possible, advanced purification techniques must be available which are efficient and reliable. Wastewater treatment for recycling means an additional cost in manufacturing as product. It can become economically feasible if it brings about reduced water intake costs and reduced discharge fees. In 1982 the government of Egypt evaluated the law 48 which has set guidelines for wastewater disposal (domestic or industrial) to limit water bodies pollution in the Country. Many of private industrial plants have been trying to do good adaptation to avoid legislation problems. On the other side some companies which uses large quantities of water such as textile industries have been looking after reducing the water bill, through reusing treated effluent wastewater. Groves et al. (1979) used effluents from a treatment pilot plant which were still appreciably palliated and nevertheless found quite acceptable results in dyeing tests for wool, polyster and viscose. Rozzi et al (1995) have found that it is possible to reach the desired water quality if both granular activated carbon and filtration are used after a suitable pretreatment (such as coagulation flocculation and settling). Color removal of textile wastewater was the objective of several researcher Mehrota et al (1995) applied coagulation to Sixth International Water Technology Conference, IWTC 2001, Alexandria, Egypt remove color from textile dyeing effluents such as Mg CO3 and Fe SO4. Ganjidost et al (1995) used various minerals for the adsorption of color from two textile dyes and found high removal rates at pH below 5. Practical Egyptian solution must be found for the new or already existed textile industrial plants as a large sector of the industrial factories. The main objective of this research is to observe and evaluated the treatability of textile wastewater to satisfy law 48 in 1982 and to reuse it.

2. MATERIALS AND METHODS

Chemicals:

Two dyes of relatively simple structures were chosen for this work, apart from the textile waste effluent collected directly from effluent treatment plant of textile industry. Congo red (60 percent purity) and Direct blue 70 (50 percent purity) were obtained from Delta plus Chemical Company (Milwaukee, .).

Microorganisms:

The microorganisms used in this work were obtained from the Department of Pure and Industrial Chemistry

Laboratory of Delta plus India Private Limited Falta. The candidates include Pseudomonas putida and klebsiella ozaenae.

Isolation and enumeration of microbial cultures:
Total bacteria were enumerated by spread plate method using 0.1ml of the dilution 10-1 to 10-4 onto nutrient agar. All cultures were incubated for 24hr to 48hr at 37 o C. The bacterial colonies, which developed on the plate were randomly picked and purified by sub culturing unto fresh agar plates by using the streak-plate technique. Isolated colonies, which appeared on the plates, were then transferred unto nutrient agar slants and stored as stock-cultures. The bacterial isolates were identified based on their morphology, gram reaction and as well as their biochemical reactions. The microscopic and macroscopic features of the hyphal mass, morphology of cells and spores, and the nature of the fruiting bodies were used for identification.

Cells-mass measurement (dry weight):
Direct approached method was used to determine the microbial dry weight. Cells growing in liquid medium were collected by centrifugation, washed, dried in an oven and then weighed using Mettler Toledo as described earlier by Cheesbrough et al., (2005).

Degradation and Decolourization :
Aliquots of 2cm3 of a clear dye solution were taken from each of the reaction flasks at time intervals and measured immediately using a UV-Visible recording double beam spectrophotometer. Diluted cultures were used prior to the measurement to change the absorbance value to below 1.0 absorbance units per centimeter of path length. Because of the low water solubility of the organic dyes, an equal volume of methanol was mixed with the analytical solution to ensure complete solubilisation prior to measurement and decolourization was assessed in two ways; Firstly, by monitoring absorbance spectrophotometrically at maximum wavelength for each cultured solution and secondly by observing the reduction of the major peak area in the visible region for each cultured solution.

3. RESULT AND DISCUSSION

Several dye-polluted wastewater samples were collected from different textile processing units situated in Falta district of South 24 parganas, vasa and then analyzed for pH and total soluble salts. Bacteria capable of decolorizing textile dyes were isolated from these wastewater samples, using Reactive Black-5 azo dye as a source of carbon and nitrogen in the mineral salt medium. The most efficient dye decolorizing bacteria were screened in the liquid media containing 100 mg L Reactive Black-5 azo dye. Various factors like substrate (dye) concentration, carbon sources, temperature and pH were optimized to accelerate the process of dye degradation by the selected strains of bacteria. Effect of varying concentration of azo dye and salt on the bio-decolorization efficiency was investigated and rate of reactions werecalculated. The bioaugmentation potential of two effective strains such as N7 and N11 for decolorizing dyes was also studied in real textile effluents as well as indifferent mixtures of dyes.

4. CONCLUSION

To achieve bioremediation, there needs to be a presence of textile dyes utilizing microorganisms and also optimum nutrient availability. The period of the research (duration) was pertinent in achieving higher rates of degradation. The present study clearly demonstrates that the indigenous bacterial community in textile dyes effluent of textile industry Kano has the ability to degrade and decolorize various types of dyes emanating from such industries and therefore can be exploited for bioremediation of textile dyes containing wastes, due to their potentiality to degrade toxic reactive dyes into non-toxic form. Knowledge of bioremediation is important for the evaluation of indigenous microbial capabilities, the persistence of organic pollutants and the design of biodegradation facilities for large scale treatment applications. Further research is needed for optimization of the process, where the degradation of the fragmented products would be of great interest considering the aquatic toxicity of the overall effluent.

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