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THE CATALYTIC OXIDATION OF SODIUM LIGNOSULFONATE
AND DIRECT RED DYE IN THE PRESENCE OF HYDROGEN PEROXIDE

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The textile industry is considered one of the most polluted industrial sectors. The pollutants in the textile industry effluents are among recalcitrant organic compounds, toxic dyes, active surface agents, chlorinated compounds, inhibitory compounds, surfactants, salts, and finally the high pH due to the large amount of alkali. In order to remove these pollutants special wastewater treatment is in demand.

The aim of this work was to investigate the removal efficiency of DR and LS using catalytic oxidation in the presence of hydrogen peroxide. Also, it was optimized the process conditions based on removal efficiency and the impact of various factors such pH, concentration of $(\text{NH}_4)_2\text{Fe}(\text{SO}_4)_2 \cdot 6 \text{H}_2\text{O}$, hydrogen peroxide concentration, initial concentration of dye and dispersing agent, and reaction time.

This paper describes a study of catalytic oxidation of (LS) and direct red dye (DR) by Fenton process in aqueous solution. Sodium lignosulfonate solutions are commonly used as dispersing agents, solvents for dyes etc. These chemicals may not biodegrade. Under such conditions, chemical oxidation could be a very effective treatment alternative for DR-LS – containing wastewaters. The primary objective of this research was to evaluate the degradation of DR₈₁ – LS by Fenton reagent. The rate and extent of LS removal and oxidant requirements were investigated. In addition, major reaction products resulting from these oxidation methods were identified and compared to each other. It is well known that Fenton reactions are more effective in oxidation of organic compounds under acidic conditions than neutral conditions. Several experiments were conducted to determine the effect of degradation/mineralization and the optimal concentrations of H_2O_2 and Mohr salt. The initial concentrations of chemicals were adjusted to 0.1, 0.3 and 0.5 mM for Fe (II) and 1.0, 3.0 and 5.0 mM for H_2O_2 . These chemicals were applied as one pulse addition. The pH was adjusted to 2.5 using 0.1 N H_2SO_4 . The optimal condition occurred at a dye concentration of 200.0 Mg/L and dispersing agent of 60.0 Mg/L, hydrogen peroxide of 1.0 mM, bivalent iron concentration of 0.3 mM and duration of 10 minutes. Under such conditions, the maximum mineralization/oxidation rate was 92.2-93.0%.

It is clear that the oxidation process depends on the reaction time. In the first 10 minutes, more than $\frac{3}{4}$ of organic compounds are oxidized. With the increase of the reaction time, the mineralization effect is slightly increased as well. The reaction time in the limits 10-60 min are not changed the oxidation/mineralization process. In order to accelerate the decomposition and oxidation reactions by means of hydrogen peroxide, the following catalysts were used: ions of iron (II). Thus, it can be stated that a higher degree of removal is achieved at the textile wastewater treatment with $\text{H}_2\text{O}_2/\text{Fe}^{2+}$, since hydrogen peroxide decomposes rather quickly by the following mechanism: the excess iron leads to a reduction in the oxidizing effect because it subsequently leads to the spending and decomposition of the hydrogen peroxide.

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