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Soap making potential of palm kernel oil

OKPALA TOCHUKWU VINCENT
LECTURER III , DEPARTMENT OF CHEMICAL ENGINEERING TECHNOLOGY, FEDERAL POLYTECHNIC OKO, ANAMBRA STATE, NIGERIA
EMAIL - tovino15yahoo.com

Abstract: *The quality of palm kernel oil was determined to know how suitable that palm kernel oil will be if employed to make soap. Soxhlet extraction method was used to extract oil from ground palm kernel and the physicochemical properties of the extracted oil were determined. The physicochemical properties are used to know the quality of the palm kernel oil. The result gotten showed 463.77 mgKOH/g, 14.21 I_2/100g, 5.05 mgKOH/g for saponification value, iodine value and acid value respectively. The values gotten are perfect and favours the production of good quality soap. Therefore palm kernel oil has the properties that makes it suitable for making soap.*

Keywords*: Palm kernel oil, Soap making, Saponification value, Iodine value, Acid value.*

1. INTRODUCTION:

Fats and oils are one of the key ingredients in the manufacture of soap. Fats and oils can react with caustic alkali to produce soap in a process called saponification (Ababio, 2005). This shows that fats and oils are in high demand for the production of soap since soap is needed by everybody for domestic purposes (washing, bathing etc) and it is also used for other industrial purposes. Fats and oils are extracted from plant and animal sources like palm fruit, melon seed, peanut seed, coconut seed, grape seed, sesame seed, beef, pork, fish etc.

Different fats and oils have the qualities that make them suitable for making soap ;such fats and oils used for making soap include palm oil, coconut oil, olive oil etc. But there are also fats and oils that are not suitable for making soap. Since fats and oils are in high demand for making soap, there is need to know whether fats and oils from various plant and animal sources will have the qualities that will make them suitable for making soap.

Palm kernel oil which is produced from the oil palm tree is available since oil palm tree is grown in some parts of Nigeria, therefore it is important to know if its quality is enough to be employed in making soap. Different studies have been done to know the quality of different oils like onion seed oil, jathropha curcas seed oil, sesame seed oil etc. (Senchi & Elinge, 2020; Ifijen & Nkwo, 2020) to check if the quality of the oil is suitable for industrial applications and soap making. There is therefore need to check if the quality of palm kernel oil meets the requirement of the perfect oil for making soap. This quality is assessed by measuring its saponification value, iodine value and acid value.

This research paper aims to support the hypothesis that palm kernel oil is good for making soap. This is achieved by measuring the physicochemical properties of the palm kernel oil like saponification value, iodine value and acid value.

2. LITERATURE REVIEW:

Different researches have been done to know the quality of different fats and oils, some studies even produced soaps with the oil to ascertain the soap's quality. A study just measured the physicochemical properties of an oil and its fatty acid content (Tsado, et al., 2018). Tsado et al.(2018) extracted oil from the seed, aril and pod of the blighia sapida fruit(ackee fruit), they measured the physicochemical properties and they also found the fatty acid composition of the oil. They found out from their study that only the oil from the aril and the oil from the pod of the blighia sapida fruit can be good for purposes like soap production.

In the work of Oguntibeju et al. (2010) where they measured the physicochemical properties of palm oil from different palm oil local factories in Nigeria. This palm oil was extracted from the reddish pulp of the fruit of the oil palm tree in different Nigerian palm oil local factories. Their work showed from the property of palm oil that palm oil is suitable if employed to make soap. Okpala (2021) checked the physicochemical properties of melon seed oil to know

its suitability for making soap. From the research , he found out that melon seed oil has properties that are suitable for making soap.

Senchi & Elinge (2021) produced good quality soap from onion seed oil which they extracted using soxhlet oil extraction method. They measured the physicochemical properties of the onion seed oil and later went on to produce soap using the onion seed oil. Senchi & Elinge (2021) found out from their research that onion seed oil can be used in soap production because of the good properties of the oil and the soap made.

3. MATERIALS AND METHOD:

Fresh palm kernels were bought from a palm kernel market in Ekwulobia, Anambra state, Nigeria. Palm kernel is the edible seed gotten from the fruit of the oil palm tree (Elaeis guineensis) after removing the shell. The palm kernels were taken to Springboard laboratory in Awka for the extraction of its oil and the determination of the physicochemical properties of the extracted oil.

EXTRACTION OF OIL

The palm kernels were ground and oil was extracted from the ground palm kernels using the soxhlet apparatus with n-hexane as the solvent.

DETERMINATION OF OIL YIELD

The Oil yield (%) was calculated according to the following formular:

$$\text{Oil yield (\%)} = \frac{\text{Weight of oil obtained}}{\text{Weight of sample used}} \times 100$$

PROCEDURES FOR OIL CHARACTERIZATION

The saponification value, iodine value and acid value were determined using AOAC (2010) official methods of analysis.

DETERMINATION OF SAPONIFICATION VALUE

The saponification value of the palm kernel oil was determined as previously described for the procedure for the determination of saponification value for melon seed oil (Okpala,2021).
2g of the extracted palm kernel oil was added into a conical flask and 25ml of alcoholic potassium hydroxide solution was added to it. The flask was attached to a reflux condenser and heated for 1 hour with frequent shaking. 1ml phenolphthalein (1%) solution was added to it. The solution was titrated while still hot with 0.5M HCl. A blank titration was also done without any oil in the potassium hydroxide.

$$\text{Saponification value} = \frac{(b-a)x\ 28.05}{\text{Weight of palm kernel oil used}}$$

b = Titre value for the blank titration.
a = Titre value for the titration with oil sample.

The multiplication by 28.05mg is because 1ml of 0.5M KOH contains 28.05mg of KOH.

DETERMINATION OF ACID VALUE

25ml of diethyl ether, 25ml alcohol and 1ml phenolphthalein solution (1%) were mixed together and carefully neutralized with 0.1M NaOH. 2g of the extracted palm kernel oil was dissolved in the mixture. The mixture was titrated with aqueous 0.1M NaOH with constant shaking until a pink colour which persists for 15 seconds was obtained.
The acid value was calculated with this formular:

$$\text{Acid value} = \frac{\text{Titre value x 5.61}}{\text{Weight of sample used}}$$

4. RESULT AND DISCUSSION:

The physicochemical properties of the palm kernel oil like saponification value, iodine value and acid value were measured to determine the suitability of the palm kernel oil for making soap.

Saponification value shows the number of milligrams of potassium hydroxide or sodium hydroxide needed to saponify one gram of fat under standard conditions. The palm kernel oil showed an extremely high saponification value of 463.77 mgKOH/g (Table 1) which is far higher than the saponification values of other Nigerian seed oils in the work of Akubugwo and Ugbogu (2007). This saponification value of 463.77 mgKOH/g is also much higher than the saponification value of 210 mgKOH/g FOR Hura Crepitans seed oil, which is the highest saponification value among a list of under-exploited seed oils in the work of Ifijen and Nkwor (2020). Therefore it can be ascertained that palm kernel oil has a very high saponification value which is desirable in soap making since soap production requires oil with high saponification value (Ifijen & Nkwor, 2020). The second conclusion from this extremely high saponification value is that this high value is caused by technical error in the laboratory when determining this saponification value, which is a plausible explaination because only one titration was done in the laboratory to determine this value. It is therefore recommended that the exact saponification value of the palm kernel oil be determined by running more than 2 titrations when determining the saponification value so as to have a dependable result.

TABLE 1. Physicochemical properties of the palm kernel oil

Parameter	
Saponification value (mgKOH/g)	463.77
Iodine value (I_2/100g)	14.21
Acid value (mgKOH/g)	5.05

Iodine value shows the degree of unsaturation of an oil. Oils with high iodine values are prone to oxidation and are not good for making soap (Okpala, 2021). The palm kernel oil showed a low iodine value of 14.21 I_2/100g (Table 1). This iodine value obtained is less than 100 I_2/100g which can be classified as non-drying oils which are good for making soap (Senchi & Elinge, 2020). Therefore this iodine value of 14.21 I_2/100g is acceptable for palm kernel oil when employed to make soap.

Acid value is the quantity of base usually potassium hydroxide needed to neutralize the organic acids present in 1g of a fat or oil. The acid value are used to measure the extent of deterioration or decomposition of the oil (Ajai et al., 2016). The higher the acid value of an oil, the lower the quality of the oil. The palm kernel oil showed a high acid value of 5.05 mgKOH/g (Table 1). This acid value is similar to an acid value of 5.13 mgKOH/g for onion seed oil (Senchi & Elengi, 2020) of which they later used the onion seed oil to produce good quality soap.

Oil yield indicates how much oil that a seed sample produces. The palm kernel oil showed a very high oil yield of 67.94%. This shows that palm kernel oil produces much oil. This value of 67.94% is higher than an oil yield range of between 48.4% to 50.2% obtained for T. emetic seed oil (Nchimbi,2020). Therefore the palm kernel oil has a high percentage oil yield which is desirable.

5. CONCLUSION:

In this study, the physichochemical properties of palm kernel oil were analysed to know how suitable the oil will be for making soap. From the results obtained, the physichochemical properties of palm kernel oil are suitable and this makes palm kernel oil suitable when employed to make soap.

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