REMOVAL OF REACTIVE BLACK 5 FROM TEXTILE WASTEWATER BY OZONE AND PHOTO-FENTON – INFLUENCE OF INDUSTRIAL MATRIX EFFECTS

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***Abstract*— Textile waste water containing dyes, surfactants, salts and other contaminants represent a challenge for the selection and design of treatment processes due to the stability of some of its components. Advanced oxidation processes (AOPs) are attractive alternatives to partially or totally degrade dyes and other persistent pollutants using relatively compact devices to perform water treatment. To test the efficiency of these technologies it is necessary to count with laboratory made solutions that can match the characteristics of a typical textile waste waters effluent. In this work the application of two AOP, ozonation and photo-Fenton, to the treatment of textile effluents are compared, using a specially design model solution. The effect of typical textile wastewater composition on the treatment efficiency is discussed. Higher decoloration efficiencies were obtained with both AOPs tested in this work, being slightly higher with ozonation. TOC was only partially removed, being more efficient photo-Fenton than ozonation.**

***Keywords*— Ozone, photo Fenton, Textile Wastewater, Dye, Reactive Black 5**

I. INTRODUCTION

Industrial processes developed in textile factories generates important volumes of wastewater that should be treated before its discharge to surface water bodies. Some of those liquids are colored, and rich in salts, additives and several organic and inorganic compounds (Bilińska *et al.*, 2016; Ulson de Souza *et al.,* 2009; Bisschops and Spanjers, 2003; O´Niell *et al.,* 1999). Textile processes involve several operations required to transform the raw material into commercial fabrics. Some operations, like washing, bleaching, mercerizing, dyeing and functional finishing are usually developed by wet processes, producing wastewaters with different characteristics (Paździor *et al.*, 2019; Bisschops and Spanjers, 2003).

Most of the dyes added to the dyeing baths are incorporated to the fabrics, but a no negligible part remains in the spent bath, and consequently in the wastewaters. The fraction of dye incorporated to fabrics (called "Exhaust" of dyeing bath) depends of the dye itself, the bath formulation, and the operative conditions. According to a survey developed between years 2013 and 2016 on cotton processing factories in Buenos Aires, for Reactive Black 5 (RB5), typical exhaust rounds 80%. Consequently, 20% of the dye remains in the solution discarded with the wastewaters. This value coincides with Arslan-Alaton *et al.* (2002).

Textile dyes are intrinsically designed to resist sunlight and biodegradation along the time, once they are on the fabrics. Therefore, those compounds are usually recalcitrant to the conventional wastewater treatment methods (Zuorro *et al.*, 2013; Arslan-Alaton *et al.*, 2008; Forgacs *et al.*, 2004; Bisschops and Spanjers, 2003). The combination of dyes with high salinity and the presence of additives result in wastewater streams with low biodegradability ratio (BOD/COD) with adverse effect to conventional biological wastewater treatment facilities. For these reasons it is necessary the development of new technologies in order to treat those liquids. (Bilińska *et al.*, 2016; Forgacs *et al.*, 2004).

Advanced Oxidation Processes (AOPs) are promising alternative for treating colored and recalcitrant wastewaters like the produced in textile industries. (Bilińska *et al.*, 2015; Anjaneyulu *et al.*, 2005) These technologies involve in-situ generation of strong oxidant species like hydroxile radicals ($HO^{\bullet}$) (Rosenfeldt *et al.*, 2006; Legrini *et al.*, 1993; Glaze *et al.*, 1987). Two AOPs were selected for comparative proposes on this work. 1) photo Fenton (phF) processes, based on the catalytic decomposition of H_2O_2 in presence of Fe(II) or Fe(III) under UVA illumination (365-420 nm), and 2) Ozonation (Oz), based on incorporation of ozone on the system. Pollutants dissolved on the system may be oxidized through two main pathways, direct reaction with ozone and reaction with $HO^{\bullet}$ radicals generated by ozone decomposition via chain reaction (Rosenfeldt *et al.*, 2006; Hoigné and Bader, 1983). The main reaction pathway depends on