

As(III) Uptake by Mg-coated Coal Waste

BONGSU CHANG¹, SEON YONG LEE¹, BONG JU KIM¹ AND
YOUNG JAE LEE^{1*}

¹Department of Earth and Environmental Sciences,
Korea University, Seoul 02841, Korea
(*correspondence: youngjaelee@korea.ac.kr)

Arsenic (As) is a toxic chemical classified as Class 1 carcinogen by International Agency for Research on Cancer. More than 140 million people in 50 countries are suffering from arsenic contamination of groundwater. Although diverse sorbents have been developed and applied for reducing arsenic in aqueous solution, there are limitations in the field applications because of some difficulties such as permeability, mass production, and cost. As an alternative to overcome these issues, coal waste materials can be a candidate for a cost-effective sorbent in groundwater remediation system. In this work, granulated waste coals (GWCs) coated with magnesium (Mg) (hereafter is called Mg-GWCs) were used for As(III) uptake. Mg-GWCs were synthesized by a sequence of soaking-drying-calcination(in N₂)-washing-drying. Synthesized Mg-GWCs were characterized by XRD, SEM, XPS and FT-IR. XRD shows that the mineral phases of Mg-GWCs mainly consist of quartz and clay minerals such as chlorite and illite. As(III) uptake by the synthesized Mg-GWCs dramatically increases up to 84% with an initial concentration of As(III), 50 mg/L at pH 3.0. This corresponds to ~2.1 times higher than that of natural GWCs. SEM also shown that newly formed micro-scaled crystals were observed on the surface of Mg-GWCs after As(III) sorption. In addition, XPS revealed that As(III) is measured in the micro-crystals. These results suggest that As(III) is preferentially sorbed into the structure of the micro-crystals. Our findings indicate that As(III) sorption on the synthesized Mg-GWCs is effective and our synthesized materials, Mg-GWCs could be a useful sorbent for practical applications as a cost-effective material.