Treatment Technologies of Textile Dyeing Effluent -A Review

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***Abstract*— This review discusses the reuse of textile waste water meet the demand of present situation. Removal of colour and reactive dye is the major process in the treatment. Advanced oxidation process is the better treatment that uses the combination of ozone, hydrogen peroxide and ultraviolet irradiation which is eco-friendly. Since reactive dyes are easily soluble in water, so removal of dye needs activated carbon with adsorption as it has high adsorption capacity and high surface area. Optimization of electrochemical technique for treatment is also effective. In this process copper and stainless steel were chosen as the best anode and cathode. Sodium chloride is used as a supportive electrolyte. An overview of these processes is presented according to their specified features.'**

I. INTRODUCTION

Textile industry role in India accounts for nearly one third of the total expert. Nowadays people has a great concern in environmental protection and increased general awareness mainly in industrial effuents that includes reactive dyes on the environment [1]. Colour water causes scarcity in the light which is essential for the development of aquatic organisms. Textile waste water is extremely polluted due to the presence of reactive dyes. The substance that pollutes the textile waste water are high suspended solids, COD, BOD, heat, colour, acidity and also other soluble substance. Oxalic acid, trifolium polyphosphate sodium hexane take phosphate, formaldehyde, pentachlorophenol are some of the harmful substance present in textile waste water [2]. The water used by textile industry ranges from 21-377 cubic meter per ton and generates waste water in large quanties from different steps during treatment. The generate effuents are mostly heavily coloured, has high salt concentration and shows high BOD, COD value [3]. This waste water treatment technique undergoes many significant in recent years giving scope for further improvement in the field.

II. ENVIRONMENTAL IMPACTS DUE TO DISCHARGE OF EFFLUENT

A wide range of fibers/yarns are produced from natural fibers like cotton, jute, silk, and wool to synthetic/man-made fibers like polyester, viscose, nylon, and acrylic is the fundamental strength of this industry[4]. Nowadays, there is an increasing demand for textile products, textile mills and their wastewater have been increasing proportionally, causing a major problem of pollution in the world. Textile industry uses chemicals which causes major environmental and health hazards[5]. Among the many chemicals in textile wastewater, dyes are considered important pollutants. Wide range of environmental problems across the world are associated with the textile industry are typically those associated with water pollution caused by the discharge of untreated effluent and those because of use of toxic chemicals especially during processing [6]. The effluent is considered as a critical environmental concern as it drastically decreases oxygen concentration because of the presence of hydrosulfides and also through water bodies it blocks the passage of light which is detrimental to the water

Methods of treatment

- Advanced oxidation process
- Electro chemical method
- Biological Method

A. *Advanced oxidation process*

The advanced oxidative process is an already existing method, but of course there is yet room for development of the process and the need to attain higher efficiencies, [9]. AOPs are generally considered as the set of chemical processes for the treatment of water and waste water by the reactions with hydroxyl radical (OH) in oxidation. The AOPs are processes based on the generation and utilization of reactive species such as hydroxyl radicals (OH), which is one of the strongest inorganic oxidants (E°=8V). The hydroxyl radicals oxidize a broad range of organic pollutants rapidly and non- selectively, [10]. Hydroxyl radicals are very unstable and highly reactive because of their oxidation potential, [11]. AOPs include also, both photocatalytic (involving Ultra violet light or Ultra Sound) and non-photocatalytic (dark) processes. AOP emerge as an important destructive method for eliminating most of the organic and inorganic pollutants including reactive dyes. They have been used to enhance the biotreatability of wastewaters containing various organic compounds that are non - biodegradable and/or toxic to common microorganisms, hence AOPs in this sense are pretreatment methods, (Josmaria, L. et.al.2012) [12]

B. *Ultraviolet (UV)*

Ultraviolet (UV) radiation is considered as an essential element in photochemical oxidation for which the emitted wavelength plays a significant role. Such AOPs are mostly used to degrade compounds that absorb UV radiation within the corresponding range of the spectrum,[13].Ultraviolet (UV) have shown positive results for disinfection and removal of pathogens like estrogen 17 ethinylestradiol (EE2), [14]. The effectiveness of ultraviolet (UV) reacting singly or in combination with other item/method can be dependent on several factors such as pH and initial concentration, [15].Enhancement of UV in this process is done by the addition of H2O2 in order to destroy certain pathogens, and organic pollutants in water, [16].Also, the UV/H2 O2 -based processes have shown better performance with removal efficiencies higher than 80% for all investigated parameters obtained when it was integrated with the biological treatment, thereby meeting the discharge limits while no-biodegradability enhancement was shown when the process was used as an end treatment, [17].

C. *Hydrogen Peroxide (H_2O_2).*

H2O2 , can be used in various applications because of the different ways in which it functions selectively, and because it has no gaseous release nor chemical residues as found with other chemical oxidants, [18].However, negligible effects were observed in the presence of H2O2 alone, compared to the Fenton-mediated decoloration, [19]. Also, H2O2 alone (i.e., without UV power) proved ineffective as for both mineralizing and biodegradability enhancing agent and that the only reactive species was essentially the hydroxyl free radical OH', [20] The effect of operating conditions was observed when measuring via a spectrophotometer at the visible maximum absorption, it was found that the rate of decolorization increased with the initial dosage of H202 up to a maximum and beyond which decoloration was inhibited, [21].

D. *UV/ H2O2, Processes.*

Hydroxyl radical formed in the range of 200-280nm[27,28] in the UV/H2O2 process is based on the photo dissociation of H2O2 by UV radiation.

In the H2O2/UV process, the pH has shown to be a significant factor in dye discoloration and the process is also more effective in acidic media, [22].

III. ELECTRO CHEMICAL METHOD

A. *Electrocoagulation Methods*

By, this method, the coagulated residue are formed by the electrochemical aggregation of heavy metals, organic and inorganic pollutants, which has to be separated or removed from water. This technique is an indirect electrochemical method which produces coagulant agents (Fe3+ orA13+) from the electrode material (Fe or Al) in hydroxide medium. The dissolved dyes can be removed by adding Fe(OH)3, either by precipitation or by otation [23]. These complexed compounds are attached to the bubbles of H2(gas) evolved at the cathode and transported to the top of solution[24]. The inconvenient of the electrocoagualtion in comparison to the other electrochemical methods is that it produces secondary residues (the complex formed with pollutant and hydroxide) which implies the use of tertiary treatments

B. *Electrochemical Reduction Method*

Only a limited number of paper as has discussed this method because when compared to direct and indirect electro-oxidation methods this method yield in poor pollutants degradation.[25]. Bechtold et al. [26], This method is particularly suitable for the treatment of highly colored wastewaters such as the residual pad-batch dyeing bath with reactive dyes. Hydrazine is produced by reduction of dyes (in the partial reduction) and when it is totally reduced it generates amino compounds . The importance of a divided cell in the case of dye baths containing chlorides are remarked^this division is important to avoid the formation of chlorine and chlorinated products.

IV. BIOLOGICAL METHOD

A. *Combination of anaerobic and aerobic process.*

Tjandra Setiadi et al (2010) was studied the ability of a combination anaerobic and aerobic processes to treat a denim process wastewater and its application in industrial scale was reported. Laboratory experiments were conducted with the varied Hydraulic Retention Time (HRT) in anaerobic process, i.e. 12, 18 and 24 hours. In this aerobic process, it takes 12, and 24 hours for hydraulic retention time, and the SRT (Solid Retention Time) was maintained at 20 days. All experiments performed in room temperature. Each experiment was run for about 90 days. From the laboratory study, it was found that increasing HRT would increase color removal on the anaerobic processes, however no significance different for COD removal. However, the majority of color was removed in the anaerobic process, on the other hand majority of COD was removed in the aerobic process. Reduction of COD, BOD and color has been done up to 91, 94 and 96 %, by the combination of anaerobic and aerobic process.

The removal of color was consistently high and visually, in the final effluent no color has been observed. The design flow rate was 20 m3/hour. The anaerobic process chosen is an biofilter with the HRT of 24 hours. The aerobic process was determined extended aeration with the HRT was also 24 hours. On March 2002, it has been completed and steady state condition was achieved on June 2002 with a performance not much different to the laboratory scale results. Although, a slightly less amount of COD and color removal was observed during the process. The COD, BOD and color removal was 87, 93 and 90 %, from 4 month operation. At the moment, for the denim processing plant the treated effluent was recycled and used in washing machine, R. Ma. Melgoza et al was studied the operation of an anaerobic/aerobic process used to degrade the colorants present in textile wastewater is presented. The objective is to produce water that can be reused. Two particular cases were studied/ the degradation of a synthetic wastewater containing the colorant disperse blue 79 (DB79) as a model compound and a real textile effluent containing reactive azo dyes. The biodegradation was achieved using a single tank operated as sequencing batch reactor. It was observed that the amines are produced by the biotransformation of DB79 in the anaerobic stage decolorizing the wastewater. The amines formed were subsequently mineralized in the aerobic phase. An increase of toxicity was observed in the anaerobic stage due to the amines formation, but the wastewater was detoxified after the aerobic treatment. After the treatment DB79 is removed with an efficiency of 92%were observed. Initial color of the real wastewater was effectively removed around 96% respectively. It was observed that the biomass pre-acclimatized to the degradation of DB79 was more effective for the color removal than a freshly inoculum used.

Anaerobic reactors designs are developed using bio methanation. With the help less energy, less biological sludge are produced in the anaerobic treatment, generates energy as biogas and anaerobic bacteria are resistant to toxicity requiring no aeration as compared to expensive aerobic decomposition [27]. After optimization of initial dye concentration, contact time, adsorbent dosage, pH and desorption with 95% removal of dyes the adsorption of methylene blue and acid violet on biogas slurry has been investigated. [28]. Anaerobic treatment of textile sludge has an additional benefitt of producing biogas as fuel[29]. By using scale anaerobic baffle reactor ABR [30] the decolorization of reactive red dye has been studied in the laboratory. Microbial population was associated with treatment of an industrial dye effuent in ABR. For the treatment of low strength synthetic wastewater (COD, 300-400 mg/1) at 24 and 12 h of hydraulic retention times (HRTs) the performance [31] has been studied of three chambered ABR. Wastewater containing vat and azo dyes was decolorized in laboratory scale semi continous reactors under anaerobic conditions using mixed bacterial cultures with long HRT [32].

V. CONCLUSION

Advanced oxidation process, Electro chemical Method, Biological process is a powerful method or treatment for removing polutants in textile waste have been developed for specific problems by proper peroxide, and UV irradiation. This is considered as eco-friendly process because technology based activated carbon with absorption is found to be a best method. From electrochemical oxidation method it is inferred that the treatment of textile waste water under optimization experimental condition can be carried out not only COD removal as well. This review has shown specified three method that can be used to treat influents and also remove Pollutants in textile waste water.

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