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Uranium recovery from liquid effluent using activated carbon-based waste packing materials as a simple process driven by the circular economy based liquid waste management

Radioactive wastewater acts as an extreme threat to human health as well as the ecological system. In tandem with the foreseen advancement in nuclear-related activities, uranium release into the environment will also increase. In this respect, investigating a simple process for uranium recovery from radioactive wastewater, driven by the aspects of the circular economy (CE), could assist in preventing the accumulation of this hazardous element into the environment and securing clean water, supplying uranium for low carbon nuclear energy (i.e., meeting the goals of the UN-SDG). Accordingly, active carbon-based waste packaging material has been applied for uranium recovery from liquid effluent generated during uranium ore processing. Active carbon (AC) was prepared from polyethylene terephthalate (PET) at pyrolysis temperatures (i.e., 500 oC) and compressed in well-defined designed molds to form a cylinder shape. Particle size, zeta potential, surface area, and topography of the prepared AC were analyzed. Kinetics, isotherm, and thermodynamics of the uranium recovery from wastewater were investigated by batch technique. The displayed data declare that the uranium sorption process using activated carbon sorbent obeyed to Pseudo-second-order kinetic model and Langmuir isotherm model. Nevertheless, it is worth noting that the sorption capacity of AC was about 39.0 mg/ g. The thermodynamic investigation found that the sorption process is endothermic, feasible, and spontaneous. The anticipated data reflects that the prepared activated carbon could be a promising and cost-effective technique for the efficient treatment of radioactive wastewater.

Primary author: Dr KHAWASSEK, Yasser (Nuclear Materials Authority)

Co-authors: MADY HUSSEIN, Ahmed (Nuclear Materials Authority); Dr TAHA, Mohamed (Nuclear Materials Authority)

Presenter: Dr KHAWASSEK, Yasser (Nuclear Materials Authority)

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