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Gamma radiation- induced synthesis of polyaniline/CuWO4 nanocomposite for potential sorption of Cobalt-60 and Cesium-137 from aqueous solutions

The release of cobalt-60 and cesium-137 in the environment is considered dangerous pollutants. In this concern, the present work deals with gamma radiation-induced synthesis of novel polyaniline/CuWO4 (PANi/CWO) nanocomposite adsorbent and estimating its potential adsorption capacity for cobalt-60 and cesium-137 from aqueous solution. The crystallite size of pure CWO NPs and PANi/CWO nanocomposite is found in the nanoscale range. Also, SEM images and XRD results confirmed the successful preparation of PANi/CWO nanocomposite. Further, the elemental mapping images proved that all entire elements were homogeneously distributed over the PANi/CWO nanocomposite. Besides, the adsorption experiments were conducted separately to investigate the adsorption behavior of cobalt-60 and cesium-137 by PANi/CWO nanocomposite. Adsorption processes have also been performed, and numerous factors, including medium pH, contact time, initial metal ion concentration, and temperature, have been tested. Batch experiments were done to get the optimum conditions for removing cobalt-60 and cesium-137. Four Kinetic models were investigated, indicating that the adsorption process of cobalt-60 and cesium-137 onto PANi/CWO nanocomposite is controlled by chemisorption and intra-particle diffusion. Four equilibrium isotherm models were investigated, revealing that the adsorption process is a monolayer and multi-layer process on a heterogeneous surface. The negative (ΔHo) value suggested that this study's removal of cesium and cobalt has an endothermic behavior, whereas the positive (ΔSo) value proved that the examined system is random. The effect of temperature was investigated, and the calculated thermodynamic parameters indicated that the removal of cobalt-60 and cesium-137 by PANi/CWO nanocomposite has an exothermic behavior.

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