Removal of Cd$^{2+}$ and Pb$^{2+}$ ions by aluminium oxide and the prepared aluminium oxide nanoparticles

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Abstract: Aluminium oxide (Al$_2$O$_3$) is one of the most versatile ceramic oxides. In this study, aluminium oxide nanoparticles were synthesized by sol-gel assisted auto-combustion method and were characterized by using TG-DTA, XRD, FT-IR and FE-SEM techniques. The resulted γ-Al$_2$O$_3$ nanoparticles were used to remove of Cd$^{2+}$ and Pb$^{2+}$ ions from model solution and contaminants in wastewater at different contact time and adsorbate dose. Then the concentration of Cd$^{2+}$ and Pb$^{2+}$ ions in the solution after adsorption were determined by atomic absorption spectrophotometer (AAS). These observations clearly indicated that the removal of metal ions purely depends on the amount of adsorbent and contact time. The comparison of adsorption properties of Al$_2$O$_3$ and prepared Al$_2$O$_3$ nanoparticles were studied. Al$_2$O$_3$ and the prepared Al$_2$O$_3$ nanoparticles were be compared in removal of Cd$^{2+}$ and Pb$^{2+}$ ions under identical conditions from wastewater. 96.31 % for Cd$^{2+}$ ion and 56.81% for Pb$^{2+}$ ion were removed by Al$_2$O$_3$. The prepared Al$_2$O$_3$ nanoparticles can completely remove Cd$^{2+}$ and Pb$^{2+}$ ions contaminants in 100 mL wastewater. Therefore, the prepared Al$_2$O$_3$ nanoparticles were more powerful than Al$_2$O$_3$.

Keywords: Aluminium oxide nanoparticles; Sol-gel; γ-Al$_2$O$_3$; Cd$^{2+}$; Pb$^{2+}$