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Nanostructures as sorbents for water purification

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Abstract: Environmental pollution is dramatically increasing due to the anthropogenic activity. Global pollution causes global pollution and affects whole ecosystem, including natural animal habitats leading to the extinction of many species [1]. One of the largest groups of compounds contaminating the aquatic environment are antibiotics, dyes, pigments, and heavy metals that are released from post-production waste. Such chemicals not only affect the fauna but also causes several health problems of humans, increasing the risk of cancer development and disrupting endocrine and immune system [2]. Despite widely used method of water purification, still, the contamination of water is a huge and global problem. Therefore, the new techniques to deal with it are needed. One of them is application of nanotechnology. In this work, the water was purified through magnetic separation of pollutants using magnetic particles, in particular iron oxide nanoparticles doped with zinc $Zn_xFe_{(3-x)}O_4$ and magnetic nanocomposites like biomass coated with magnetic iron oxide-based nanoparticles. Proposed materials were used for the removal of model dyes like titan yellow (TY) dye and methylene blue (MB) in function of experimental conditions, e.g., adsorbent dose, contact time, pH, ionic strength, and concentration of pollutant [3, 4]. The efficiency of TY adsorption process using magnetic particles was about 80% within 60 minutes, where The adsorption capacity for TY is about to 43.0 mg g^{-1}. In the case of the biomass-based nanocomposites, the coffee, cellulose, and volcanic red algae were used as a biomass and covered with iron oxide nanoparticles. The effectiveness of removal of methylene blue was 90.9%, 83.6%, 90.5% with 180 min contact time for coffee@Fe_3O_4, cellulose@ Fe_3O_4, and algae@ Fe_3O_4, respectively, where the adsorption capacity was from 38.23 mg g^{-1} to 48.11 mg g^{-1}. In the case $Zn_xFe_{(3-x)}O_4$, coffee@Fe_3O_4, algae@Fe_3O_4 the adsorption process follows Redlich-Peterson model, while the adsorption with cellulose@ Fe_3O_4 undergoes Langmuir model.

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