Removal mechanism of Mn(II) by coagulation-sedimentation method using calcium hydroxide

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Acid mine drainage (AMD) from abondoned/closed mines has been still one of the environmental problem in Japan, because it contains many harmful elements. Manganese (Mn) is generally contamintated to AMD. The most popular method to treat Mn is the coagulation-sedimentation method using calcium hydroxide as a neutralizer, but the removal mechanism has been not yet obvious.

The objective of this study is to clarify the removal mechanism of Mn(II) in neutralization process using calcium hydroxide. From the result of XRD, it was confirmed that β-MnOOH[1] was mainly precipitated after 10-minutes experiments. Thus, removal mechanism of Mn using calcium hydroxide was oxidation of Mn(II) to Mn(III) and precipitation as β-MnOOH. To investigate oxidation rate of Mn, XAFS analysis was done for precipitates after experiments. From results of XANES analysis, precipitate was combination of 75 % of Mn_3O_4 and 25 % of β-MnOOH after 5 minutes, whereas it was mostly β-MnOOH after 10 minutes. These results indicated that the oxidation of Mn(II) to Mn(III) was dependent on the reaction time.

A quantitative model was constructed by combination of first order oxidtaion rate of of Mn(II) and chemical equilibrium calculation. Oxidtation rate constant was obtained from experimental results and the constructed model could successfully represent all experimental results with different itinial concentration of Mn.

Not only oxidation/neutralization but also coagluation were important role of calcium hydoxide as neutralizer. Small granular size of calcium hydroxide with small amout of calcium carbonate was most efficient in Mn removal because of high reactivity and high aglomerating property.

[1] Peng & Ichinose(2011), *Advanced Functional Materials* **21**,2080-2087.