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Study on the cesium removal efficiency of sludge generated from the coal mine drainage treatment in aqueous system

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In 2021, the nuclear power generation accounted for 34.1% of the total power generation of the South Korea. There exist worries about the potential for bring serious problems of radioactive contamination into surround environments such as soil, groundwater and surface water due to accidents around nuclear power plants and the radioactive waste storage site. Among radioactive byproducts originated from the nuclear power plant, cesium-137(Cs) has been known as one of the most dangerous radioactive materials because it has long half-life and has high water solubility. The adsorption has been considered as one of the most effective removal processes. But most of previous adsorbents have limitation on the usage in the large scale field operation because of the relatively high-cost and the low Cs removal efficiency.

Sludge as the byproduct after the acid mine drainage treatment for the coal mine was generated in the South Korea and they were classified as one of industrial wastes regardless of their composition and toxicity, and all of them were safely disposed in landfill sites without more recycling. Experimental studies have been performed to develop a new, more effective Cs adsorbent by using the sludge (coal mine drainage treated sludge: CMDS). Various Cs adsorption batch experiments were performed to evaluate the Cs removal capacity of the CMDS and the Cs adsorption characteristics on the CMDS were also investigated by the sorption isotherm model study. In order to increase the Cs adsorption capacity, the CMDS was improved by four different treatment processes including heat treatment and addition of three different chemicals. The physicochemical properties of the improved CMDSs were investigated to evaluate its potential as the Cs adsorbent.

From results of experiments, the Cs removal efficiency of the CMDS from water ranged 30–50% and the improved CMDSs showed more than 70% of Cs removal efficiency within 24 hour. The result of SEM-EDS revealed that the CMDS has the complicated porous structure and the Cs was successfully adsorbed on the outer and inner space of the CMDS. These results suggest that the CMDS has a great possibility as the practical adsorbent for Cs in aqueous system.