

BLEACHING PERFORMANCE OF A NIGERIAN (YOLA) BENTONITE

O.O. JAMES[†], M.A. MESUBI[†], F.A. ADEKOLA[‡], E.O. ODEBUNMI[‡], J.I.D. ADEKEYE^{††} and R.B. BALE^{††}

[†]*Dept. of Chemistry, College of Science and Technology Covenant University, Ota, Nigeria.*

[‡]*Dept. of Chemistry, University of Ilorin, Ilorin, Nigeria.*

^{††}*Dept. of Geology & Mineral Sciences, University of Ilorin, Ilorin, Nigeria.*

Abstract— The bleaching performance of raw and acid activated Yola montmorillonite clay was studied. The bleaching performance was enhanced upon activation. The predominant active sites on the raw clay are Lewis acid sites, those on the improved clay are Bronsted acid sites. The best bleaching performance was obtained with clay sample activated with 5M H₂SO₄ at acid/clay ratio 0.7, bleaching temperature of 120°C and at 10 minute stirring time. At these conditions the improved clay compares favorably well in terms of bleaching performance with the imported industrial standard sample. Thus, it could be a local substitute for the industrial standard.

Keywords— Bentonite, bleaching, adsorption, β -carotene, palm oil, clay activation.

I. INTRODUCTION

The unique properties of bentonite clay materials had made them valuable in many important industrial applications. These properties include thixotropic, swelling and adsorption. They constitute a peculiar and important group in the field of clay minerals. Application areas include edible oils, fats, industrial oils, soaps, cosmetics, pharmaceuticals, catalysts, paints etc (Takada *et al.*, 1995; Velde 1992; Dear *et al.*, 1989; Ross and Hendericks 1945; Ulrich *et al.*, 1935). This commercial value of bentonite accounted for the large scale mining and exploitations of bentonite deposits at various locations around the globe (Slabaugh and Anne Hiltner 1969; Wander and Haydn, 2004).

In Nigeria, bentonite deposits had been found in different part of the country. An estimated reserve of about 700 million tones had been indicated in the north eastern (black cotton soil) part of Nigeria. These areas comprise of Borno, Yola, Adamawa and Taraba state (RMRDC 1990, 1991; Aribisala 1993). This large bentonite reserve awaits commercial exploration for its various uses, most especially as drilling fluid in the oil industry. However, results from earlier studies revealed that Yola bentonite is a low-grade calcium montmorillonite. It was found unsuitable for drilling fluid applications, even on treatment with sodium salts (James, 2005).

It had been widely reported that acid activated montmorillonite clays have, in particular proved supe-

rior to other clay minerals for removal by adsorption of chlorophyll and other trace pigment from edible oils. And thus remains the principal class of bleaching clay in the oil refining industry (Alexanian 1939; Guillaumin and Pertiniost 1968; Mokoya and Jones, 1993). The acid activation enhances the properties of the montmorillonite by manipulating its physical and chemical properties without destroying its layered crystal structure. Thus the acid activation must be optimized in order to enhance the properties that are responsible for the pigments adsorptions.

It is therefore of interest to establish the best conditions for acid activation of Yola bentonite (acid /clay ratio, acid concentration and the bleaching temperature).

II. MATERIALS AND METHODS

A. Clay activation

Samples of Yola montmorillonite clay were obtained from four locations of the deposit base on nearness to major settlements. The sample lumps were crushed and air dried, grounded and sieved with 150 μ m mesh size. The samples were first treated with H₂SO₄ solution at a chosen concentration of 5M and acid/clay ratio of 0.4. The treatment was carried out as follows: 10 cm³ of 5M H₂SO₄ solution was added to 25g clay sample suspended in 125 cm³ of water. This recipe is equivalent to 20 %($\frac{w}{v}$) clay suspension and 0.4 acid (volume)/clay (mass) ratio. The mixture was maintained at a temperature of 95°C for 3hrs. The resulting mixture was filtered, washed with hot distilled water and air dried. The dried clay was then grounded into fine powder and used to bleach a standard palm oil sample obtained from Global Soap & Detergent Industries, Ilorin.

The effect of variation of the acid/clay ratio on the bleaching performance was examined by varying the volume of the acid solution added in the activation recipe. The acid/clay ratio or acid volume (cm³) examined include: 0.1 (2.5); 0.2 (5.0); 0.3 (7.5); 0.4 (10.0); 0.5 (12.5); 0.7 (17.5); 0.9 (22.5); 1.2 (27.5); 1.5 (37.5) and 2.0 (50.0)

B. Bleaching of palm-oil

The bleaching process was carried out by adding 10g of a sample 100cm³ palm oil at 105°C. The mixture was stirred for a chosen time of time minute, and then filtered to separate the bleached oil from the clay.

The sample with the best performance was used to study the effect of varying stirring time on the bleaching performance.

* jamesoladele2003@yahoo.com, Author to whom all correspondence should be addressed.