Chapter 4
Application of Persulfate in Textile Wastewater Treatment

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ABSTRACT

As textile and dyeing industries increase, pollution due to effluent discharges from the same industries also increase and become of great concern to a healthy environment. In an attempt to understand the generation and treatment of textile wastewater, this chapter discusses the processes from which textiles are made, items of importance that are used in the production process which may account for the characteristics of the wastewater and persulfate, applied in the treatment of textile wastewater. Although these wastewaters are generally characterized by color, fluctuating pH, heat, salts, suspended solids (SS), the presence of metal ions, biological oxidation demand (BOD), and chemical oxygen demand (COD), color is the most obvious. The presence of color in the effluents from textile dyeing and finishing is due to the inefficient dyeing processes, resulting in unfixed forms of the dyestuff. To achieve the primary objective of obtaining a clean environment, there is a need for continuous monitoring of textile wastewater discharges, of which major concern is color.

INTRODUCTION

The desire to achieve and maintain a green environment continue to increase. The Environmental Engineer and other Environmentalists make every effort towards its sustainability and indeed everyone should join in these efforts as the benefit is to be enjoyed by all. These necessitates the clean-up of coloured, unsightful, non-biodegradable and often toxic, textile wastewater discharges that is able to endanger every specie that is exposed. Health and the general wellbeing within the environment suffers a great

DOI: 10.4018/978-1-5225-5766-1.ch004

setback from the exposure to water pollution, aquatic habitat is particularly affected. Water pollution, involves contamination by particulate matter, chemicals and bacteria that deteriorate its purity. One of the most common source of water pollution is the industrial wastewater which could pose serious environmental threat if not properly treated prior its discharge either directly into any surface water or via sewers. Similarly, textile wastewater may degenerate the environment due to the high content of chemical substances, suspended solids and intense colour among other characteristics. Several point source water pollution have been traced to the disposal of textile wastewater which have worked against the wellbeing of both human and aquatic lives. Downstream waters have also been negatively affected aesthetically, (Yadav & Verma, 2014) Also, contamination of both surface and ground waters have made them unfit for irrigation and drinking, (Marwari and Khan, 2012).

To this end, it is very important that definite steps should be taking to treat pollution of water at source, and to the required standard before an eventual discharge into either sewers or surface waters.

While the most obvious characteristic of any polluted water is colour, it may not necessarily be the most detrimental of them all. Colours and dyes have a long history and are important components of our daily lives. In the beginning, natural plants and insect sources were used by the dye industry for their generation and then rapidly turned to synthetic manufacturing processes. But now, the Synthetic dyes are considered a major part of our lives, (Rauf & Ashraf, 2009; Divya et al., 2013). Many synthetic dyes, particularly azo dyes, were found to be toxic, carcinogenic and mutagenic and were therefore banned throughout the world, (Ashraf et al. 2012; Shah et al., 2013). However, their manufacture and use have continued because of their ease of synthesis, low cost and other desirable properties (Bafana et al., 2011; Shah et al., 2013). Azo dyes have been considered the largest group of dyes and/or industrial colourants which are currently representing 60-70% share in the worlds dye market (Singh & Arora, 2011; Mahne, 2012; Wu et al., 2012). One of its basic properties is the ability of the bonds to resist breakdown, and thus exhibit the capacity for persistence and accumulation in the environment, (Shah et al., 2013).

Textile Production

Similar to paper, food, tannery, cosmetic and related industries, textile industries use dyes as colourants in their production. About 15% of the over 0.7million tons of artificial dyes that are manufactured annually worldwide are lost during the production processes, (Mahmoodi et al., 2011).

The application of dyes by the textile industry has grown steadily because they react well with fibers and the colour is stable. Dyes have been discussed more in literatures because of their high solubility in water and also as effluents containing environmentally problematic compounds (Papić et al., 2009) in (Guimarães et al., 2012) which are visible even in small quantities because of their brilliance, (Robinson et al., 2001).

Dyeing and finishing in textile production generates the largest quantity of wastewater. The raw materials are cleaned with water and the latter is also used in many flushing stages in the wet production (Mahamuni and Adewuyi, 2010; Oller et al., 2011). Generally, the traditional textile finishing industry use about 100 liters of water to process about 1 Kg of textile material but the new closed-loop technologies such as the reuse of microbial or enzymatic treatment of dye effluents may help to reduce the enormous water pollution (Shah et al., 2013).