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ORIGINAL RESEARCH

Highly efficient recovery of bioactive ingredients from solid waste of onions onto functionalized SWCNTs supported on amberlite nanocomposite

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Abstract
Preparation of single-walled carbon nanotubes (SWCNTs) with carboxylic (–COOH) acid was executed by functionalization with amine functional groups ($–NH_2$). The obtained functionalized SWCNTs were supported by macroporous resin (amberlite XAD-7HP). The synthesized nanocomposite has been characterized by scanning electron microscopy (SEM) and Fourier transform infrared spectroscopy (FTIR) methods. FTIR analysis indicates that functionalized SWCNTs supported onto the amberlite resin were synthesized successfully. The surface morphology of the nanomaterial was also successfully embedded into the amberlite of the functionalized SWCNTs. Huge solid residues of onions are produced as agricultural and food wastes each year. The related biowaste includes biologically active phenolic compounds which have positive effects with strong antioxidant properties on human health when properly isolated and concentrated. In the present research, functionalized SWCNTs have been utilized for the separation of bioactive phenolics from onion waste extracts. Equilibrium (Langmuir, Freundlich and Toth) and kinetic (pseudo-first order, pseudo-second order, intraparticular diffusion and Elovich) models have been applied for analysis and representation of data. Pseudo-second-order model is in good agreement with the experimental data. On the other hand, the equilibrium findings were represented best with Freundlich isotherm model. Additionally, thermodynamic indicators have also demonstrated that the current system is a spontaneous and exothermic chemisorption process.

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