



Journal Homepage: -www.journalijar.com

INTERNATIONAL JOURNAL OF ADVANCED RESEARCH (IJAR)

Article DOI:10.21474/IJAR01/17375

DOI URL: <http://dx.doi.org/10.21474/IJAR01/17375>



RESEARCH ARTICLE

A CRITICAL REVIEW OF DYE EFFLUENT

Dr. Madhumita Bhattacharjee

Associate Professor Department of Botany Post Graduate Govt. College For Girls Sector 11, Chandigarh.

Manuscript Info

Manuscript History

Received: 05 June 2023

Final Accepted: 09 July 2023

Published: August 2023

Key words:-

Textile Industries, Synthetic Dyes,
Effluent

Abstract

The worldwide increase in fashion, there is mushrooming of textile industry. A number of harmful chemicals including synthetic dyes are used in processing of textile. All synthetic dyes are coal tar dyes. The effluent from textile industry whether partially treated or untreated are discharged in various water bodies or agricultural field causing a major threat to human.

Copy Right, IJAR, 2023,. All rights reserved.

Introduction:-

Industrialization is a major means for development in any society. Despite the numerous benefits of industrialization, it has been classified as a serious environmental threat, because industries emit a variety of poisonous chemicals, water and solid wastes etc. in our environment and making it polluted. Among all types of pollution, the water pollution is of particular relevance, as it has become a global issue with the increasing industrialization. In the present scenario people are more sensitive of their appearance and attractive clothing. Smart look has become a tool to impress anyone and expressing one's personality. There is rat race among people to wear gorgeous and fascinating clothing, which has resulted in mushrooming of textile industry. The textile business has become a rapidly expanding market now a days. The worldwide textile industry was estimated to be worth USD 1000.3 billion in 2020 and it is forecast to increase at a CAGR of 4.4 percent from 2021 to 2028. Dye is the main component of the textile industry. It is estimated that over 10,000 various dyes and pigments are used industrially. Textile manufacture is one of the world's most polluting industries and textile dyeing is the world's second-largest polluter of water, with the fashion industry accounting for 20% of global emissions. Azo dyes make almost 70% of all commercial dyes used in the textile industry across the world (Phugare et al., 2011). Azo dyes are a type of synthetic organic dye that contains nitrogen and is chemically classified as '-N=N-'. Due to low cost and other advantageous, the synthetic azo dyes has taken a lead position and over 7X10⁵ tons of synthetic dyes are yearly produced globally (Zollinger, 1987; Robinson et al., 2001; Ogugbue and Sawidis, 2011). It has been observed that approximately 50% of synthetic dyes used in the textile business do not stay on the fabric and are released into the environment. (Rehman et al., 2018). The textile dyes are extremely toxic, mutagenic and carcinogenic in nature (Phugare et al., 2011; Aquino et al., 2014, Khatri et al., 2018), providing a serious health risk.

Critical Review of Dye Effluent

In the textile business, thousands of chemicals are utilized in various operations such as dyeing and printing. The textile industry produces a significant amount of highly poisonous effluent that is rich in colour and other organic compounds like sulphur, naphthol, vat dyes, nitrates, acetic acid, soaps, chromium compounds and heavy metals like copper, arsenic, lead, cadmium, mercury, nickel, cobalt etc. Numerous harmful chemicals that are poisonous and have carcinogenic consequences are released by the textile industry, which consequently contribute to

Corresponding Author:-Dr. Madhumita Bhattacharjee

Address:-Associate Professor, Department of Botany, Post Graduate Govt. College For Girls Sector 11, Chandigarh.

environmental deterioration and a variety of diseases in people, animals, and plants (Sharma, et al.,2018;Malik 2018).

The textile effluent is carcinogenic due to the presence of substances including naphthalene, benzamine, and other aromatic compounds. These substances are dangerous to human health and cause direct or indirect harm. Clothing dyeing and printing necessitates a large amount of water. Dyeing water consumption varies from 30 to 50 litres per kg of cloth, depending on the type of dye used. Synthetic dyes are known to be carcinogenic in about 40% of cases. The dyes are soluble in water (Mahapatra ,2016) ,so difficult to remove them easily (Hassan and Carr,2018).The effluents from the dye manufacturing industries are dumped into neighboring water bodies like ponds ,river ,lakes etc. .Sometimes also discharged in nearby farmland fields and irrigation channels. Industrial waste water comprises a wide range of potentially hazardous and environmentally detrimental chemicals (Fahdilet al.,2018). These effluents can spoil health of humans, livestock, animals, fish etc. by creating constant fluctuations in turbidity, odour, temperature, pH and other characteristics of water. According to Liu et al., (2017) these colours have been found to be detrimental to aquatic life forms, because of highly suspended solids (SS), increased biological oxidation requirement (BOD,chemical oxygen demand (COD), heat, colour, acidity, basicity, and other inorganic contaminants. As a result of less light penetration caused by dissolved dyes in water bodies, aquatic plants' rate of photosynthesis has been decreased (Imran et al., 2015, Hassan and Carr, 2018).In many studies, it is indicated that the discharge of coloured water from the textile, dye , tannery, paint and varnish industries and the food sector pollutes the water, causing major environmental problems. (Yamjala et al., 2016; Salima et al., 2013).The majority of the dyes are stable, non-degradable, and are unaffected by light (Mondal et al.,2017). Some toxic metals may be present in metalized mordent dyes (Madhav et al., 2018),which can make the dye effluent more toxic . Toxic metals present in dyes and pigments inadvertently find their way into aquatic habitats, posing major threats to aquatic life and the system (Waranusantigul et al., 2003).In India, untreated textile wastewater also contributes to groundwater contamination. (Rajaguru et al., 2002).It has been established that Benzidine based azo dyes are tumorigenic in lab animals and can cause bladder cancer in humans . Due to simple inhalation or its readily solubilization in water, the azo dyes also increase the danger of allergic reaction, cancer, eye irritation, etc. (Sudhaet al.,2014).Hepatocarcinoma, splenic sarcoma, nuclear abnormalities in test animals and chromosomal errors in mammalian cells are few major effects of it (Singh et al.,1988).

Table 1:- Chief contaminants in dyeing waste-water (Liu, 2020).

Types of dyes	Chief Contaminants in Dyeing waste-water
Direct dye	Dyes, Ming powder, salt, soda, surfactant
Reactive dye	Dyes,causticsoda,sodiumphosphate,bakingsoda,metapowder,urea,surfactant
Acid dye	Dyes,Mingpowder,ammoniumsulfate,aceticacid,sulfuricacid,surfactant
Acidmordant dye	Dyes, acetic acid, meta-powder, dichromate, surfactant
Metalcomplex dye	Dyes,sulfuricacid,sodiumacetate,ammoniumsulfate,metapowder,surfactants
Cationic dye	Dyes, sodium acetate, soda, ammonium acetate, surfactants
Primulin bases	Dyes, Sulphur Alkali, Soda, Metamarine
Vat dye	Dye caustic soda, insurance powder, meta powder, redoil
Navto dye	Dyes,causticsoda,hydrochloricacid,sodiumnitrite,sodiumacetate,surfactants
Disperse dye	Dyes, carriers, powder, surfactants
Coating material	Pigments, ammonia, sodium alginate, resins, mineral oils

Conclusion:-

Dyes pose a major threat to environmental quality and the aquatic ecosystem. Certain regulations must be followed before discharging the dye containing effluent into the water channels.

References:-

1. Aquino, J.M., Rocha-Filho R.C., Ruotolo, L.A., Bocchi, N. , Biaggio, S.R.2014.Electrochemical degradation of a real textile wastewater using β -PbO₂ and DSA® anodes. Chemical Engineering Journal, 251 : 138-145.
2. Fahdil, A. AL-Niaimi,D. & Olaiwy,A.A. 2018. Adsorption of Orange G Dye from Aqueous Solutions Using Magnesium Oxide Nanoparticles. J Biochem Tech 9(3): 31-38.
3. Hassan, M. M. and Carr , C.M. 2018. A critical review on recent advancements of the removal of reactive dyes from dyehouse effluent by ion-exchange adsorbents. Chemosphere 209 (1) : 201-219.

4. Imran M., Shaharoon , B., Crowley, D.E.,Khalid, A., Hussain, S., Arshad, M. 2015. The stability of textile azo dyes in soil and their impact on microbial phospholipid fatty acid profiles. *Ecotox. Environ. Safe.* 120: 163–168.
5. Khatri, J., Nidheesh, P.V. , Singh, T.A. , Kumar, M.S. 2018.Advanced oxidation processes based on zero-valent aluminium for treating textile wastewater. *Chemical Engineering Journal* 348 : 67-73.
6. Liu,Q .2020. Pollution and Treatment of Dye Waste Water. *IOP Conf. Ser. Earth Environ. Sci.* 514 052001.**DOI** 10.1088/1755-1315/514/5/052001
7. Liu, N., Xie, X., Yang, B., Zhang, Q., Yu, C., Zheng, X.,Xu, L., Li, R., Liu, J. 2017.Performance and microbial community structures of hydrolysis acidification process treating azo and anthraquinone dyes in different stages. *Environ. Sci. Pollution Research* 24: 252–263.
8. Madhav, A., Singh, P., Mishra ,P.K.2018. A review of textile industry: Wet processing, environmental impacts, and effluent treatment methods. *Environmental Quality Management* 27(3):31-41.
9. Mahapatra, N. N.2016. *Textile dyes* , Woodhead Publishing India Pvt, boca Raton: CRC Press , new Delhi ,ISBN9385059041.
10. Malik, A.2018. Toxicity evaluation of textile effluents and role of native soil bacterium in biodegradation of a textile dye. *Environ Sci. Pollution Res Int.* 25(5):4446–4458.
11. Mondal, P., Bakshi, S., Bose, D.2017. Study of environmental issues in textile industries and recent wastewater treatment technology. *Wor. Sci. Fic. News.* 61(2):98-109.
12. Ogugbue, C.J. and Sawidis, T. 2011.Bioremediation andDetoxification of Synthetic WastewaterContaining Triarylmethane Dyes by Aeromonashy drophila Isolated from Industrial Effluent. *Biotechnology Research International* . Article ID 967925. DOI 10.4061/2011/967925
13. Phugare, S.S., Kalyani, D.C., Surwase, S.N., Jadhav, J.P. 2011.Ecofriendlydegradation, decolorization and detoxification of textile effluent by a developed bacterial consortium. *Ecotox. Environ. Safe.* 74: 1288–1296.
14. Rajaguru, P., Vidya, L., Baskarathupathi, B., Kumar, P.A., Palanivel, M., Kalaiselvi, K., 2002. Genotoxicity evaluation of polluted ground water in human peripheral blood lymphocytes using the comet assay. *Mutat. Res.* 517: 29–37.
15. Rehman, K., Shahzad, T., Sahar, A., Hussain, S., Mahmood, F., Siddique, M.H., Siddique, M.A., Rashid, M.I.2018. Effect of reactive black 5 azo dye on soil processes related to C and N cycling. *PeerJ.* 6: e4802.
16. Robinson, T., McMullan, G., Marchant, R.and Nigam, P.2001. Remediation of dyes in textile effluent: a critical review on current treatment technologies with a proposed alternative. *Bioresource Technology* 77 (12): 247-255.
17. Salima, A., B. Benaouda, B. Noureddine and L. Duclaux.2013. Application of Ulvalactuca and Systeirastrictraalgae-based activated carbons to hazardous cationic dyes removal from industrial effluents. *Water Res.* 47: 3375-3388.
18. Sharma, B., Dangi, A.K., Shukla ,P. 2018.Contemporary enzyme based technologies for bioremediation: A review. *J Environ Manage.* 210:10–22.
19. Singh, R.L., Khanna, S.K., Singh, G.B.1988. Acute and short-term toxicity of a popular blend of metanil yellow and orange II in albino rats. *Indian J. Exp. Biol.* 26(2):105 -111.
20. Sudha, M., Saranya, A., Selvakumar G and Sivakumar, N.2014. Microbial degradation of azo dyes: a review. *Int. J. Current Microbiol .App. Sci.* 3(2): 670–690.
21. Waranusantigul, P., Pokethitiyook ,P., Kruatrachue, M., Upatham, E.S. 2003.Kinetics of basic dye (methylene blue) biosorption by giant duckweed (*Spiraodela polyrrhiza*).*Env. Pol.* 125:385-391.
22. Yamjala, K., Nainar, M. S., & Ramiseti, N. R. 2016.Methods for the analysis of azo dyes employed in food industry–a review. *Food chemistry* 192: 813-824.
23. Zollinger, H.1987. *Synthesis, Properties of Organic Dyes and Pigments.* In *Color Chemistry.* New York, USA: VCH Publishers: 92-102.