POLLUTION AND TREATMENT OF DYE WASTE-WATER

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In recent years with the rapid development of industry, the production of dye waste-water has being increased year by year. Due to complex nature, high concentration, and high colour they are very difficult to biodegrade.As per the United States" Color Index", commodity dyes have been reached tens of thousands. About 60,000 tons of dyes have been directly discharged into the environment in the form of waste each year worldwide and 80% of which are azo dyes. Dyeing Industry, issued in 2001," according to incomplete statistics, the amount of wastewaterthat have been discharged by textile industry is 900 million tons per year, accounting for the sixth place in industrial discharge ". The dye composition in these printing and dyeing waste-water are complex, high concentration, high colour, difficult to biodegrade substances are many, and contain a variety of organics with biological toxicity and three properties (carcinogenic, teratogenic, mutagenic), so it is oftenvery difficult to achieve the desired effect by using a single treatment technology. The traditional biological treatment has the disadvantage of low processing efficiency and even unable to run, while the physical and chemical treatment has the disadvantages of high processing cost, small processing capacity and harsh operating conditions. So it is very urgent to develop a new treatment process which is effective for this kind of waste-water which can meet more and more stringent discharge standards and achieve the purpose of comprehensive treatment. On applying CWO technology to the treatment of dye waste-water, especially azo dye waste-water, has great environmental significance, theoretical significance and practical application value.

Types of dyes

There are so many dyes with complex structures. There are more than 5,000 varieties of dyes with different chemical structures have been used world-wide. Dyes are classified according to their methods of application and chemical structure.The names of commercial dyes are mostly classified according to their application, while the classification by chemical structure directly represents the characteristics and commonness of dye structure. According to the chemical structure of dyes they are mainly classified to eight

ISBN 978-93-5457-774-1

categories: azo dyes, anthraquinone dyes, indigo dyes, phthalocyanine dyes, sulfur dyes, Jia Chuan dyes, triaryl methane dyes, heterocyclic dyes. According to the application based on classification of dyes they are mainly divided into fourteen categories: reactive dyes, acid dyes, direct dyes, insoluble azo dyes, vat dyes (refers to insoluble), soluble vat dyes, sulfur dyes, acid mordant dyes and acid medium dyes, oxidation dyes, polycondensation dyes, disperse dyes, basic dyes and cationic dyes, fluorescent dyes, fluorescent brighteners. Neutral dyes and cationic dyes are two kinds of dyes which are singled out from acid dyes and alkaline dyes, respectively. Among them acid dyes, reactive dyes, cationic dyes, alkaline dyes, direct dyes, vector dyes and neutral dyes are generally water-soluble dyes and acid dyes, reactive dyes, cationic dyes and basic dyes have a higher solubility in water, and the solubility of direct dyes, vector dyes and neutral dyes is slightly poor; generallyice dye, disperse dyes, vat dyes and sulfur dyes are insoluble in water. In the molecular structure of reactive dyes there are reactive groups, which can form covalent bonds with hydroxyl groups on cellulose fibers, protein fibers and amine groups on polyamide fibers under appropriate conditions and combine into a "dye-fiber" as a whole. The reactive dyes have such a large proportion compared with other cellulose fiber dyes because it has the advantages of complete chromatography, bright color, excellent fastness to washing, simple application process, convenient use and applicability, relatively cheap price, and its structure does not contain carcinogenic aromatic amines and so on. At present, reactive dyes have been able to replace some ice dye, sulfur dye and vat dye, but also suitable for the printing and dyeing needs of cellulose fiber products, which makes it more widely used. Although the reactive dyes have many of the above advantages, they also have the following disadvantages:

(1) Low utilization.

The general utilization rate is only 60%~70%, producing a large amount of coloured sewage, its chromaticity is more than a few thousand times, and the concentration of organic matter is high.

(2) High electrolyte consumption during dyeing.

This causes the increase of chlorine ion concentration in the waste-water, which increases the difficulty of dye waste-water treatment.

(3) The amount of nonferrous wastewater containing salts is large and difficult to treat.

(4) The colour fastness of some types of dyes does not not meet market requirements.

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Source and characteristics of dye wastewater

Sources of dye wastewater

Wastewaterhas been discharged by the dye industry, including dye production, and the mixing of various wastewater produced by the reprocessing of natural and man-made fiber materials by printing and dyeing plants, wool spinning plants, knitting plants, silk factories, etc. Printing and dyeing proce ssing generally includes pre-treatment (desizing, refining, bleaching, mercerization), dyeing, printing, and finishing. The pretreatment stage (including the process of firing, desizing, boiling, bleaching, mercerizing, etc.) should discharge the desizingwastewater, cooking waste-water, bleaching waste-water and mercerizing waste-water, dyeing process discharge dyeing waste-water, printing process discharge printing waste-water and soap liquid waste-water, finishing process discharge finishing waste-water in to water bodies. The printing and dyeing waste-water is a mixture of the above kinds of waste-water.

Components of various printing and dyeing waste-water.

Themain Contamination Components in waste-water are Direct dyes, Ming powder, salt, soda, surfactants, caustic soda, sodium phosphate, baking soda, meta powder, urea, surfactant Acid dyes, Ming powder, ammonium sulfate, acetic acid, sulfuric acid, surfactant acid mordant dyes, acetic acid, meta-powder, dichromate, surfactant Metal complex dyes, sulfuric acid, sodium acetate, ammonium sulfate, meta powder, surfactants Cationic dyes, sodium acetate, soda, ammonium acetate, surfactants Primulin bases Dyes, Sulphur Alkali, Soda, Metamarine Vat dye Dye, caustic soda, insurance powder, meta powder, red oil Navto dye Dyes, caustic soda, hydrochloric acid, sodium nitrite, sodium acetate, surfactants Disperse dye Dyes, carriers, powder, surfactants Coating material Pigments, ammonia, sodium alginate, resins, mineral oils

Treatment of textile dye polluted waste- water

There are many techniques have been developed to find an economic and efficient way to treat the dyes in waste water including physical chemical biological, combined treatment processes and other technologies. These technologies have beenfound to be highly efficient for the textile dyeing waste water. Chemical treatment processesare oxidative process consists of Fentons reagent, Ozonation, Photochemicals, Solium hypochloride, Cucurbituril and electrochemical destruction. Oxidative processes are the most used method of decolourization by chemical means. This is mainly due to its

ISBN 978-93-5457-774-1

simplicity of application. In Physical treatments process adsorption techniques have rapidly gaining prominence as a method of treating aqueous effluent due to their efficiency in the removal of pollutants too stable for conventional methods and economically feasible. Physical process consists of activated carbon peat, wood chips, fly ash and coal mixture silica gel, membrane filtration, ion exchange irrradiationeletrokinetic coagulation an other materials, such as natural clay and agro-waste materials.

Biological treatment process

Thebiological treatment is also one of the techniques which is environmentally friendly and pollution free by using various potential organisms. The biological process consists of decolourisation by white-rot fungi, other microbial culture, adsorption by living/dead microbial biomass and anaerobic textiledye bioremediation system.

Alternative measures based on all about cited problems regarding the discharge of effluents into the environment, it is obvious there is a need to find alternative treatments that are effective in removing dyes from effluents. By enhancing the existing effluent treatment plants to reverse osmosis (RO) and the resultant water can be used as fresh water for the region. The industries should switch over to cleaner production technologies (CPT) by using combination of soft flow machines, low salt dyes and membranes filtration. This will effectively reduce the water consumption by 50%. The air dyeing technology is a new dyeing process that uses air instead of water to dye garments, allowing companies to create garments with vivid designs and colours without polluting the water and environment. The air dyeing uses 95% less water, emits 84% less greenhouse gases (GHG) and requires 97% less energy.

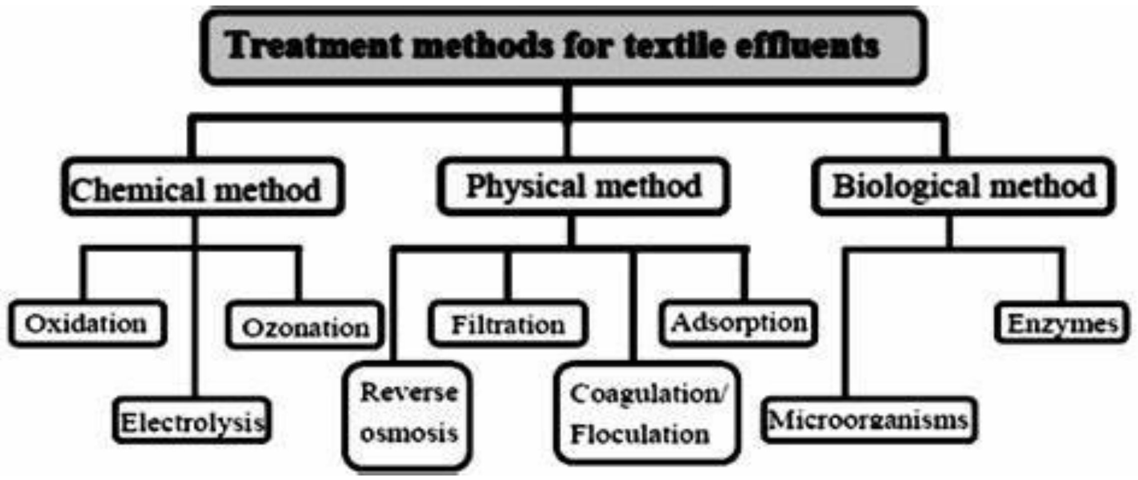

Figure 1 Treatment methods for textile effluents

ISBN 978-93-5457-774-1

Conclusion

The production of dye waste-water develops rapidly with the development of modern industry.Dye waste-water is difficult to degrade because of its complex composition, high concentration, high colour and many difficult biodegradable substances. It is important to underline that toxic compound (e.g.toxic aromatic amines, benzidine and its derivatives) can be formed in the environment via transformation of textile dye precursors (e.g., reduction or hydrolysis of textile azo dyes). The textile dye-precursors are introduced in water environment due to industrial production of dyes and industrial production of textile fibres, fabrics and clothes via waste-water. The quality problem of dye content and/or colour in the dye house effluent discharged in water courses can be solved by using of a range of advanced decolorization technologies investigated by the major dye suppliers, textile operators and customers who are under pressure to reduce colour and residual dye levels in their effluents. An alternative to minimize the problems related to the treatment of textile effluents would be the development of more effective dye that can be fixed fiber with higher efficiency decreasing losses on tailings waters and reducing the amount of dye required in the dyeing process, reducing certainly improve the cost and quality of the effluent. The global demand for cheap end products like paints, textile, printing inks, paper, plastics and food will push dye houses to simply react to local regulations by maving operations to another city. Current, the textile dyeing waste water is one of the most important source of pollution. Thetype of this waste-water has the characteristics of higher value of colour, BOD and COD. Complex composition, large emission, widely distributed and difficult degradation. If being directly discharged without being treated, it will bring serious harm to the ecological environment.

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ISBN 978-93-5457-774-1