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In_2O_3 catalyst supported on carbonaceous nanohybrid for enhancing the removal of methyl orange dye from aqueous solutions

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ABSTRACT

This work aims to assess the adsorption and catalytic wet oxidation (CWO) performance of In_2O_3 supported on carbonaceous nanohybrid (In_2O_3-CNH). CNH was prepared from carbon xerogel reinforced with graphene oxide through sol-gel of resorcinol–formaldehyde then followed by carbonization at 500°C for 2 h. The morphological, chemical and textural properties of nanohybrids obtained were determined using scanning electron microscopy/energy-dispersive X-ray spectroscopy, X-ray diffraction, Fourier transform infrared spectroscopy and N_2 gas adsorption at –196°C measurements. The adsorption efficiency of CNH and In_2O_3-CNH samples toward methyl orange dye (MO) was studied. CWO experiments over the In_2O_3-CNH catalyst were performed at different variables like the temperature, pH of the solution and initial dye concentrations. The reusability of the nanohybrid catalyst was employed also. Adsorption results showed that In_2O_3-CNH possesses larger adsorption capacity (58.8 mg/g) than that of CNH (32.2 mg/g). The most effective catalytic oxidation performance of In_2O_3-CNH was attained at a temperature of 40°C, pH 4 and initial MO concentration of 20 mg/L to degrade fully the dye within 30 min. Results of reusability showed excellent catalytic performance for In_2O_3-CNH during four CWO cycles, indicating superior degradation toward MO dye up to 88% till 180 min at the fourth CWO run. Overall, the obtained In_2O_3-CNH has higher adsorptive and catalytic activity than that of CNH individually, confirming that In_2O_3 nanoparticles played a key role as reactive sites at the surface of CNH.

Keywords: Carbonaceous nanohybrid; Indium oxide; Methyl orange dye; Adsorption; Catalytic wet oxidation

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