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# EVALUATION OF WHITE BENTONITE MODIFIED BY ACID ATTACK

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## Abstract

For industrial use, the smectite clays must be cleared of impurities, usually obtained by acid modification, using a high concentration solution of inorganic acid at temperatures under boiling point. In the present paper, a sample of white bentonite from Paraiba, Brazil, was modified by hydrochloric acid under moderate conditions (90°C, reaction times of 1, 6, 12, 18 and 24hours in close reactor, concentration of the aqueous solution of hydrochloric acid 1.5 M, acid solution/clay ratio of 1g/10mL). The purpose of these attacks is to reduce the concentration of impurities with minimal change in the clay minerals structure. The modified samples were characterized by X-ray diffraction (XRD), X-ray fluorescence (XRF), Cation Exchange Capacity (CEC), Stereomicroscopy, Scanning Electron Microscopy (SEM) and Energy Dispersive X-ray Detector (EDS). Thus, this modified bentonite tends to be a good economic and environmental alternative in manufacturing of products with high added value such as cosmetics and polymer/clay nanocomposites.

## Introduction

The brazilian white bentonite from Paraiba is a smectite clay with non-preponderate interlayer cation and low iron concentration [1].
The classification of bentonites is determinate according the geologic origin of clay, but if the smectite clays presents the same properties of traditional bentonites and/or is commercialized to the same use, those clays, by a common agreement, can be classified as bentonites, which presents similar properties such as colloidal material, absolving capacity and activation capacity with high grades [2-5].
Among the bentonites for industrial use, exist those with highly water absorption and non-water absorption. The sodium interlayer is responsible for the capacity of bentonites absorption instead those not, have calcium as a preponderate cation [6,7].
The industrial application of bentonites is vast, mostly used in oil industry as drilling fluids, in pharmaceutic and cosmetics as dissecant, in the food industry as oil bleaching, among others applications. For those applications, bentonites needs to be clean of mineral impurities. Acid attack is a common method that provides a specific area increased by structure disorganization, mesopores and mineral impurities cleaning. Other benefit of acid attack is improving of acid sites with more porosity, excellent properties when apply in catalysis [8-13].

Modified clays with organic acid with high concentrations have being studied by several groups, aiming clays bleaching e purifying, for posterior use mostly in bleaching process or oil, grease and organic, minerals and animals fat. The industrial use for clays is also based on exchangeable cations and clay minerals properties [14-16].
The economic advantages over imported clays used in processes to obtain products with high value as cosmetics and nanocomposites justify the studies aiming to demonstrate that the white bentonite modified by moderated acid attack tends to be a good alternative to material raw.

## Materials and Methods

### Start Materials

The white bentonite, in its natural form, was from Paraíba´s State, Brazil was submitted to mild acid attack using a concentration of the aqueous solution of hydrochloric acid 1.5 M, clay/acid solution ratio of 1g/10mL, at 90°C under bellow boiling temperature and at short times of reaction 1, 6, 12, 18 and 24 hours in close reactor.
The attacked clay was washed, by filtration, with distilled water until pH 7-8, and then subjected to drying at 60°C for 24 hours.
After drying, the clay was grounded using a manual mortar and vibratory ball mill until completely pass through #200 mesh sieve.

### Materials Characterization

The modified samples were characterized by X-ray diffraction (XRD), X-ray fluorescence (XRF), Cation Exchange Capacity (CEC), Stereomicroscopy, Scanning Electron Microscopy (SEM) and Energy Dispersive X-ray Detector (EDS).
The XRD was performed on diffractometer model X'Pert Pro MPD (Panalytical) with Cu anodes; scan from 5° to 90° 2Θ; 40kV and 40mA.
The scanning electron microscopy (SEM) and energy dispersive X-ray detector (EDS) were performed on scanning electron microscopy, Philips - EDAX INSPECT 50 with energy dispersive x-ray detector (EDS).
To observe the clay was used a stereomicroscopy Zeiss, model Stemi 2000C.
CEC was performed using the ammonium acetate method.
The XRF was performed on X-ray fluorescence spectrometer Panalytical model Axios Advenced with loss on ignition.

## Results and Discussion

The intensity of the smectitic $d_{(001)}$ peak tend to diminish its intensity with the time of attack as the acid have more time to destroy the octahedral sheet of the clay mineral. The increase of the quartz peak with the time of acid attack is a possible indicative of the dissolution of part of the clay minerals. It was verified that the clays submitted to mild acid attack during long times presented more bleaching than others.
Table 1 presents the interplanar distance of the $d_{(001)}$ smectite peaks for white bentonite samples attacked for different times and its intensities. The table shows also the intensities of the quartz peaks at 3,33Å.