The cesium sorption characteristics of polysulfone carrier with the HNO_3 treated bamboo charcoal

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The cesium (Cs) is considered as a dangerous radionuclide for human health and ecosystem because it has a long half-life and likes to exist as a soluble form when it is exposed to the environments. The physico-chemical adsorption of Cs is one of the effective removal treatment processes from solution. In this study, polysulfone carrier with HNO_3 treated bamboo charcoal coated with two microorganisms (*Pseudomonas fluorescens* and *Bacillus drentensis*) were performed to remove Cs from water. Batch experiments for the Cs adsorption with different conditions was investigated to decide ideal adsorption conditions having the optimum Cs removal efficiency (adsorbent dosage, contact time, pH, temperature, and bamboo charcoal amount in the carrier). The 5% HNO_3 treated bamboo charcoal was produced according to the previous method [1]. After polysulfone carrier was added to Cs contaminated solution, it was stirred at 125 rpm and the room temperature for 1 hour and Cs concentration of the supernatant was analyzed on ICP/MASS to calculate the Cs removal efficiency. SEM/EDS analysis was also performed to visualize the structure of the polysulfone carrier and its compositional characteristics before/after the experiments. The Cs removal efficiency of polysulfone carrier having 5% HNO_3 treated bamboo charcoal (without coated micro organisms) was 83.9%. When the microorganisms coated polysulfone carrier was used, the Cs removal efficiency increase by additionaly 5% (average removal efficiency : 87.7%). Results of continuous column experiments showed that the polysulfone carrier coated with the microorganisms maintained more than 80% of Cs removal efficiency during 100 pore volumes flushing and the microorganisms may positively affect the Cs removal efficiency from water. SEM analysis of the polysulfone carrier after the adsorption experiment suggested that the bamboo charcoal carrier has complicated porous structures contributing well for the transfer of Cs to adsorption actives sites. The EDS result after the Cs adsorption also indicated that Cs was successfully adsorbed on the outer and inner space of the polysulfone carrier. From this study, the polysulfone carrier with HNO_3 treated bamboo charcoal is available to remove Cs from the contaminated water system under a wide range of pH and temperature conditions.

[1] Kim, I., Lee, M., and Wang, S. Heavy metal removal in groundwater originating from acid mine drainage using dead *Bacillus drentensis sp.* Immobilized in polysulfone polymer. J. Environ. Manag., 146, 2014, p.568-574.