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Phosphate uptake by monohydrocalcite

shintaro Yagi^{1*}

¹Kanazawa University

Abstract

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Shintaro Yagi

Introduction

Phosphate is nutrients for organism. Therefore, chemical fertilizer containing phosphate can significantly increases food productions. However, dissolved phosphate due to the fertilizer leads to eutrophication in hydrosphere environment and has much effect on ecological system in lakes. For that reason, it is necessity to remove the dissolved phosphate to avoid lake eutrophication. It is advisable to build up the removal technology of dissolved phosphate at a low price and efficiency (Schindler et al.2008). Moreover, in about half of the countries, economic phosphate resources currently will have been used up within a 60-70 years. Therefore, new development of phosphate resources is imperative for food production. Recovery of phosphates and reusing them as chemical fertilizer attracts attention in the world, because they can become brake-through for both the resource and environment problems (Kuroda .2005).

One of effective schemes for the removal of phosphate from discharged water is adsorption and coprecipitation by aluminum and iron oxides (Antelo et al.2005). However, the cost associated with the use of metal salts may hinder the widespread application. Besides, the product of the chemical immobilization is metal phosphate sludge, which is disposed with relatively high phosphate content, as the recovery of phosphate from sludge is very difficult (Karageorgiou, 2007). Consequently, the removal of phosphate compounds through sorption processes onto various sorbents other than metal oxides has been tested. Calcium carbonate minerals are abundant in nature. Their environmental loads are extremely small. Therefore, research has also been used as sorbent calcite and aragonite (Frank Millero, 2000). Calcite adsorbed-phosphate product is friendly to the environment , as it does not require further treatment for the phosphate species desorption. Therefore, it can reuse as fertilizer in acid soils. However, it is indicated the disadvantage that uptake of phosphate by calcite is inefficient when comparing that by metal salt method (Karageorgiou,2007).

Monohydrocalcite (CaCO₃·H₂O; MHC) has been known as a metastable phase of calcium carbonate minerals. It is rare mineral and has been found in saline lakes or seawater environment. It has been known that metastable phase has larger specific surface area and more reactive than stable phase (Fukushi and Sato, 2005). Because MHC is a metastable phase, it is expected that MHC is more efficiency for dissolved species uptake than calcite and aragonite. The object of this study is to investigate the uptake behavior of phosphate by MHC.

Keywords: monohydrocalcite, phosphate, sorption, magnesium