INVESTIGATION OF RADIATION STABILITY OF THE RESORCINOL-FORMALDEHYDE RESIN FOR ^{60}CO RADIONUCLIDE REMOVAL.

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The management of nuclear waste, particularly the removal of radiocobalt (Co-60) from aqueous solutions, remains a critical environmental and safety concern. Resorcinol–formaldehyde (RF) resins are widely utilised in various industrial applications due to their excellent mechanical strength, thermal stability, and chemical resistance. Their potential for sorbing radioactive isotopes, such as radiocobalt, makes them promising candidates for radioactive waste management. However, the radiation stability of RF resins under exposure to ionising radiation is a critical factor influencing their performance and longevity in such applications. This study investigates the effects of ionising radiation (gamma rays or electron beam) on the structural integrity and sorption capacity of RF resins for radiocobalt. Batch adsorption experiments were conducted to assess the sorption capacities of the RF resin under varying conditions, including pH, contact time, and initial radiocobalt concentration. Kinetic and isotherm models are applied to analyse the adsorption mechanisms. Preliminary results indicate optimal sorption was achieved at pH 4, with a contact time of 30 minutes, an initial Co (II) concentration of 1 mM, and a temperature of 328 K. To assess the resin's radiation stability, samples of RF resin were subjected to varying doses (100–1000 kGy) of gamma radiation or electron beam to simulate conditions encountered in radioactive waste environments. Post-irradiation analyses were conducted to assess changes in chemical structure, mechanical properties, and radiocobalt sorption efficiency at optimum sorption conditions. Fourier-transform infrared spectroscopy (FTIR), electron paramagnetic resonance (EPR) spectroscopy and thermogravimetric analysis were employed to detect any chemical modifications within the resin matrix. Preliminary results indicate that RF resins maintain their structural integrity and sorption capacity up to a certain radiation dose threshold. These findings suggest that while RF resins are suitable for radiocobalt sorption in environments with moderate radiation levels, their application may be limited under high-dose conditions.

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