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Design of Black-Seed Pulp biomass-Derived New Bio-Sorbent by Combining Methods of Mineral Acids and High-Temperature for Arsenic Removal

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Abstract : Arsenic is known as a potential threat to the environment. Therefore, the aim of this research is to assess the arsenic removal efficiency from an aqueous solution, with a new biosorbent composed of a black seed pulp (BSP). To treat BSP, the combination of two methods (i.e. treating with mineral acids and use at high temperature) was used and designed bio-sorbent called BSP-activated/carbonized. The BSP-activated and BSP-carbonized were also prepared using HCL and 400°C temperature, respectively, to compare the results of each three methods. Followed by, adsorption parameters such as pH, initial ion concentration, biosorbent dosage, contact time, and temperature were assessed. It was found that the combination method has provided higher adsorption capacity so that up to ~99% arsenic removal was observed with BSP-activated/carbonized at pH of 7.0 and 40°C. The adsorption capacity for BSP-carbonized and BSP-activated were 87.92% (pH: 7, 60°C) and 78.50% (pH: 6, 90°C), respectively. Moreover, adsorption kinetics data indicated the best fit with the pseudo-second-order model. The maximum biosorption capacity, by the Langmuir isotherm model, was also recorded for BSP-activated/carbonized (53.47 mg/g). It is notable that arsenic adsorption on studied bio sorbents takes place as spontaneous and through chemisorption along with the endothermic nature of the biosorption process and reduction of random collision in the solid-liquid phase.

Keywords : black seed pulp, bio-sorbents, treatment of sorbents, adsorption isotherms
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