

# Composites of CoFe<sub>2</sub>O<sub>4</sub>/Graphene Oxide/Kaolinite for Adsorption of Lead Ion from Aqueous Solution

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## Abstract

*In this work, we established composites from kaolinite (K), CoFe<sub>2</sub>O<sub>4</sub> (CF), and graphene oxide (GO) for the adsorption of the lead ion (Pb (II)). Initially, a composite of CF-GO was synthesized by hydrothermal method using cellulose bio-template extracted from false banana. The weight ratio of GO varied from 0.20 to 0.30, i.e., (1-x) CF/(x)GO (x = 0.20, 0.25, 0.30). The sample with x = 0.30, i.e., CF-0.3GO exhibited a better adsorption capacity of about 23.6 mg g<sup>-1</sup> from the binary composite samples at the initial Pb concentration of 50 mg L<sup>-1</sup>. Then, the contact time and adsorbent dosage of CF-0.3GO were optimized with the corresponding results of 90 min and 1.2 g L<sup>-1</sup>, respectively. A ternary composite was formulated from the sample of CF-0.3GO and Kaolinite (K) with the nominal composition of (1-y)K/(y)(CF-0.3GO), where y = 0.30, 0.45, 0.60, and 0.75. Among the ternary composites, the sample with a composition of 0.25K/0.75(CF-0.3GO) showed the best adsorption capacity of about 4.2 mg g<sup>-1</sup> at the initial Pb concentration of 10 mg L<sup>-1</sup>, and this sample was subsequently selected for further studies. Atomic absorption spectroscopy (AAS) was used to determine the adsorption capacity of samples. The effect of pH ranging from 2 to 10 was investigated for the present composite. At pH of 4, the adsorption capacity and removal efficiency changed significantly, with the corresponding results of 6.62 mg g<sup>-1</sup> and 99 %, respectively, and becomes constant. Adsorption isotherms and kinetics were investigated for a composite with a composition of 0.25K/0.75 (CF-0.3GO). The Freundlich isotherm model best fits the adsorption isotherm, with a correlation coefficient of 0.93, and the kinetic behavior followed Pseudo-second-order adsorption kinetics. Finally, the synthesized composite was stable for three-round tests toward the Pb(II) removal. Therefore, the results of this study indicate that the composites of CoFe<sub>2</sub>O<sub>4</sub>/Graphene oxide/Kaolinite could be a potential candidate for the removal of Pb (II) ions.*

**Keywords:** CoFe<sub>2</sub>O<sub>4</sub>/Graphene oxide/Kaolinite, Graphene oxide, Kaolinite, Adsorption, lead ion.