Simona Gabriela Muntean,[1] Maria Andreea Nistor,[1] Robert Ianos,[2] Cornelia Pacurariu[2]

[1]Institute of Chemistry Timisoara of Romanian Academy, 24 Mihai Viteazul, Timisoara, Romania
[2]Faculty of Industrial Chemistry and Environmental Engineering/ Politehnica University Timişoara, Romania

sgmuntean@acad-icht.tm.edu.ro;
sgmuntean@yahoo.com

Magnetite/silver/carbon nanocomposites: Synthesis, Characterization and Evaluation as Specific Sorbent

Fe_3O_4/Ag/C nanocomposites have attracted much interest in many applications due to their valuable properties. These nanocomposites combine the good catalytic and antibacterial activity provided by silver and high adsorption capacity supplied by carbon with the advantage of easy magnetically manipulation given by magnetite. Meanwhile, the carbon presence prevents the oxidation or erosion by acid or base and agglomeration of the composite in aqueous solution[1,2]. Generally, the methods reported for the synthesis of Fe_3O_4/Ag/C nanocomposites require multi-step routes, high temperatures or long reaction times[2]. In this work we report the synthesis of magnetite/silver/carbon nanocomposites nanocomposites (MSC) with different mass ratio by the combustion method, working in controlled atmosphere. This method is environmentally friendly and has many advantages such as simplicity, short reaction time, low energy consumption[3,4]. The presence of magnetite in the samples was certified by Mössbauer spectroscopy. The thermal behaviour and textural properties of the samples are significantly influenced by the high carbon content. The values of the saturation magnetization of the samples are in accordance with their phase composition, decreasing with the decrease of magnetite content, from 2.6 to 2.0 emu/g. The SEM images of the samples indicate the presence of small agglomerated magnetite and silver particles located on the surface of activated carbon. Combustion synthesis allows obtaining magnetite/ silver/carbon nanocomposites with large surface area and ferrimagnetic properties, which ensure good adsorbent properties, easy separation of the phases and opportunities for regeneration and reuse that recommend them as efficient adsorbents for the removal of different pollutants from wastewater. The obtained nanocomposites were tested as adsorbents for the removal of anionic and cationic dyes from single and binary systems in aqueous solution, in selected working conditions. In binary systems the removal efficiency slightly decreased due to competitive effect. Even after five adsorption-desorption cycles the magnetite/carbon nanocomposites still present a good efficiency (greater than 75%) for dyes removal from aqueous solution, indicating the possible industrial application of MSC.

References

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Figures

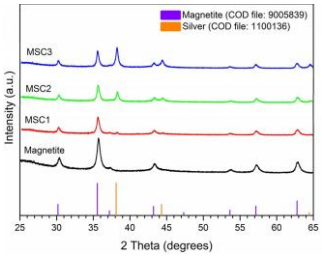

Figure 1: XRD patterns of the nanocomposites

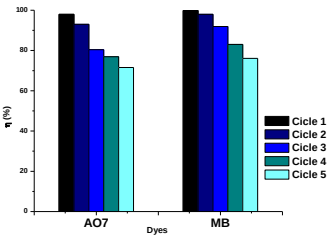

Figure 2: Removal efficiency of MSC1 in five adsorption-desorption cycles.