NIGERIAN JOURNAL OF MATERIALS SCIENCE AND ENGINEERING
NJMSE
ISSN 214-453-2

BLEACHING OF ATILI (BLACKDATE) OIL FOR USE AS WHITE OIL

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ABSTRACT
Atili (blackdate) oil was bleached in this research using three different adsorbents; acidic fuller's earth, activated carbon, and the mixture of fuller's earth and activated carbon. The adsorbents were compared to give the most suitable of the three. The bleaching process was carried out by agitation of varying amounts of the different adsorbents at 80°C and a contact time of 45mins. The bleaching data were fitted to Langmuir and Freundlich isotherms; bleaching with fuller's earth gave good fits to both. Fuller's earth was observed to be most suitable for bleaching of Atili (blackdate) oil, giving a colour removal of 88.25%, which was followed by activated carbon with a colour removal of 85.95% and lastly the mixture, with colour removal of 85.34% all with 2g of adsorbent. Finally, photometric colour was determined as the average absorbance between 420 and 800 nm.

Keywords: *Atili, oil, bleaching, adsorbent, white*

1.0 INTRODUCTION

White oils are highly refined mineral or vegetable oils which are designed for use in various industrial products and applications (Product Data Sheet, 2009). They offer the following advantages or benefits: Water-white colour, non-staining, odour free, non-reactive and low aromatic content suitable for direct and indirect food contact applications (Product Data Sheet, 2009). White oils are used in pharmaceutical formulations as processing aids and in many cosmetic products (Miller, et al 2006). Bleaching or purifying edible oils by adsorption involves not only the removal of the color, but also removal of minor constituents. During the bleaching of vegetable oils peroxides are degraded and removed, traces of soap and a portion of Cu and Fe are removed, traces of phospholipids are adsorbed, the resistance of oil to rancidity is reduced and partial hydrolysis of the oil takes place (Salma, et al 2003). The selective adsorption of pigments from oils and fats on clay or carbon, specially chosen and activated for specific effects is the source of the description ''bleaching''. Activated carbon is a highly porous, amorphous solid consisting of micro crystallites with a graphite lattice, usually prepared in small pellets or a powder. It is non-polar and cheap. One of its main drawbacks is that it is combustible (Wikipedia.org, 2010). Fuller's earth is a variety of clay that has high capacity for adsorbing basic colors and can remove these colors from solution in animal, vegetable, or mineral oils, as well as from some other liquids, especially water. It is valuable when its adsorptive powers are strong enough to permit it to compete actively with fuller's earth already accepted as of standard quality for refining oils (en.wikipedia.org, 2010). The Atili (Blackdate) oil used as a potential source of white oil in this experiment was obtained from the Atili (Blackdate) fruit. The fruit is commonly found in large quantities in Pankshin, Plateau State of Nigeria and is also produced in similar quantity in other states of northern and southeastern Nigeria (Agu, et al 2008). Bleaching of Atili (Blackdate) oil was studied in this work with a view to stimulating large scale production of white oil from atili.

2.0 MATERIALS AND METHODS

The Atili (Blackdate) oil used in this work was procured from Bauchi Road Motor Park Jos-Plateau State, Nigeria. Ultraviolet (UV) spectrophotometric analysis was carried out on the raw unbleached Atili oil. This was done using distilled water as blank between the wavelengths of 420-800nm at intervals of 20. 20mls of Atili oil was bleached by agitation with 1g, 1.5g.1.8g, 2.0g, and 2.5g of fuller's earth, activated carbon and a mixture of both in turn for 45mins and at 80^0C. After each run, the samples were filtered and the filtrate taken for spectrophotometric analysis to obtain the photometric colour. The results are shown in Figures 1 to 4. The colour of the bleached and unbleached oils were obtained by determining the area under their respective absorbance vs. wavelength curves (by Simpson's 1/3 rule) (wikipedia.org, 2010) and dividing by the difference between the largest and smallest wavelength from which the absorbances were taken. The bleaching data were fitted to Freundlich and Langmuir isotherms.

3.0 RESULTS AND DISCUSSION

From the curves obtained from the absorbance vs. wavelength of varying weight of adsorbents as seen in Figures 1 to 4, bleaching was observed to have taken place as seen in the gap between the unbleached and bleached curves. Bleaching was most effective with 2.5g of adsorbent which lies at the base of the plot in Figure 2. Bleaching also increased with increasing weight of adsorbent as is seen in the curves which lie on the one next to it progressively which is in line with literature (Perry, 2005). Figure 3 shows bleaching with activated carbon, it was observed that bleaching took place as seen in the gap between the unbleached and bleached curve. Bleaching was most effective with 1.8g, 2.0g and 2.5g adsorbent as seen in their curves which lie closer to the base of the plot. Bleaching did not take place uniformly with increasing adsorbent as seen in the scattered curves for increasing weight of adsorbents. This may be as a result of error in filtration (Perry, 2005). Figure 4 shows bleaching with a mixture of fuller's earth and activated carbon.

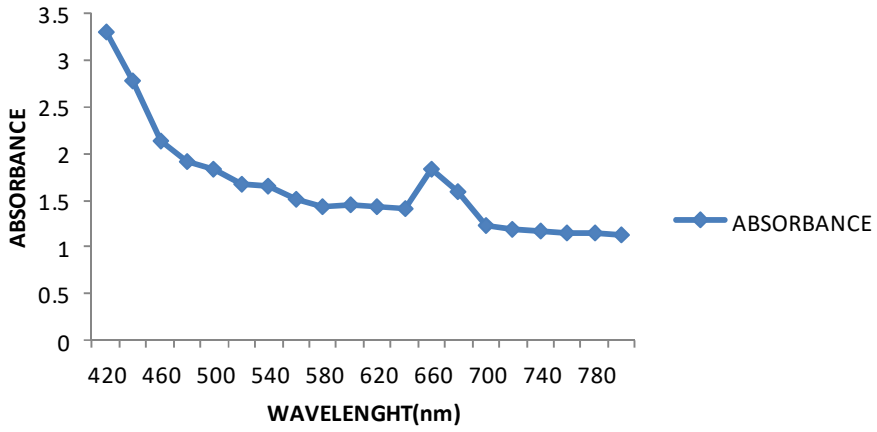

Figure 1. Determination of wavelength of maximum absorbance using unbleached Atili oil

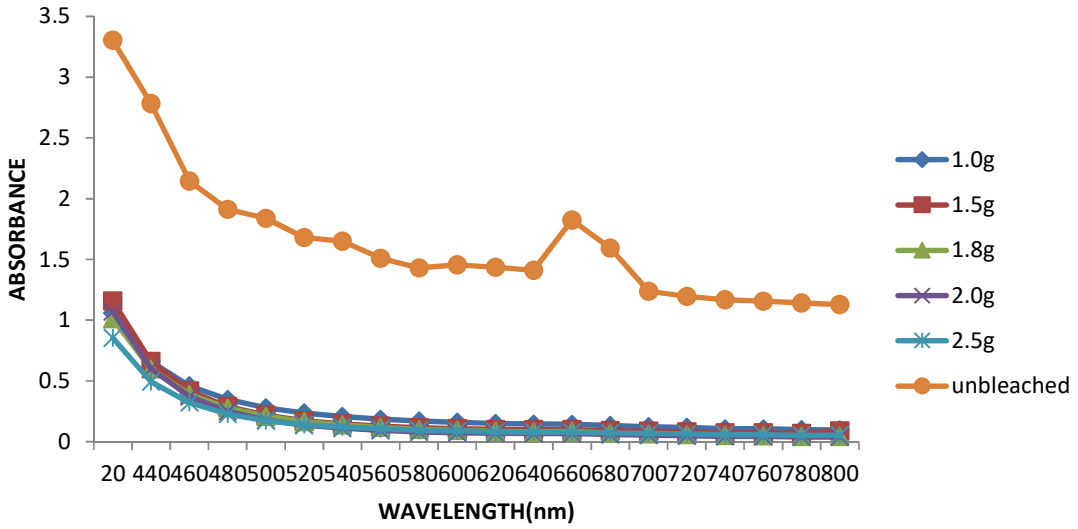

Figure 2 Absorbance with varying weight of Fuller's earth

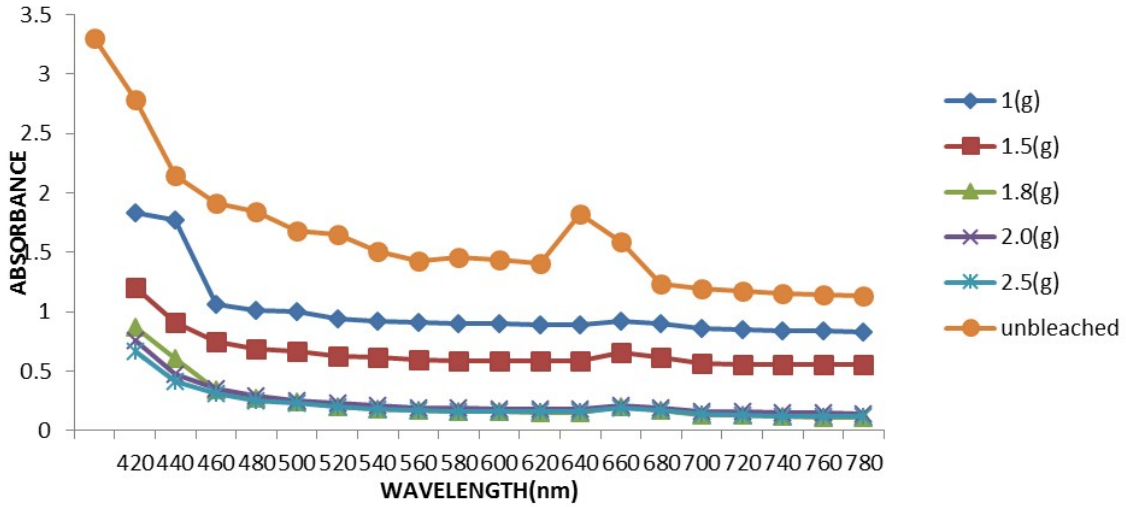

Figure 3 Absorbance with varying weight of Activated carbon

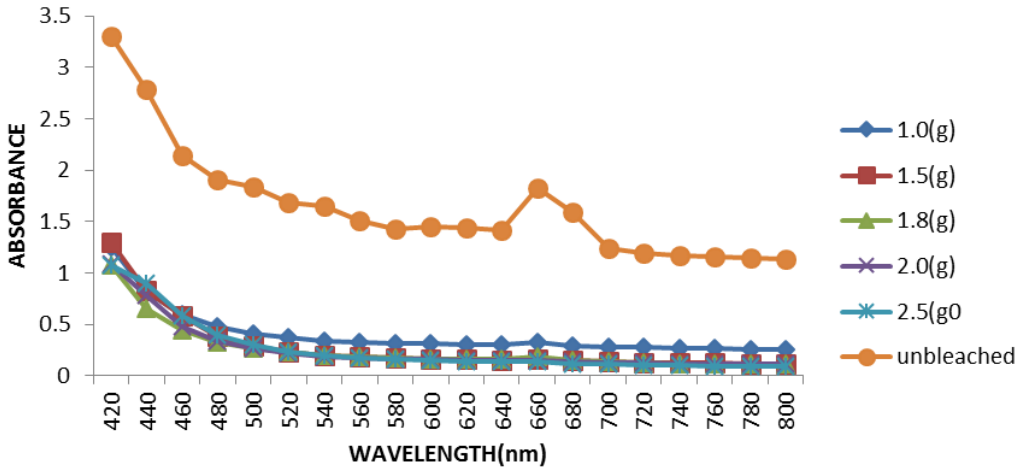

Figure 4 Absorbance with varying weight of the mixture of Fuller's earth and Activated carbon

It was observed that bleaching took place in the gap shown between the unbleached and bleached curves. Bleaching was most effective with 2.5g of adsorbent as seen in curve which lies at the base of the plot. Bleaching increased with increasing weight of adsorbent as seen in the curves which lie on the one next to it progressively as predicted by Literature (Perry, 2005). For the Freundlich isotherm: The adsorbate adsorbed per unit weight of adsorbent was plotted as a function of the concentration of adsorbate remaining after the bleaching process. From the plot in Figure 5 it was seen that the bleaching with fuller's earth gave a better fit of 0.9 for the Freundlich isotherm compared to the bleaching with activated carbon which gave a fit of 0.687 (Figure 6). The failure of activated carbon and the mixture of fuller's earth and activated carbon (Figures 6 and 7) to fit the Freundlich isotherm does not necessarily mean that bleaching did not take place using these adsorbents. For the Langmuir isotherm: The reciprocal of the adsorbate adsorbed per unit weight of adsorbent was plotted as a function of the reciprocal of the concentration of adsorbate remaining. From Figure 7 it was seen that the plot for fuller's earth gave a better fit of 0.894 for the Langmuir isotherm compared to the fit for the mixture of fuller's earth and activated carbon which gave 0.881 (Figure 8).The failure of activated carbon and the mixture to fit the Langmuir isotherm may be the result of varying temperature or error in filtration resulting to failure of the removal of colour to be in direct proportion to the amount of adsorbent added. From the isotherm data in the figures, it was observed that colour was removed from the oil as seen in the x values which gave the percentage of colour removed. It was also observed that to a great extent, as the amount of adsorbent increased the amount of colour removal also increased as seen in Figures 2-4.

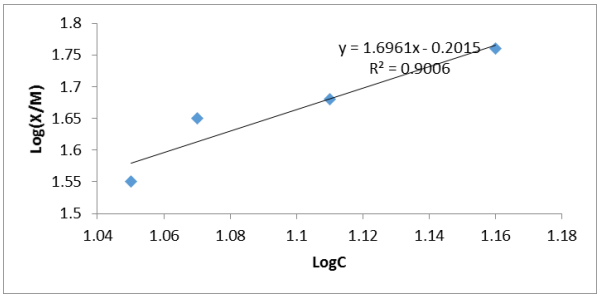

Figure 5 Freundlich isotherm for bleaching with fuller's earth

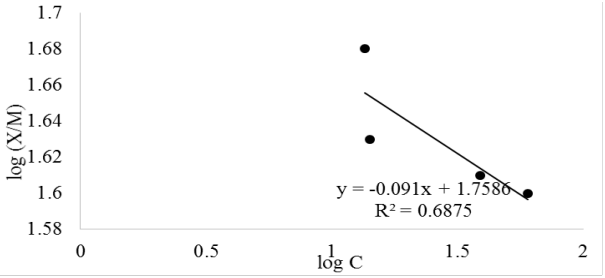

Figure 6 Freundlich isotherm for bleaching with activated carbon

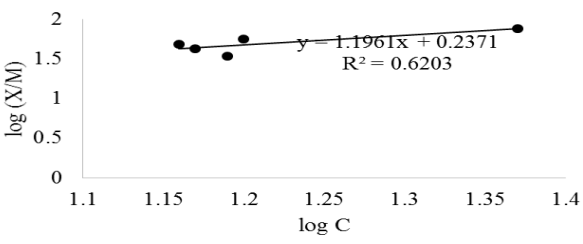

Figure 7 Freundlich isotherm for bleaching with a mixture of Fullers earth and Activated carbon

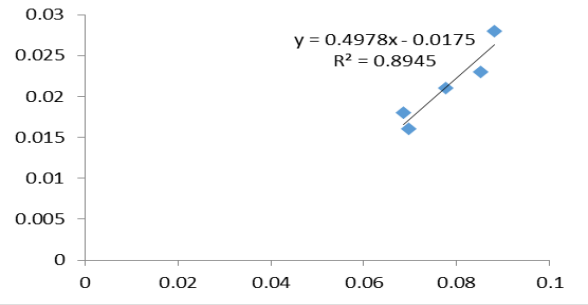

Figure 8 Langmuir isotherm for bleaching with fuller's earth

From the isotherm data in the figures, it was observed that when 2.0g of fuller's earth was used in the bleaching process, 88.25% of colour was removed whereas 85.95% of colour was removed with 2.0g of activated carbon and 85.34% with 2.0g of the mixture of fuller's earth and activated carbon. Fuller's earth was therefore seen to give the best colour removal.

4.0 CONCLUSIONS

The following conclusions can be drawn from the bleaching of Atili (blackdate) oil using fuller's earth, activated carbon and a mixture of fuller's earth and activated carbon: 1) The suitable wavelength for maximum absorbance of Atili oil is 660nm, 2) Colour removal was observed with all three adsorbents as seen in the X values which give the percentage of colour removed, 3) Fuller's earth was found to be the most effective adsorbent with colour removal of 88.25% with 2.0g of the adsorbent, second to it is activated carbon with colour removal of 85.95% and lastly the mixture of fuller's earth and activated carbon with colour removal of 85.34% all with 2.0g of respective adsorbent, 4) Colour removal increased progressively as the weight of adsorbent increased as seen in Figure 2 where colour removal increased from 76.59% to 84.03% for an increase in adsorbent from 1g-1.5g for bleaching with fullers earth, 5) The bleaching process with fuller's earth was found to obey the Freundlich and Langmuir isotherms with a fit of 0.9 and 0.894 respectively.

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