EVALUATION OF REACTIVE BLACK 5 OXIDATIVE DEGRADATION FROM WATER BY HPLC, COD AND TOC METHODS

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The extensive uses of reactive dyes have a strong impact especially on aquatic ecosystems. For this reason, over the last few years, the development and the evaluation of some advanced oxidation processes becomes a priority.

In this work, the oxidation of a reactive dye, Reactive Black 5 with hydrogen peroxide from an aqueous solution over CuO/Al₂O₃ and NiO/Al₂O₃ catalysts was studied during a series of batch experiments.

Removal of the dye was investigated by HPLC method (UV – Diode Array detector), Chemical Oxygen Demand (COD) and Total Organic Carbon (TOC) measurements.

The Black 5 concentration, measured by HPLC, decreased in time for both catalytic systems. This decrease is more pronounced for the CuO/Al₂O₃ catalyst, above 90% for one hour reaction time (Black 5 initial concentration = 100 mg.L⁻¹, H₂O₂ initial concentration = 1g.L⁻¹).

Obviously the COD and TOC values also decrease, but taking into account the Black 5 concentration/COD and Black 5 concentration/TOC ratios we have observed that when NiO/Al₂O₃ was employed these ratios remain almost constants during the process. Instead, in the presence of CuO/Al₂O₃ the Black 5 concentration/COD and Black 5 concentration/TOC ratios are diminished in time. These results suggest that for CuO based catalyst the dye removal occurs by the oxidation with formation of smaller molecular weight compounds, when for NiO based catalyst the Black 5 removal is due, in principal, to the adsorption on catalyst surface. The above supposition is also supported by HPLC analysis which has emphasized the formation of some by-products (with ε_max at λ = 250nm, and λ = 575nm) only for CuO/Al₂O₃.

The combination of these three analytical techniques allows an effective evaluation of the reactive dye removal by catalytic oxidation processes.

References