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Research on Purification of Attapulgite Clay and Adsorption Characteristics for Metal Cations

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Keywords: attapulgite clay; purification; alkaline treatment; acid treatment; cation-adsorption

Abstract. Attapulgite clay(ATP) from Xuyi county of China was purified by a wet method then treated with NaOH and 1.0 mol/L, 2.0 mol/L and 3.0 mol/L solutions of HCl. Transmission electron microscope(TEM) and X-ray diffraction (XRD) were used to characterize treated ATP. Results showed that wet purification could remove most of impurities. Treatment by alkaline and HCl of 1.0 mol/L and 2.0 mol/L could increase purity while treatment of 3.0 mol/L hydrochloric acid could dissolve some element of ATP so much as form SiO_2 and destroy fiber structure to clips. Adsorption experiments of Fe^{3+} and Ni^{2+} from aqueous solutions were done using original ATP, purified ATP and treated ATP as absorbents. Results showed that Attapulgite could adsorb metal cations in significant amounts. Sodium hydroxide activation had little influence on adsorption capacity. Influences of acid treatments to ATP on adsorption capacity varied on different concentration solutions.

1. Introduction

Attapulgite (ATP) is a hydrated magnesium silicate mineral and with a structure consisting of ribbons of layers and specific surface area. Applications of ATP were mostly co-effect with its attendant minerals. Because of different deposits, remove of attendant minerals can help research on ATP.

ATP can be used as adsorbent in decoloring of edible oil, remove of heavy metal cation and dye. E.Álvarez-Ayuso et al. [1] researched removement of Cd^{2+} by ATP. R.A. Alvarez-Puebla et al. [2] reported process of Cu^{2+} heterogeneous nucleation on surface of ATP. According to the results, $CuCl_2$ formed non-crystal and then nucleus to hydroxy-copper chloride crystal. Jian-Liang Cao et al. [3] loaded CuO on surface of ATP to adsorb CO and compared with other adsorbent. Ahmed Al-Futaisi et al. [4] researched adsorption of methylene blue and crystal violet on ATP. Research of purification and activation of ATP can instruct application of ATP.

In this paper, ATP treated by purification, sodium hydroxide activation and hydrochloric acid activation were characterized by TEM and XRD. Then adsorption capacity of Fe^{3+} and Ni^{2+} on ATP of treatments were studied and their mechanics were concerned.

2. Experimental

2.1. Purification

Attapulgite clay (referred to as ATP, following the same) from Xuyi (Jiangsu, China) was