Waste Water Treatment of Textile Industry: Review

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Abstract— The discharge of colored wastewater represents a severe environmental crisis and community healthiness worry. Color taking away from textile wastewater has turn out to be a huge challenge over the previous decades, and until now, there is no single and inexpensively eye-catching cure way that can successfully decolorize the wastewater. Textile industry is a conventional and pillar industry, which possesses an extensive part of the national economy. In latest days, particular concentration has been paid to the application of biotechnology in textile industry. Treatment of textile effluents with biotechnology, textile effluents typically include high concentration of inorganic as well as organics, and are then hard to treat. Membrane processes can be used for lots of these wastewaters in the textile industry. Textile industries stand for a significant environmental difficulty because of their huge water consumption. Textile wastewater is known to display strong color, a huge quantity of suspended solids, extremely unpredictable pH, high temperature and high COD concentration. Treatment technologies were evaluated for application in water use again for the textile industry. Recently, a growing application of so called Advanced Oxidation Processes (AOPs) to industrial wastewater has been observed. Membrane process is able to be used for several of these wastewaters in textile industry. Expansion of new type of textile polymers and fibers, like naturally colored cotton, colored silk and silk gene-sequence, and spider silk non-woven's, chitin fiber etc. A straightforward technique is anticipated to bring to a halt of TiO2 for photo catalytic transformation of organic pollutants in aqueous solution.

Key words: Waste Water Treatment, Textile Industry

I. Introduction

Textile dyeing is the popular environmental unfriendly industrial process, because they create coloured wastewaters that are greatly contaminated (polluted) with dyes, textile auxiliaries and chemicals [1]. Effluents created by textile industries are frequently strongly colored and their disposal into water causes environmental spoil, together with important impact on the photosynthetic action of aquatic plants due to reduced light penetration. These wastewaters can be toxic to aquatic organisms due to the existence of for example metals, or chlorides, and breakdown products of dyes [4]. Textile industries symbolize a central environmental trouble due to their high water consumption [6]. The removal of colour is associated with the breakup of the conjugated unsaturated bonds in molecules. For this reason, many chemical treatment processes have been used extensively to treat textile waste waters [1]. In most of the Spanish region by means of water shortage, this fact can be fights to create wastewater recycle essential. The most common treatments applied to treat and recycle textile wastewater comprise biological treatment, precipitation, coagulation or flocculation, flotation, oxidation and adsorption [6,9]. Activated carbons can act as an adsorbent for the organic compounds and also as a catalyst for their oxidation [3]. These wastewaters may also be toxic to aquatic organisms due to the presence of, for example, metals, or chlorides, and breakdown products of dyes. Treatment of industrial effluents containing aromatic compounds is necessary, therefore, prior to final discharge to the environment [4]. Waste water quality that depends on process step, dye and textile material (cotton, synthetic fabric, silk, etc.) [9]. The textile industry generally has difficulty in meeting wastewater discharge [12]. The goal of zero discharge is to recycle all treated wastewater back into the manufacturing process. Advantages of zero discharge in the textile industry includes, lower water use, lower pollutant discharges, lower wastewater treatment costs, energy savings since many textile manufacturing processes are conducted at elevated temperatures, and reductions in chemical use (i.e., salts, acids, and bases) [11]. Textile wastewater, being mostly non-biodegradable under both natural and sewage treatment plant conditions. The AOPs are defined as those processes which utilize the hydroxyl radical (OH) or the primary oxidant and include systems such as combinations of O_3, H_2O_2 and UV [16]. The ability of ozone to destroy dyestus and to cause alteration in surfactant molecular structure has been already demonstrated. Although the ozonation leads to reduction of foaming ability and decolourisation [17]. The textile industry generally has difficulty in meeting wastewater discharge limits, [12]

II. Literature Review

A. M. Hassan et. al. [1] :

dosage was one of the most important parameters that been considered to determine the optimum condition for the performance of chitosan in cogulation and flocculation.The pH was controlled by adding either strong acid (HCL) or strong base (NAOH). pH is also effect on stabilization of the suspension.The removel of COD and turbidity increased with increasing dose of polyelectrolyte.

B. O. Turgay et. al. [3] :

The adsorption effect of activated carbon increased in the acidic conditions and also at a higher temperature. Adsorption performance is highly affected by the pH of the solution activated carbon was increased the dye removal also increased. the dye removal has increased with increasing the reaction time.

C. R. Khlifi et. al. [4] :

Industrial effluents may be complex substrates, containing not only dyes but also salts, sometimes at very high ionic strength, and extreme pH values, chelating agents, precursors, by-products, and surfactants. Effluent concentration affected the efficiency of colour removal. In contrast to the effect of NaN_3, these compounds do not decrease oxygen consumption by laccase during catalysis.

D. J. Zafrilla et. al. [6]:

NF200 and NF270 yield similar salt rejection, and that NF90 was able to achieve a salt rejection index over 85% A pressure of 10 bar was also selected as a balance between the flux and the rejection values. The flux decrease between experiments was attributed to the increase in COD and salt concentration The UF used to remove between 30 and 40% of the COD.

E. R. Loos et. al. [7] :

NP was effectively separated by LC from the NPECs using an acetonitrile–water gradient without the addition of acetic acid. Long-chain NPEOs (NPE4_17O) are generally well removed in WWTPs, because they are degraded to shortchain NPE1_3O, NPECs, NP and dicarboxylated metabolites. These higher levels can be explained by the fact that NP is the final degradation product from the NPEO surfactants.

F. C. Suksaroj et. al. [9] :

Biological treatment allowed a good COD and DOC removal efficiency, but mineral parameters seem not to be effective with the biological process. The main parameters that induce fouling were caused by coloured compounds and were evaluated through absorbance and DOC measurement.

G. B. Van der Bruggen et. al. [10] :

The contact angle of pure water on a wet, clean Desal DL 5 membrane was 40.7° while a 100 ppm spin finish solution had a contact angle of 29.5° with a Desal DL 5 membrane to which a 100 ppm finish solution had been allowed to adsorb for 24 hour. The lower contact angle indicates that the membrane surface is more hydrophilic.

H. S. J. Ergas et. al. [11] :

Reactive dyes, such as the ones used in this study, are the principal dyes used in the cotton industry, which makes up 50% of the world’s fiber consumption. A possible reason for the low color removal has been cited by Aplin and Waite_2000_ as due to the formation of FeCl2+ and FeCl2+ complexes that cannot be efficiently reduced to regenerate Fe2+.

I. X. Chen et. al. [12] :

The treated water can be reused in many production areas of the textile dyehouse factory. It is reported that Ti/RuO_2, Ti/SnO_2 and $Ti/SnO_2+Sb_2O_5$ electrodes have better ability to oxidize toxic compounds and are more efficient than our Ti/PbO_2 anode. The wastewater can be treated more effectively, if more efficient electrodes are used in system.

J. K. Rao et. al. [13] :

All catalysts used adsorption has a negligible effect on the concentration. In the case of pumice stone, the decrease in efficiency after a long use may be attributed either to the elimination of some particles of titania or to a chemical damage on the surface of the catalyst.

K. T. Kim et. al. [15] :

Aeromonas salmonicida and Pseudomonas vesicularis, that showed higher COD and color removal. The increases of COD and color removal were enhanced by the inoculation of selected microbes, the increase of biomass concentration (MLSS) and the increase of SRT by using support media. The main purpose of chemical coagulation was decreasing the pollutant loading on post-treatment.

L. S. Ledakowicz et. al. [16] :

The textile wastewater such as anthraquinone dyestuff and two different kinds of surfactant: Tetrapol CLB and Awiwaz-KG concentration. Even very long contact time of activated sludge with the dyestuff solution (10 days) did not result in complete decolourisation. However, an application of ozonation to the coloured wastewater enabled its complete decolourisation. Chemical oxidation can break large molecules of wastewater contaminants into smaller easier biodegradable fragments. The dehydrogenase as says for untreated and chemically oxidised wastewater

M. S. Ledakowicz et. al. [17] :

bacteria of activated sludge from a wastewater treatment plant can easily adapt to H_2O_2 as the ozone doses employed in the present work seem to be high. all ozone doses decrease the inhibitory effect on microbial growth in textile wastewater below 47%. ozone combined with UV radiation showed the optimum ozone dose in the range from 60 to 150 mg O3 dm^{-3}.

III. Real Wastewaters

Real wastewaters from dye industry collected after biological treatment (light pink colour) were photocat-alytically treated with the same device using various titania photocatalysts immobilized on pellets of pumice stone.Real wastewaters collected before biological treatment were also treated in the same manner. Colour disappeared after 4 h (in place of 2 h), but the main problem is the formation of insoluble products that appear as suspended matter in the solution. Conse-quently, photocatalysis is not so convenient for the treatment of rough wastewaters. [13].

Real wastewaters from dye industry collected after biological treatment (light pink colour) were photocatalytically treated with the same device using various titania photocatalysts immobilized on pellets of pumice stone. The degradation was monitored by UV absorption at 260 nm since aromatic and quinonic derivatives absorb at this wavelength. Results are reported in Fig. 5a and b for sunlight and artificial UV light, respectively. It appears that P25 is more efficient than PCs 50 and 500 immobilized in the same conditions on pumice stone. PC 50 gave slightly better results than PC 500. No meaningful difference was observed when pellets are fixed on white cement or on polycarbonate. It is also noteworthy that degradation is more rapid in sunlight (bright sunlight in April, latitude 46◦N, altitude 400 m) than in artificial UV light (four lamps, 300–450 nm). It means that the half-lives evaluated in indoor experiments are surely longer than that of half-lives in summer sunlight. Photocatalytic elimination of pollutants present in wastewaters were also monitored by the determination of total organic carbon. Results are depicted in Fig. 5c. Real wastewaters collected before biological treatment were also treated in the same manner. Colour disappeared after 4 h (in place of 2 h), but the main problem is the formation of insoluble products that appear as suspended matter in the solution. Consequently, photocatalysis is not so convenient for the treatment of rough wastewaters. [13]. However, bacteria of activated sludge from a wastewater treatment plant can easily adapt to H_2O_2 as has been shown. The ozone doses employed in the present work seem to be high, however the wide range of ozone doses was chosen in order to check the influence of the oxidant on toxicity change of the textile wastewater. [17].

IV. Treatment of Wastewater

Textile operations are extremely water and energy intensive and textile effluents contain high concentrations of salts, total suspended solids, colour, chemical oxygen demand COD, nutrients nitrogen and phosphorous-, and toxic compounds, such as surfactants, heavy metal, and chlorinated organic compounds [11]. Textile industries represent an important environmental problem due to their high water consumption [6]. A physicochemical precipitation was effective to reduce dye concentration, chemical oxygen demand (COD) and turbidity and allowed also the reduction of fouling [9]. The membranes should reject relatively small organic compounds, broken down in the biological degradation step. The use of NF for removal of dyes from wastewater, and the use of UF for removal of spin finish. The composition of the spin finish depends on the end use of the yarn. Wastewater treatment should be done by using physico-chemical methods such as membrane filtration. In this case, the spin finish from the production of polyamide carpet contains only anionic and nonionic surfactants. These observations lead to the conclusion that fouling is closely related to transport mechanisms [10]. Decolourization and detoxification of a textile industry effluent by laccase from Trametes trogii in the presence and the absence of laccase mediators was investigated. Laccase alone not able to decolorize effluent efficiently even at peak enzyme concentration tested. To enhance effluent de-colorization, several potential laccase mediators were tested at concentrations ranging from 0 to 1mM. The effect of several physico-chemical parameters that could influence enzyme activity, such as pH, temperature and dye concentration was tested. Optimal de-colorization occurred with 20% effluent at pH5, a temperature of 50ºC, and in the presence of 1mM hydroxybenzotriazol (HBT) [4]. Biological treatment allowed a good COD and DOC removal efficiency, but mineral parameters seem not to be effective with the biological process. Absorbance reduction was also observed, but this effluent was still coloured and did not permit direct discharge or reuse [9]. The methods of Nano Filtration is available for bilogiacl treatment of wasterwater which is coming out from cotton threaded industry, those are first is direcr nano filtration treatment and second is nano filtration after pretreatment stage by ultra filtration [6].

Type of Industry/fiber	Production, tones/day	Wastewater m^3/day
Composite industry cotton, synthesis	10.63	840
Synthesis	2.60	180
Processing industry, blended	1.61	150
Blended	16.66	1,500
Woolen industries	8.50	2,700
Woolen	3.30	700

Table 1: Quantity of wastewater generated by textile industries in India [2]

In textile wastewaters containing high chloride concentrations, it has been proposed that the principle decolourization mechanism is indirect oxidation by various forms of chlorine. The chemical oxidation and anaerobic biological methods are used for treatment of textile industrie's wastewater which contains azo dyes.

V. Conclusion

Department of Environment controls the discharge of wastewater characteristics from textile (or any other industry from which wastewater coming out) industrial activities. A big problem to nature/environment, due to wastewater coming out from textile industry. The release of colored wastewater represents a serious environmental problem and public health concern. Color removal from wastewater turn out to be a huge challenge over last few decade. The a variety of chemicals such as biocides and stain repellents used in industry for softening, brightening, anticreasing, sizing, and wetting of the fabric or yarn. These chemical are are present in wastewater. High concentrations of dyes can cause water borne diseases and increase BOD of receiving waters. The pH was controlled by adding either strong acid (HCl) or strong base (NaOH). The quantity of wastewater from textile industries has been increasing together with growing demand for textile products. The release of textile industry wastewater into the environment can cause serious health and environmental problems. After reviewing all this, textile wastewater needs environmental friendly, effective treatment processes. The main objective of the study was to show the availability of alternative treatment processes.

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