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REDOX TRANSFORMATION PROCESSES OF THE REACTIVE BLUE DYE

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The current study presents the research data results about the influence of Reactive Blue (RB4), a textile dye that belongs to the azo-compounds group, on the self-purification processes of natural waters.

The oxidation process has been examined spectrophotometrically, by the dye consumption, registered at 602 nm wavelength ($\varepsilon_{exp} = 1{,}2 \cdot 10^4$ L/mol·cm). The concentrations of the model systems compounds are: [RB4] = (1-9)·10^{-5} M; [H_2O_2] = (1-10)·10^{-5} M; [Cu(II)] = (0.09-5)·10^{-4} M; [NH_4^+] = (1-10)·10^{-4} M; [$C_2O_4^{2-}$] = (1-100)·10^{-4} M; [HA] = 3 mg/L. The studies of oxidation processes of RB4 have been performed at the pH = 5.5.

Studying the dependence of the oxidation rate upon the dye concentration, it has been established that the velocity of the process slows down with the increase of its own concentration. The registered decrease is not the result of binding copper ions in the inactive catalytic compounds, because the preliminary research has proved the absence of the dye - catalysts complexes. An explanation for this is that the system oxidation capacity is exceeded.

The experimental data resulted out of the kinetic study of the oxidation process in the RB4-O_2-H_2O_2-Cu(II) system, performed in aerobic conditions and catalyzed by the copper(II) ions, have proved that the oxidation reaction rate is directly proportional to oxidant and catalyst concentration, and is inversely proportional to the substrate amount.

The expression for the initial reaction rate:

$$W = 9.37 \cdot 10^{-9} \cdot \frac{[Cu(II)]^{0,4}\,[H_2O_2]^{0,4}}{[AA]^{0,4}}$$

The results obtained out of the research have demonstrated that there are $OH^{\cdot}$ radicals producing in the studied systems, as demonstrated by consumption of the $OH^{\cdot}$ radicals trap, para-nitroso-N,N-dimethyl aniline (PNDMA).

In order to study the self-purification process in the same conditions as in natural waters, some compounds such as ammonium, oxalate and humate ions were added in the model systems. These substances were added in the same concentrations as in the environmental medium.

The results of the experimental work have demonstrated that the maximum degradation speed is recorded at a Metal-Ligand concentration ratio 1:2, also, the oxidation rate increases 1.2 times in the presence of NH_4^+, the $C_2O_4^{2-}$ diminishes it 2.7 times, while sodium humate inhibits it.