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ASSESSMENT OF THE SOAP-MAKING POTENTIAL OF SOYBEAN OIL USING PHYSICOCHEMICAL PROPERTIES

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Abstract

The selection of suitable oils for soap production depends largely on their physicochemical characteristics. In this study, soybean oil obtained from a Nigerian market was evaluated to determine its suitability for soap manufacture. Standard analytical procedures were employed to determine the acid value, iodine value and saponification value of the oil sample. The results obtained revealed an acid value of 1.57 mgKOH/g, an iodine value of 1.56 I_2/100 g and a saponification value of 131.91 mgKOH/g. The low acid value suggests that the oil had undergone minimal deterioration and contained a relatively low concentration of free fatty acids. The iodine value obtained indicates a low degree of unsaturation. However, the saponification value was considerably lower than values commonly reported for soybean oil and below values generally preferred for soap production. Consequently, although the oil exhibited acceptable quality in terms of acid value, its relatively low saponification value suggests limited suitability for efficient soap manufacture.

Keywords: Soybean oil, physicochemical properties, saponification value, acid value, iodine value, soap production.

Introduction

The manufacture of soap remains one of the most important industrial applications of fats and oils. Soap is produced through the alkaline hydrolysis of triglycerides, a process commonly referred to as saponification. During this reaction, oils react

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with sodium hydroxide or potassium hydroxide to yield soap and glycerol. The effectiveness of an oil in soap production is influenced by its chemical composition and physicochemical properties. Parameters such as acid value, iodine value and saponification value are frequently used to evaluate the quality of oils intended for industrial use. These properties provide useful information regarding the degree of degradation of the oil, its level of unsaturation and its potential to undergo saponification. Soybean (Glycine max) is among the most important oilseed crops cultivated worldwide. The oil extracted from soybean seeds is widely consumed as edible oil and is also utilized in the manufacture of paints, cosmetics, biodiesel and other industrial products. Owing to its availability in Nigerian markets, there is a need to assess whether commercially available soybean oil possesses the required characteristics for soap production. The aim this research is to know if soybean oil has the properties that can make soybean oil suitable for making soaps. This is is achieved by getting the Physicochemical Properties of the soybean oil and checking if it is up to the acceptable standard.

LITERATURE REVIEW

The physicochemical properties of vegetable oils have been widely investigated because of their importance in food processing and industrial applications. According to Gunstone (2011), the industrial value of vegetable oils is largely dependent on their fatty acid composition and physicochemical characteristics. Soybean oil is composed predominantly of unsaturated fatty acids, particularly linoleic acid and oleic acid. These fatty acids contribute significantly to its chemical behavior and industrial usefulness (Hammond et al., 2005). Research conducted by Sayed (2019) reported saponification values between 176 and 177 mgKOH/g for refined soybean oil. Similar findings were reported by Wang et al. (2018), who obtained values above 180 mgKOH/g for soybean germ oil. Such values indicate good soap-forming potential because a greater quantity of alkali can react with the oil to produce soap.

Acid value is another important quality parameter. According to Shahidi (2005), oils with low acid values are generally preferred because high concentrations of free fatty acids can adversely affect product quality. Similarly, iodine value provides an indication of the degree of unsaturation of an oil and is commonly used to classify oils as drying, semi-drying or non-drying.

Studies have shown that oils intended for soap manufacture should possess adequate saponification values and relatively low acid values in order to produce soaps with desirable cleansing and lathering properties.

MATERIALS AND METHODS

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Commercial soybean oil was purchased from a local market in Nigeria. Analytical-grade chemicals and reagents were used throughout the study.

Determination of Physicochemical Properties

The acid value, iodine value and saponification value of the soybean oil were determined using standard analytical methods recommended by AOAC.

Determination of Saponification Value

The oil sample was refluxed with alcoholic potassium hydroxide solution for a specified period. The excess alkali remaining after the reaction was titrated against standard hydrochloric acid solution using phenolphthalein as indicator. A blank determination was conducted under identical conditions.

Determination of Iodine Value

The iodine value was determined by measuring the amount of halogen absorbed by the unsaturated bonds present in the oil sample.

Determination of Acid Value

The acid value was determined through titration of the oil sample against standard potassium hydroxide solution and expressed as milligrams of potassium hydroxide required to neutralize the free fatty acids present in one gram of oil.

RESULT AND DISCUSSION

The results of the physicochemical analysis of the soybean oil are presented below

Table 1: Physicochemical Properties of Soybean Oil

Parameter	Value
Saponification Value (mgKOH/g)	131.91
Iodine Value (I_2/100 g)	1.56
Acid Value (mgKOH/g)	1.57

The acid value obtained for the soybean oil was 1.57 mgKOH/g. This relatively low value indicates that the oil contained a small quantity of free fatty acids and had not undergone extensive hydrolytic degradation. Low acid values are generally associated with good quality oils suitable for industrial processing.

The iodine value of 1.56 I_2/100 g suggests a low level of unsaturation. This value is substantially lower than values typically reported for soybean oil in literature. The result therefore suggests either significant variation in the sample analyzed or possible differences arising from processing, storage conditions or analytical procedures.

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The saponification value obtained was 131.91 mgKOH/g. This value is markedly lower than the range commonly reported for soybean oil by previous researchers. Since the saponification value reflects the amount of alkali required to convert oil into soap, lower values generally indicate reduced soap-forming potential. The result suggests that the soybean oil analyzed may not produce soap as efficiently as oils possessing higher saponification values.

Although the acid value indicates acceptable oil quality, the low saponification value remains a significant limitation when considering the oil for soap manufacture. Therefore, the overall suitability of the oil for soap production appears to be restricted by its low capacity for saponification.

CONCLUSION

The present study evaluated the physicochemical properties of soybean oil obtained from a Nigerian market in order to determine its suitability for soap production. The oil exhibited an acid value of 1.57 mgKOH/g, an iodine value of 1.56 I_2/100 g and a saponification value of 131.91 mgKOH/g.

The low acid value obtained indicates that the oil was of acceptable quality and had not undergone significant deterioration. However, the saponification value was considerably lower than values commonly reported for soybean oil and lower than values generally regarded as desirable for soap-making oils.

Since saponification value is a key parameter in assessing the soap-forming ability of oils, the low value obtained suggests that the soybean oil may not be an efficient raw material for soap production. Consequently, despite its acceptable acid value, the soybean oil investigated in this study is not recommended for soap manufacture based on its low saponification value.

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