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Sorption and reaction kinetics of arsenate and arsenite from aqueous solution by waste cast iron

B. J Kim (1), k. H Cho (1), D. W Wi (1), N. C Choi (2), and C. Y Park (1)

(1) Energy and Resources Engineering, Chosun Univ, Republic Of Korea (nega6495@hanmail.net), (2) Engineering Research Institue, Chonnam National Univ, Republic Of Korea

The Sorption and reaction kinetics of As(III) and As(V) from aqueous solution was investigated using waste cast iron, which is a byproduct of the iron casting process in foundries. Two types of waste cast iron were used in the experiment: grind precipitate dust (GPD) and cast iron shot (CIS). The X-ray diffraction analysis indicated the presence of Fe0 on GPD and CIS. Non-equilibrium batch experiments were performed under different concentrations of As(III) and As(V) and in the absence/presence of PO4-3 for prevention of sorption effect. Results showed that waste cast iron was effective in the removal of As(III) and As(V). The removal parameter pattern indicated that the two-stage reduction pattern type (consists of fast reduction type (sorption and reaction) and limited slow (reaction) type) was better than the first order reduction pattern at describing the experimental result. In the reduction of both As(III) and As(V), the reduction capacity of GPD was greater than CIS, mainly due to the fact that GPD had higher surface area and weight percent of Fe than CIS. The results of reduction parameter estimation revealed that In the removal of As(III) and As(V) by GPD and CIS case, both GPD and CIS were more effective at the removal of sorption and reaction than reaction under given experimental conditions. This study demonstrates that waste cast iron has potential as a reactive material to treat wastewater and groundwater containing arsenic.