POLYMER-BASED FENTON CATALYSTS FOR WASTEWATER TREATMENT

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Water is one of the most important resources for sustainable life. The contamination of water by inorganic and organic pollutants, such as heavy metals, petroleum, plastics, surfactants, pesticides, pharmaceuticals requires the development of new efficient approaches to water treatment. The use of advanced oxidation processes (AOPs) seems to be the efficient method for catalytical degradation of the organic pollutants. The Fenton process is one of the AOPs, therefore the development of the Fenton catalysts with high surface area, good stability and low iron leaching is in the focus of the researches.

The aim of this study was to develop a new low-cost method of obtaining the polymer-based heterogeneous Fenton catalyst for efficient wastewater treatment from organic contaminants. Methylene blue dye (MB) was chosen as a model organic pollutant.

The catalysts were prepared by UV-polymerization of acrylonitrile (AN), acrylic acid (AA) and sulfocontaining monomer (SM): 2-acrylamido-2-methylpropane-1-sulfonic acid (AMPS), 3-sulfopropyl acrylate potassium salt (SPAK) or sodium styrene sulfonate (SSS) – at a ratio AN : SM : AA = 60 : 25 : 15 (wt %). The synthesized sulfo group-containing copolymers were immersed in $FeCl_3 \times 6H_2O$ solution, so Fe^{+3} ions were adsorbed on the membranes. The catalysts were placed in MB solution ($5 \cdot 10^{-5}$ mol/L), then the oxidant H_2O_2 was added to the solution. The MB degradation was determined by monitoring the dye concentration changes over time at a characteristic wavelength of 665 nm using spectrophotometer Spekol 11 (Carl Zeiss Jena, Germany). The kinetic curves for MB degradation are presented in Fig. 1.

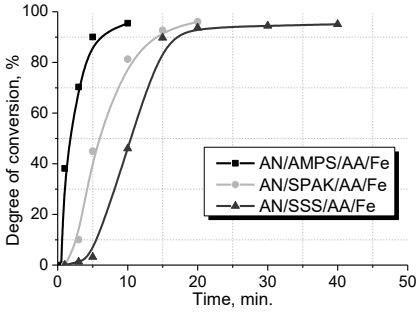

Fig. 1. Kinetic curves for MB degradation

As one can see, all the catalysts demonstrated a higher catalytic activity in the process of MB degradation reaching 90 %. The degradation efficiency was higher when using the AN/AMPS/AA/Fe catalyst as compared to the catalysts AN/SPAK/AA/Fe and AN/SSS/AA/Fe. In the presence of the AN/AMPS/AA/Fe catalyst the degradation efficiency was 90 % after 8 min, whereas for the AN/SPAK/AA/Fe catalyst – after 13 min and for the AN/SSS/AA/Fe one – after 15 min.

Therefore, the obtained polymer-based Fenton catalysts showed a high catalytic activity in the process of MB degradation by H_2O_2 and may be good candidates for further research.