**ABSTRACT**

Magnetite nanoparticles (Fe3O4) decorated reduced graphene oxide (rGO) composite was synthesized by the solvothermal method and utilized as a potential adsorbent for the removal of cesium (Cs+) and strontium (Sr2+) ions from aqueous solution. The effects of adsorbate concentration and reaction time on the removal efficiencies of Cs+ and Sr2+ were investigated. The adsorption capacity increases as the initial concentration of Cs+/Sr2+ increased from 1 to 170 mg/L, which might be due to the more available adsorption sites, and the adsorbent reached equilibrium at 360 min. The adsorption isotherm was fitted to the Freundlich model with maximum adsorption capacities of Cs+ and Sr2+ being 128.2 and 384.6 mg g–1, respectively. The kinetic study showed that the adsorption behavior followed pseudo-second-order kinetics. The rGO/Fe3O4 nanocomposite showed excellent selectivity toward Cs+ and Sr2+ even in the presence of competitive cations (Na+, K+, and Mg2+) having a higher concentration.