

Selenite sorption on magnesium oxide under the highly alkaline conditions

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Selenium occurs widely throughout nature. It is one of essential the elements for human, but it shows toxicity at degree to double of the necessary quantity. Selenium is environmental standard designation item.

After earthquake disaster, the contribution of the nuclear power generation in the electricity source of supply in Japan decrease, while that the thermal power generation increases. In coal-fired station, the selenium concentrations more than industry waste water regulation (100ppb) in the drainage has been reported to occur in a desulfurization processes of the gases which is generated during burnt coal (Central Research Institute of Electric Power Industry, 2005). The solutions used in the desulfurization processes is kept alkaline in order to facilitate the dissolution gases.

Selenium mainly exists as selenite($H_xSeO_4^{2-x}$, Se(VI)) or selenite($H_ySeO_3^{2-y}$, Se(IV)) in solution. Most of selenium exists as selenite in waste water in desulfurization process (Central Research Institute of Electric Power Industry, 2005). A general selenite removal method in the solution includes the adsorption on iron oxide. However, adsorption significantly decrease under the alkali condition because the surface charge of iron oxide become to minus at alkaline conditions (Fukushi, 2008). Therefore, the effective removal of selenite under the alkali condition is expected.

The anions of which oxygens coordinate to the center atom are called oxyanions. There are many oxyanions which cause the water pollutions, e.g., arsenite and borate. It is reported that magnesium oxide (MgO) has ability for the removals of arsenite and borate (Liu et al., 2011; Fuente and Eugenio, 2006). It can be expected that MgO has ability for removal for selenite in solution. MgO is metastable phase under the Earth surface environmental, and it transforms to brucite ($Mg(OH)_2$) in solution with time (Yabe et al., 2011). Liu et al., (2011) studied the removal of arsenite from solution by MgO with high surface area. They suggested that the transformation in solution is related to the uptake of arsenite, i.e., the sorption mechanism of arsenite on MgO under the high arsenite concentration condition is formation of an "arsenite-Mg compound" following transformation to $Mg(OH)_2$. Their study was conducted under the very high sorbate concentration (>1ppm) condition. There were no arguments about the mechanisms under the low concentration condition with sub-ppm order. The water pollution related to selenium mainly becomes problem with low concentration around the waste water standards (100ppm order). It is thought that understanding the sorption behavior in the low concentration condition is necessary. I conducted batch sorption experiments of selenite by MgO and magnesium hydroxide which is stable phase in this study to examine the selenite uptake behavior and mechanism on MgO.

Keywords: Selenite, Magnesium Oxide, Metastable Phase, Magnesium Hydroxide, Alkaline Conditions