

## **Coprecipitation and adsorption of Mn by Fe (hydr)oxides during limestone reaction in passive treatment facilities**

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Mn is not generally removed only via limestone reaction and oxidation in passive treatment facilities, but coprecipitation and adsorption by Fe (hydr)oxides help the decrease of Mn. In the 14 passive treatment facilities including SAPS in Korea, Mn decreased by 0.17 to 4.87 mg/L. Nevertheless, geochemical modeling by PHREEQC indicated that the effluents were undersaturated with Mn precipitates except for only one facility. This result suggests that decrease of Mn was induced by coprecipitation and adsorption of Mn by Fe (hydr)oxides rather than precipitation of Mn by pH increase and oxidation. Lab-scale experiments to simulate coprecipitation and adsorption of Mn by Fe (hydr)oxides were conducted by reacting synthetic mine drainages with various Mn and Fe concentrations with limestone in an aerobic condition. After raw water with ~3.5 mg/L of Mn and 7.8-90.7 mg/L of Fe reacted for 16.5 hr, the residual Mn concentrations and pH became 1.2-2.3 mg/L and 7.6±0.1, thus 1.1-2.3 mg/L was removed. Moreover, raw water with ~7.0 mg/L of Mn and 9.1-92.1 mg/L of Fe reacted with limestone for 14 hr, the residual Mn concentrations and pH became 3.2-4.7 mg/L and 7.9, thus 2.2-3.7 mg/L was removed. The higher the Fe concentration of the water samples from both experiments, the lower the Mn concentration of the treated water. Although it was saturated with MnOOH (manganite), the saturation index (SI) was lower even when the Fe concentration was higher, suggesting that the coprecipitation effect was large. Relationships between Fe concentration of the raw water and decrease of Mn concentration for the effect of coprecipitation and adsorption of Mn in passive treatment facilities were derived for 3.5 mg/L and 7.0 mg/L of Mn, respectively.