

## Application of Separation Technology to Waste Water Treatment

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### Abstract

We have various kinds of separation methods for aqueous solution, such as solvent extraction, ion exchange resin, adsorption method, etc. They are applicable to the treatment of waste water discharged in various industries. The important thing is how they can be combined for the suitable purpose.

Zeolite and hydrotalcite, which naturally exist or are synthesized by their low materials, have cation and anion exchange properties, respectively. From coal fly ash, zeolite P, HS (hydroxysodalite) and K-CHA (potassium-chabazite) are mainly formed as zeolite species in NaOH or KOH solution at 393K. The zeolite P and K-CHA have a large exchange capacity as a cation exchanger. On the other hand, hydrotalcite can be obtained by a co-precipitation method from the aluminum dross and the waste  $MgCl_2$  solution discharged in an aluminum regeneration process.

Zeolite synthesized from coal fly ash and hydrotalcite synthesized from aluminum dross were used for removal of heavy metal ions. The cation exchange isotherms of various monovalent and divalent cations with zeolites were investigated. The order of selectivity of the zeolites is as follows,  $NH_4^+ > K^+ > Li^+$ . For the divalent cation, the order of selectivity of zeolites in a low concentration is expressed in the following order;  $Pb^{2+} > Co^{2+} > Cd^{2+} > Ca^{2+} > Mg^{2+} > Ni^{2+}$ . The toxic metal ions were removed by hydrotalcite from aqueous solution according to the anion exchange reaction in the pH region where toxic metal ions exist as the anionic species like  $AsO_4^{3-}$ ,  $HAsO_4^{2-}$ ,  $CrO_4^{2-}$ , and  $SeO_3^{2-}$ . The exchange amount is concerned with the valence of anionic species and the size of anionic species. The removal of toxic metal ions were investigated from the engineering aspects such as the low concentration limit to be removed, the amount of hydrotalcite to be used for the perfect removal of toxic metal ions and so on.