APPLICATION OF WASTE MATERIAL FOR CATALYTIC DEGRADATION OF METAL COMPLEX DYE

Edita Sodaitienė*, Audronė Gefenienė, Aušra Selskienė,

Romas Ragauskas, Rimantas Ramanauskas

Department of Chemical Engineering and Technology, Center for Physical Sciences and Technology, Vilnius, Lithuania
** edita.zubryte@ftmc.lt*

The amount of dyes used in various industries is increasing, posing a risk to the environment and human health. Organic dyes into wastewater generally get from the coloring and rinsing procedures. Catalytic degradation of the dyes could be as an alternative method for adsorption processes. Various iron-based materials (oxides, hydroxides and oxyhydroxides) are classified as promising heterogeneous Fenton catalysts [1, 2]. Recently, the catalytic activity of iron-rich wastes of various composition generated during industrial processes were tested for activating hydrogen peroxide. The purpose of this study was to evaluate the efficiency of groundwater treatment waste (GWTW) in catalytic oxidative degradation of organic pollutant the chromium complex azodye used for anodized aluminum coloring. The sunlight as a cheap and sustainable source of energy was explored. The catalyst was characterized using SEM (Fig. 1a), XPS, FTIR and X-ray fluorescence spectroscopy. The main components of GWTW are ferrihydrite ($Fe(OH)_3$), goethite (α-FeOOH) and hematite (α-Fe_2O_3) that can activate the decomposition of peroxide leading to radical formation. The activity of GWTW catalyst in oxidative degradation of metal complex dye has been investigated depending on the solution pH, catalyst loading (Fig. 1b), reaction time and temperature. The dye anions (RSO_3^-) are electrostatically attracted by the positive catalyst surface, where the dye degradation process in the presence of H_2O_2 occurs. The rate of the dye degradation increased with increase in catalyst dose from 0.5 to 1.0 g/L. The rise in temperature from 20 to 60 °C and solution acidity from pH 5 to pH 3 positively influenced the dye removal process. The obtained results show that the nanostructured GWTW produced as a result of the deironing of groundwater by cascade aeration is an effective catalyst in the Fenton-like oxidation of metal complex dye in the presence H_2O_2 leading to discoloration of wastewater.

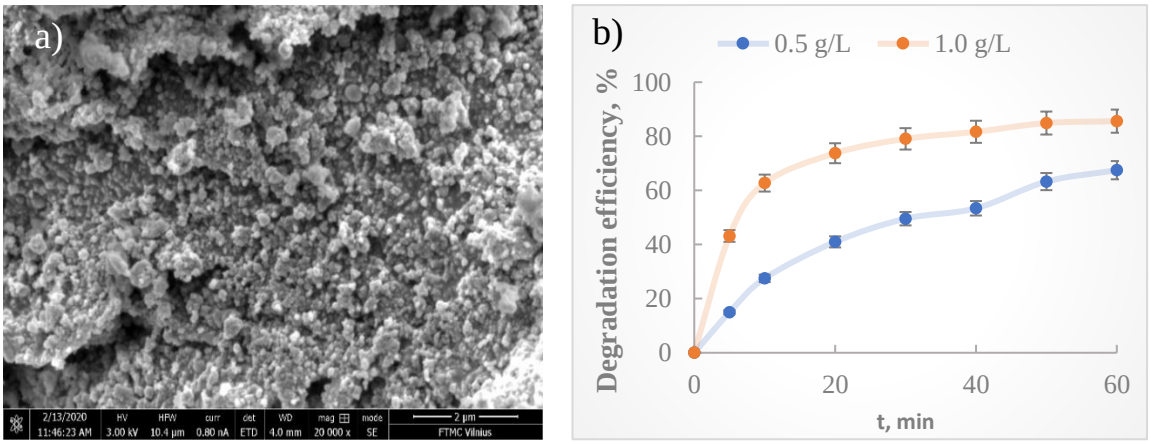

Fig. 1. SEM image of the surface morphology of the GWTW catalyst dried at room temperature (a); impact of GWTW catalyst loading and reaction time on the dye degradation efficiency (b).

References

1. N. Thomas, D.D. Dionysiou, S.C. Pillai. J. Hazard. Mater. **404** (2021) 124082.
2. E.G. Garrido-Ramírez, B.K.G. Theng, M.L. Mora. Appl. Clay Sci. **47** (2010) 182–192.