TOWARDS A SAFER ENVIRONMENT: 3) PHOSPHATIC CLAYS AS SOLUTION FOR REMOVING PB^{2+} FROM WASTEWATER

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Abstract

To immobilize the pollutants from wastewater in situ, two phosphatic clays collected from different areas in Egypt (eastern and western Sebaia, Aswan-Isna, Upper Egypt) used to remove contaminant ions from industrial wastewater. Obtained results confirmed the strong relationship between phosphatic clay and Pb elimination from wastewater. The sensitivity classification of phosphatic clay toward ions retained as described in three categories: highly sensitive to retain Pb , Al and Cr ; moderately sensitive for Mn; and weakly sensitive for B and Zn. Data suggested that large fraction of Pb removed by phosphatic clays stayed intact under a wide variation in extracting solution pH (3-11).

In situ immobilization is considered a promising technique that has the potential to remove contaminant ions from wastewater. Two important factors need to be considered when applying this technique: The first, is the clay must be effective and selective under different composition of wastewater. The second, is the immobilized ions should be stable and non-leacheable under varying water conditions. Phosphatic clays with Pb^{2+} were suitable to achieve these two factors.

Possible mechanism for removal Pb^{2+} by phosphatic clays is the formation of fluoropyromorphite through the dissolution of fluoro and hydroxyl apatite by its precipitation from solution, beside, Pb complexation at phosphatic clay surface at P-OH sites.

Keywords: contaminants Ion - Industrial wastewater - Phosphatic clays Pyromorphite – XRD.

1. INTRODUCTION

With growing population and increasing the living standards and growing concern for environmental issues, claims on water resources are intensifying. Competition between sectors is increasing and water allocation mechanisms currently in place- such as fixed allocations or rationing may no longer be adequate. At the World Water Forum 2000, an important international conference, the majority of the international water community called for reforms in water allocation mechanisms, especially in relation to agriculture. Worldwide, 70-80% of all developed water resources is used for agricultural production. In arid countries, where rainfall is insufficient for rainfed agriculture, this percentage reached to 90%. As such, reusing treated wastewater is necessary to utilize for different purposes.

The principal objective of wastewater treatment is generally to allow human and industrial effluents to be disposed without danger to human health or damage to the natural environment. Irrigation with wastewater is both disposal and utilization and indeed is an effective form of wastewater disposal. Methods to treat the ion contaminated

effluent are through precipitation, ion exchange and adsorption, etc., but the selection of the wastewater treatment methods is based on the concentration of waste and the cost of treatment, Yavuz et al.(2003) and mercier et al.(2002). In situ immobilization of metals using inexpensive sequestering agents, such as minerals (apatite or clay minerals) is an attractive alternative to many current remediation methods. The most common among these remediation minerals are apatite and zeolite. Phosphatic clay minerals form naturally and are stable across a wide range of geologic conditions Ma (1996). Phosphatic clay has been used primarily in association with remediation Pb-contaminated soils (Ma et al.(1995), singh et al.(2001), seaman et al.(2001) and Ryan et al.(2001). Therefore, the objectives of the current study are to:

1- Investigate the effectiveness of phosphatic clay in removing different contaminants from low quality water.

2- Evaluate the stability of formed solid phase under acidic and alkaline conditions.

3- Answer the question of what is the specific relationship between phosphatic clay and lead?

2. CONCLUSION

Phosphatic clays are extremely effective in removing Pb existed in wastewater. Approximately 95% of Pb was removed from wastewater representing a capacity of 1.9 mg/g. Obtained results suggest the sensitivity classification of phosphatic clays in relation to removing ions from wastewater into three main categories: highly sensitive to retain Pb , Al and Cr , moderately sensitive for Mn and weak sensitive for B and Zn. Although phosphatic clays eliminate many contaminant ions from wastewater, only one solid phase related to Pb is formed. The hydroxy fluoropyromorphite is formed through the dissolution of fluoro and hydroxyl apatite followed by its precipitation from solutions. In addition, Pb complexation at the phosphatic clay surfaces at P-OH sites which was proved via decreasing pH after removal of ions. The immobilized Pb stayed stable and not remobilized under wide variety of pH conditions ranging from3 to 11.

The obtained results imply that implementation of phosphatic clays could be a cost-effective option in the remediation of Pb from wastewater.

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