

## IMMOBILIZATION OF Co<sup>2+</sup> AND Sr<sup>2+</sup> ON LESSCRYSTALLIZED Mg-Al LAYERED DOUBLE HYDROXIDES (LDH)

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### Introduction

In order to remove radionuclides from nuclear waste waters, the approach using Zeolite, RO membrane, specific resin, and ferric hexacyanoferrate are currently employed in industrial application. These standard practice materials requires high cost and maintenance. From the point of cost performance and stability, layered double hydroxides (LDH) could be one of suitable and promising materials for waste storage. The chemical formula of LDH is given as  $[(M_1^{II})_{1-x}(M_2^{III})_x(OH)_2](A^{n-})_{x/n} \cdot mH_2O$ , where  $M_1^{II}$  is a divalent cation,  $M_2^{III}$  is a trivalent cation,  $A^{n-}$  represents an interlayer anion with valence  $n$ ,  $x$  corresponds to  $[M_2^{III}]/[M_1^{II}] + [M_2^{III}]$  ( $0.25 < x < 0.33$ ) (Brindley and Kikkawa, 1980; Miyata, 1983). Since positively charged metal layer of  $[(M_1^{II})_{1-x}(M_2^{III})_x(OH)_2]$  allows the interlayer incorporates anions in the structure, LDH has been widely investigated as sorbents for harmful anionic species [Goh et al., 2008]. On the other hand, there have been few studies that tried to examine the LDH efficiency as a sorbent for removal cations. Lazadiris study (2003) showed that LDH can be a promising material for removal of Ni, Pb, and Cd. In this study, less crystallized Mg-Al LDH produced by freeze drying method was used as a sorbent to immobilize Co<sup>2+</sup> and Sr<sup>2+</sup> from aqueous system. We report the characteristic property of the material and the efficacy for immobilization of Co<sup>2+</sup> and Sr<sup>2+</sup>.

### Methods

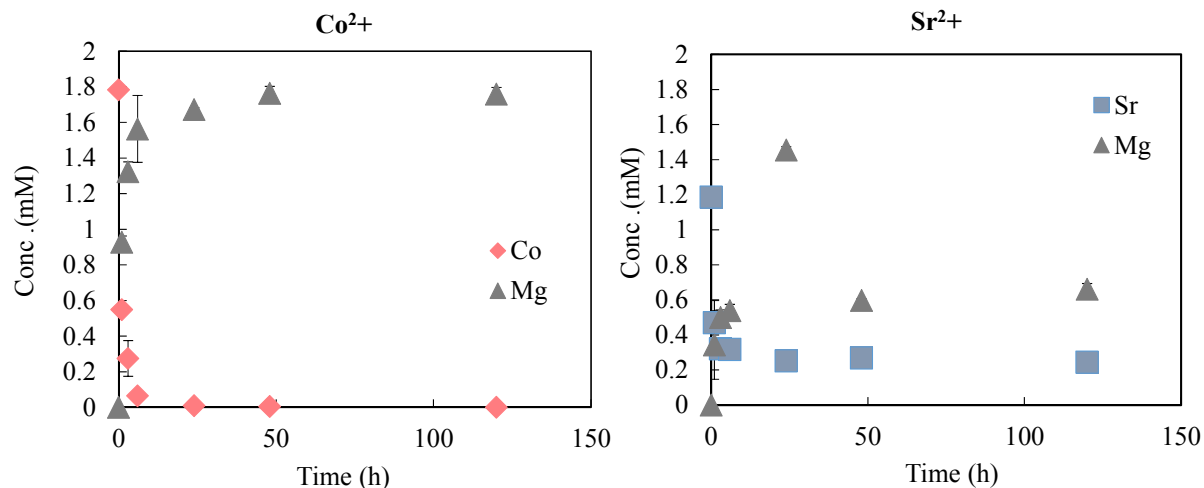
Mg-Al LDH was synthesized LDH with Mg/Al molar ratio of three was synthesized according to a previously reported co-precipitation method [Arco et al., 2003] using MgCl<sub>2</sub>·6H<sub>2</sub>O and AlCl<sub>3</sub>·9H<sub>2</sub>O. The obtained precipitates were filtrated and freeze dried by lyophilizer. The powdered sample was characterized by X-ray diffraction (XRD), Fourier transform infrared spectroscopy (FTIR), Raman spectroscopy, and electron microscopy (SEM and TEM). LDH was tested for their ability to immobilize Co<sup>2+</sup> and Sr<sup>2+</sup> from aqueous solutions. The sorption experiments were conducted by single batch test (Co<sup>2+</sup>/Sr<sup>2+</sup>) and binary batch test (Co<sup>2+</sup> and Sr<sup>2+</sup>). Moreover, the sorption capacities of LDHs prepared by freeze drying method and conventional drying method were compared.

### Results

XRD patterns matched well with that of magnesium aluminum hydroxide (JCPDS database; pattern number 00-046-0905), confirming that the LDHs were hydrotalcite-like compounds. LDH prepared by freeze drying method t exhibited smaller (nanosized) crystallites, had a lower degree of crystallinity than those of dried at 100°C. Figure 1 show the changes in Co<sup>2+</sup> and Sr<sup>2+</sup> during the single batch sorption (initial [Co<sup>2+</sup>]=1.78 mM, initial [Sr<sup>2+</sup>]=1.18 mM). Immobilized amount of Co<sup>2+</sup> and Sr<sup>2+</sup> on LDH in Figure 1 was 3.56 mmol/g for Co<sup>2+</sup> and 1.89 mmol/g for Sr<sup>2+</sup>, respectively. Released Mg<sup>2+</sup> appears to be the cause of ion-exchange with Co<sup>2+</sup>/Sr<sup>2+</sup>. Immobilization of Co<sup>2+</sup> was more favorable than Sr<sup>2+</sup> in single and binary sorption tests. XRD patters for the solid residues after immobilization of Co<sup>2+</sup>/Sr<sup>2+</sup> showed LDH structure was maintained.

## Conclusion

Until now, however, immobilization ability of LDH for cation species has not been investigated well. Our study shows that the potential for remediation of metal waste from aqueous solution. In particular, immobilization of  $\text{Co}^{2+}$  was more favorable than immobilization of  $\text{Sr}^{2+}$ .



**Figure 1.** Immobilization of  $\text{Co}^{2+}$  and  $\text{Sr}^{2+}$  on less crystallized Mg-Al LDH as a functional of constant time in single batch tests.

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