Adsorption of methylene blue onto chemical modificated carbon nanotubes

Pełech R.[1*], Pełech I.[2]

[1]*Institute of Chemical Organic Technology, West Pomeranian University of Technology, Szczecin, Pulaskiego 10, 70-322 Szczecin, Poland*
[2]*Institute of Chemical Technology and Environmental Engineering, West Pomeranian University of Technology, Szczecin, Pulaskiego 10, 70-322 Szczecin, Poland*
**e-mail: robert.pelech@zut.edu.pl*

Carbon nanotubes possess splendid potential applications in energy storage, environmental remediation and medical delivery due to their unusual one-dimensional hollow nanostructures and unique chemical and physical characteristics. The strong adsorption affinity of carbon nanotubes towards organic contaminants, such as dioxins, trihalomethanes, aromatic organic chemicals, antibiotics and organic pesticides was approved. In order to improve carbon nanotubes properties, pristine CNTs are oxidized in nitric acid or hydrogen peroxide.

In this work the studies of sorption properties of modified carbon nanotubes are presented. The pristine carbon nanotubes were produced by a chemical vapor deposition method using iron-cobalt catalyst and subsequent modified using chlorine gas at 150°C under atmosphere pressure. When the process was ended, the sample was degasified under vacuum in the same temperature like temperature of chlorination process. Next the material was washed with acetone, filtered and dried at 120°C under vacuum. Additionally the carbon material after chlorination process was boiled using 1M NaOH for 1h. After that the sample was neutralized using 0.1 M HCl and washed with distilled water up to pH≅7. At the end the sample was dried under vacuum at 120°C.

Both carbon nanotubes after chlorination and oxidation using sodium hydroxide were studied in the process of methylene blue (MB) adsorption from aqueous solution. Adsorption process was conducted in the batch agitator containing 500cm^3 of solution of MB. The initial concentration of MB was fixed to 10mg/dm^3, the mixing velocity - 300 rpm, the weight of carbon material - 200mg.

It was found that on the raw material adsorption process practically didn't proceed. The material is characterized by very poor wettability and its dispersion in the aqueous solution wasn't observed. Carbon nanotubes after modification processes possessed very good wettability with water and formed a homogeneous suspension. In this case reduction of MB concentration at 25°C amounted about 45%.