CLARIFICATION OF COTTONSEED OIL: HOW STRUCTURAL PROPERTIES OF TREATED BENTONITES BY ACID AFFECT BLEACHING EFFICIENCY

E.L. FOLETTO[1], C. VOLZONE[2] and L.M. PORTO[3]

[1] *Chemical Engineering Department, Federal Universtiy of Santa Maria, 97150-900, Santa Maria,RS, Brazil.*
foletto@smail.ufsm.br
[2] *Centro de Tecnología de Recursos Minerales y Cerámica, CETMIC (CIC-CONICET), CC.49, (1897) M.B. Gonnet, Prov. Buenos Aires, Argentina*
[3] *Chemical and Food Engineering Departament, Federal University of Santa Catarina, 88040-900, Florianópolis, SC, Brazil*

Abstract – **Natural occurring bentonites may show very little activity for bleaching oils and fats. For that reason, acid-activation of bentonites with inorganic acids is usually carried out to promote earths' adsorptive capacity during clarification of vegetable and animal oils and fats, as well as mineral oils. In this work we used two acid-activated natural bentonites from Mendoza, Argentina, with different mineral compositions and submitted them to acid treatment with hydrochloric acid to further clarify cottonseed oil. Both clays were treated with HCl at 4 and 8*N* for two hours in order to evaluate important structural properties modifications that may affect oil bleaching. X-ray diffraction, thermal and chemical composition analyses were performed. Cottonseed oil clarification experiments were run in previously established appropriated laboratory conditions. It was shown that clarification efficiency is strongly dependent on the acid concentration and natural clay mineral compositions used to activate the bentonites for the clarification process.**

Keywords – **Oil clarification, acid-activated clay, bleaching of vegetable oil.**

I. INTRODUCTION

Bleaching is an important step in the refining of fats and vegetable/animal oils for industrial applications. In edible oil processing, bleaching is responsible for a clarified oil that is more stable and also more attractive to the consumer. Clarification is usually performed by an adsorption process which preferentially uses acid-treated clays to remove undesirable oil components. Bleaching primarily removes coloring pigments such as chlorophylls and carotenes but peroxides and other impurities (*e.g.* soap, trace prooxidant metals and phosphatides) are also important targets of the bleaching process. Such light-colored oil influences consumers' preferences but are also beneficial for quality and stability (Proctor and Palaniappan, 1989).

Adsorbent earths used for clarification are bentonite clays with high montmorillonite content. In their natural state they show very low decolorizing effect; however, when treated with strong inorganic acids, particularly with hydrochloric and sulfuric, they develop a high clarification power. Hydrogen ions from the acid attack the aluminosilicate layers via the interlayer region (Taylor and Jenkins, 1987). It is believed that the increased clay adsorption capacity results from this process that alters the structure, chemical composition, and physical properties of the clay (Mokaya *et al*., 1993).

Several acid treatment experiments under different operating conditions have been reported in the literature, in particular the choice of inorganic acid used, treatment time, and temperature (Hassan and A.-Khalek, 1998, Foletto *et al*., 2003, González-Pradas *et al*., 2005, Nguetnkam *et al*., 2005, Tyagi *et al*., 2005). Earth original mineral composition has, of course, a decisive effect on clay bleaching properties, but it with worth noticing that impurity levels are also critical in establishing the quality of the material produced by the acid-activation treatment with respect to its clarification capacity.

In this work, we report structural properties modification of two natural bentonites promoted by HCl treatment and how they affect structural parameters and consequently bleaching clay efficiency for the clarification of cottonseed oil.

II. MATERIALS AND METHODS

Two natural clays from the Mendoza Province, Argentina (identified here as K and W samples) were taken as starting materials. Samples of K and W earths have been characterized as described elsewhere (Foletto *et al*., 2000). Table 1 reports mineralogical composition of the studied clays. Major phases detected include smectite, quartz and feldspat in sample K, and smectite, quartz, feldspat, caulinite and gypsum in sample W, in that order of occurrence. According to these results, bentonite W is richer in clay components (smectite + caulinite) (49.5%) than bentonite K (35%). It also contains less impurities, 50.5% (quartz, feldspat, gypsum and others) when compared to sample K (65% of quartz, feldspat and others).

Dried earth samples were crushed to 200 mesh; 40 g of each sample were added to 400 mL of hydrochloric acid 4 and 8 *N* under mechanical stirring. Acid treat-