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Approaches for Treatment of Textile Waste Water

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ABSTRACT: In addition to other minor problems, such as solid waste and material waste management, waste water is a significant environmental barrier to implementation of the textile industry. As the absorption of these dyes by fabrics is very low, the textile industry utilizes several types of synthetic dyes and discharges vast volumes of heavily coloured waste water. This strongly coloured textile waste water greatly affects the plant's photosynthetic activity. Owing to poor light penetration and oxygen intake, it also has an effect on marine life. Because of the presence of component metals and chlorine found in synthetic dyes, it can also be harmful to some species of marine life.So, before they are drained, this cloth waste water must be processed. The methods of treatment mentioned in this article include method of oxidation, physical method and biological methods. This review article would also propose practicable remedial action for the treatment of the various forms of effluent created by the textile process.

KEYWORDS: Biological, Chemical, Oxidation, Physical, Treatment, Wastewater.

INTRODUCTION

In any country's growth, industrial revolution plays a vital role. The textile industry in India is a critical and rapidly emerging industrial market. The garment industry uses numerous raw materials/resources, like cotton, wool and synthetic fibres. In this report, cotton based textile industries are taken into account. It is also possible to divide the textile industry into two categories, namely the dry and wet cloth industries. In the dry fabric sector, solid waste is produced when liquid waste is generated in the wet fabric industry. This research considers all textile industries in the later grouping.In the wet cloth manufacturing market, processing operations like desizing, scouring, bleaching, mercerizing, dying, printing and finishing phases are included. The water consumption and waste water production from a wet manufacturing textile industry relies on the activities throughout fabric forming. Due to higher water use for its multiple wet manufacturing processes, the textile industry is a big creator of effluent waste water. Chemicals such as salts, alkalis, dyes, hydrogen peroxide, sugar, surfactant dispersants and metal soaps are found in these wastewater effluents.Thus, the textile sector is estimated to use more water than any other industry in terms of its environmental effects, and nearly all waste water released globally is heavily contaminated. The average textile mill size absorbs approximately 200 L of water per kg of fabric produced per day. According to the World Bank report, about 17 to 20 percent of industrial waste water is created by textile dyeing and finishing treatment provided to a cloth[1][2].

Aromatic and heterocyclic dyes are currently used in the textile industry. When present not only in textile waste water but also in some kind of complex matrix, the complex and durable structure of dye presents a greater challenge in degradation. A major problem and ecological issue is the mineralization of dyes, organic compounds and, thus, the toxicity of waste water

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produced by the textile and dye manufacturing industries. Thus further, it is ecologically remarkable to recognise and improve real textile treated wastewater[3].

The main purpose of this paper is, therefore, to provide a detailed survey of the various wet processing measures in the cotton textile industry and the expense of the processes used to handle dyes in textile waste water. The essential review of the most widely used methods (chemical, physical and biological) of dye removal from industrial textile waste is also explained in this study

DISCUSSION

The textile industry standards for water pollutants

As it is hazardous to the atmosphere and community, there are specific criteria for the disposal of clothing waste water. Owing to the difference of the raw materials used, various types of dyes and machinery, the requirements of waste water discharge have many too many criteria. The national environmental protection department of the Central Pollution Control Board (CPCB) defines these guidelines based on unfixed local climate and environmental safety criteria[4].

In the case of clothing waste water, owing to its harmfulness to the atmosphere and humans, metal ions, dyes and their colour are of the first consideration. Recently, because of the lack of water, the recycling and reuse of waste water has gained significant attention. Today, the focus is not in colour reduction technology, but in innovations that can generate reusable water, eliminate toxicity, mineralize aromatic compounds or recover dyes, recover salt, do not generate harmful sludge, do not generate sludge at all. Color reduction methods were significant 30 years ago and are well established today.Therefore, in the following pages, waste water treatment methods for the mineralization of dyes are addressed rather than for colour removal[5].

Treatment processes for textile wastewater

There is a high colour, high BOD/COD and salt load (Total Dissolved Solids, TDS) in the clothing waste water. Due to the existence of reactive dyes that are not readily susceptible to biological treatment, the textile waste water produced from the cotton dyeing industry is extremely contaminated. Color water causes light scarcity, which is important for marine species to evolve. This adds to an inequality in the atmosphere as a result. The filtering cost of the river water used for drinking should be reduced; no colour and poisonous substances should be available.Therefore, several treatment methods, particularly physical, chemical, biochemical, hybrid treatment processes, were created to handle it in an inexpensive and effective way before discharge of textile wastewater into the river. Ses innovations have been checked as having a high impact on the handling of clothing waste water.

Physical methods

Physical approaches based on coagulation-flocculation are useful for the decolorisation of waste water containing scattered dyes. They still have poor decolorization efficiency for the reactive and vat dyes in waste water. Due to the poor decolorisation efficiency and the huge generation of resulting sludge, these techniques often restrict their application.

Filtration methods have been used for the recovery and reuse of water, such as ultrafiltration (UF), nanofiltration (NF) and reverse osmosis (RO). When selecting the filter and its permeability, the quality and temperature of textile waste water that is necessary for the separation process must be taken into consideration.The use of membranes in the textile industry offers exciting opportunities for the processing of hydrolysed reactive dyes and auxiliaries used during dyeing, thus reducing biological oxygen demand (BOD), chemical oxygen demand (COD) and textile waste water colour. However, membranes often have major drawbacks, such as their initial investment expense, potential membrane fouling and the production of other waste containing dyes that are insoluble in water (e.g. indigo dye) and starch that need further treatment[6].

Oxidation methods

Due to their ease of use, these are the most widely employed methods of oxidation of dyes by chemical means. It is possible to categorise these oxidation technology as advanced oxidation processes (AOP) and chemical oxidation. These systems have the ability to partially or fully degrade the toxic original and the component additives, dyes, pesticides, etc. under atmospheric conditions. It is possible to use these oxidation technologies both independently and in synergy with each other. The hybrid advanced oxidation process (AOP) technologies are referred to as this synergism. Advanced oxidation processes (AOP) are those processes in which sufficient quantities of hydroxyl radicals are formed.This hydroxyl radicals are strong agents of oxidation. Compared to traditional oxidants like hydrogen peroxide or potassium permanganate, these oxidising agents have an oxidation potential of 2.33 V and demonstrate higher rates of oxidation reactions. Hydroxyl radicals answer with high-rate reaction constants with most dyes[7][8].

Biological methods

Only the dissolved matter in clothing waste water is extracted by the biological procedure. The efficiency of removal is influenced by the organic load/dye ratio and the load of the microorganism, its temperature and the concentration of oxygen in the environment. Biological approaches can be categorised into aerobic, anaerobic and anoxic or facultative, or a mixture thereof, on the basis of oxygen needs. Aerobic methods use microbes in the presence of oxygen for the treatment of clothing waste water, whereas anaerobic methods use microbes in the absence of oxygen for the treatment.In actual life, the mix of anaerobic and aerobic processes is usually applied using an anaerobic procedure for the management of chemical oxygen demand (COD) textile waste water, followed by the use of aerobic polishing treatment for the treatment of low COD textile waste water. It is only possible to produce 'methanogenic biogas' by anaerobic method if the waste water has a very high COD, more than 3 g/L, which is the case with wastewater desiccation containing more biodegradable organic compounds like polyvinyl alcohol (PVA) or starch. Thus, anaerobic therapy results in some calorific value being produced by methanogenic biogas.Part of the energy provided by its combustion can then be used for the aerobic phase of polishing. Microorganisms adjust themselves to clothing dyes in these biological methods and new resilient strains spontaneously evolve out of survival requirements, which then turn multiple dyes into less dangerous types. Enzymes like laccase, lignin peroxidase, NADH-DCIP reductase, tyrosinase, hexane oxidase and aminopyrine N-demethylase are the basis of the biodegradation pathway for recalcitrant dyes in this method[2][9].

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CONCLUSION

In the textile industry, the goal of Effluent Treatment Plants (ETP) is to introduce technologies that have minimal or zero water contamination. The most widely known solutions to ensuring environmental protection are these waste treatment plants (ETP) in the textile industry. Unfortunately, though, no clear treatment technique for all forms of textile effluents is acceptable or uniformly adoptable. Therefore, the treatment of textile waste water is carried out by a mixture of several methods which, depending on the method and quantity of the contamination load, include physical, chemical and biological methods.

Several approaches that can be implemented for handling the dye in garment waste water and reducing the emission load have been addressed in this study.

For the deterioration of dye in textile waste water, physical and oxidation approaches are successful only if the amount of textile effluent is minimal. This limits the use of physical and chemical techniques. The cost of filtration of the membrane restricts its use. This is valid even in laboratory-scale experiments. Hence, in large-scale experiments, they are not used.Instead of chemical methods, effluent treatment plants (ETP) using biological methods say that their choice is due to low production of inorganic sludge, low running costs and full biological process of ineralization/stabilization of dye.

Normally, the conditions of textile waste water following biological treatment do not meet with the requirements for the discharge of textile waste water. In order to reach the disposal of contaminated water and to minimize the impact of poisonous or inhibitory substances on bacteria, first, recalcitrant organic compounds and dyes should be desired to be oxidised by chemical oxidation or advanced oxidation methods in order to turn them into biodegradable constituents before bacterial treatment of waste water. It is possible to use cavitation to kill microbial life in water, if any. The processed water could be reused for cleaning purposes after the elimination of microbes.More researchers can now concentrate on the kinetic analysis of decolorisation/degradation and bioreactor modelling for the combination of AOP or chemical oxidation processes as pre-treatment or post-treatment of separated recalcitrant streams from each level of wet processing prior to or after biological treatment of textile waste water. In addition, studies on emission management for the textile industry should rely on a detailed overview of combination processes rather than just a qualitative debate. In order to determine the role of the different classes of bacteria in the degradation of azo-based water soluble dyes, extensive research has been carried out.Few experiments on the anthraquinone-based reactive dye have been published. Therefore, studies that will aim to highlight the oxidation of anthraquinone-based dyes with the help of integrated solutions must be carried out in the future (AOP and biological combination processes). The biodegradability of textile waste water containing anthraquinone-based water soluble dyes used for dyeing can be improved by such work. Through the introduction of MFC technologies, energy recovery from waste water and (possible) elimination of energy usage by effluent treatment plants, the performance of work related to low-cost materials for MFC would have a positive effect on the local textile water treatment plant.

REFERENCES

[1] C. R. Holkar, A. J. Jadhav, D. V. Pinjari, N. M. Mahamuni, and A. B. Pandit, "A critical review on textile wastewater treatments: Possible approaches," *Journal of Environmental Management*. 2016, doi: 10.1016/j.jenvman.2016.07.090.

ISSN: 0374-8588
Volume 21 Issue 10, October 2019

[2] D. Bhatia, N. R. Sharma, J. Singh, and R. S. Kanwar, “Biological methods for textile dye removal from wastewater: A review,” *Critical Reviews in Environmental Science and Technology*, 2017, doi: 10.1080/10643389.2017.1393263.

[3] S. A. Paul, S. K. Chavan, and S. D. Khambe, “Studies on characterization of textile industrial waste water in Solapur city,” *International Journal of Chemical Sciences*, 2012.

[4] R. Kant, “Textile dyeing industry an environmental hazard,” *Natural Science*, 2012, doi: 10.4236/ns.2012.41004.

[5] Z. Carmen and S. Daniel, “Textile Organic Dyes – Characteristics, Polluting Effects and Separation/Elimination Procedures from Industrial Effluents – A Critical Overview,” in *Organic Pollutants Ten Years After the Stockholm Convention - Environmental and Analytical Update*, 2012.

[6] M. N. Chollom, S. Rathilal, V. L. Pillay, and D. Alfa, “The applicability of nanofiltration for the treatment and reuse of textile reactive dye effluent,” *Water SA*, 2015, doi: 10.4314/wsa.v41i3.12.

[7] A. Al-Kdasi, A. Idris, K. Saed, and C. T. Guan, “Treatment of textile wastewater by advanced oxidation processes– A review,” *Global Nest Journal*, 2004.

[8] Y. Deng and R. Zhao, “Advanced Oxidation Processes (AOPs) in Wastewater Treatment,” *Current Pollution Reports*. 2015, doi: 10.1007/s40726-015-0015-z.

[9] A. G. R Ananthashankar, “Production, Characterization and Treatment of Textile Effluents: A Critical Review,” *Journal of Chemical Engineering & Process Technology*, 2013, doi: 10.4172/2157-7048.1000182.