



RESEARCH ARTICLE

EXTRACTION AND CHARACTERIZATION OF MORINGA OLEIFERA SEED OIL

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ABSTRACT

The extraction and characterization of crude oil of *Moringa oleifera* oil found in India, Tamil Nadu has been carried out. Normal hexane was used as solvent for the extraction process. The oil produced was refined through transesterification process using methoxide and magnetic stirrer local. The characterization analysis revealed that tested parameters, which include specific gravity, refractive index, viscosity, density, acid value, saponification value and iodine value for both crude and refined Moringa oil produced, were within the ASTM standard specifications. The oil is of good quality and could be recommended suitable for industrial usage.

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INTRODUCTION

Moringa oleifera plant which is the most widely cultivated species of the genus *Moringa* belongs to the family *Moringaceae*. It is considered very useful, as every part of it is used for food or other beneficial applications. Moringa oil is the oil that can be extracted from *Moringa* seeds. The oil can be used for soap making and consumption. Besides the industrial uses such as fine lubricant and perfumery, the fatty acids profile of the oil with its very high content of oleic acid make its oil with high potential for further industrial application. The oil yield from the seeds depends on the nature of the solvent, the temperature of extraction, seed particle size, contact (residence) time between the solvent and the seed and pre-treatment conditions. Another potential use of *Moringa* oil is as biodiesel feedstock. Biodiesel is an alternative diesel fuel, made from renewable biological sources such as vegetable oils and animal fats. It is biodegradable and non toxic, has low emission profiles and so is environmentally beneficial. Biodiesel being a renewable diesel fuel substitute can be made by chemically combining any natural oil or fat with an alcohol such as methanol or ethanol. Methanol has been the most commonly used alcohol in the commercial production of biodiesel. This study is aimed at extraction and characterization of *Moringa oleifera* Seed oil.

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MATERIALS AND METHODS

Moringa seeds from wild trees in Tamil nadu were purchased from market. The seeds were separated from the membranes and broken to remove the kernel from the hard shell. The kernels were sun-dried so as to reduce the moisture content. The dried kernels were crushed into fine particles with blender to make solvent extraction easier. The sample was stored in a safe place for solvent extraction

Soxhlet Extraction Method

The Soxhlet apparatus used for solvent extraction where 300ml of n- Hexane was poured into round bottom flask. 10 grams of powdered *Moringa Oleifera seed* was placed in the thimble and inserted in the centre of the extractor. The Soxhlet was heated at 60°C. When the solvent was boiling, the vapour rises through the vertical tube into the condenser at the top. The liquid condensate drips into the filter paper thimble in the centre, which contains the oil to be extracted. The extract seeps through the pores of the thimble and fills the siphon tube, where it flows back down into the round bottom flask. This was allowed to continue for 30 minutes. It was then removed from the tube, dried in the oven, cooled in the desiccators and weighed again to determine the amount of oil extracted. The experiment was repeated by placing 5g of the *Moringa oleifera* into the thimble. The weight of oil extracted was determined at 30 minutes interval. At the end of the extraction, the resulting mixture containing the oil was distilled off using simple

distillation to recover solvent from the oil. The oil extracted was stored in a plastic container for further use.

Transesterification

Transesterification process using magnetic stirrer, A 500 ml 3-necked round bottom flask equipped with mechanical stirrer, thermometer and condenser with guard tube to prevent moisture entering into the system, is heated to expel residual moisture. On cooling, 200 ml of oil was then added to the flask. The oil was stirred and heated in a silicon oil bath to 60 °C at which a prepared sodium methoxide (40 ml methanol and 1 g NaOH) was added rapidly under stirring condition and the reaction continued for at least two hours at the same temperature. Two layers were observed clearly after cooling. The top and lower layers observed were biodiesel (refined oil) and glycerin respectively. The suspected biodiesel layer was neutralized by diluted acetic acid and then washed with distilled water.

Determination of the Percentage of Moringa Oleifera Oil

The crude and the refined oil were weighed separately and their percentage yield was calculated on dry matter basis as shown in equation.

$$\% \text{ of yield} = \frac{\text{Weight of oil}}{\text{Weight of sample on dry matter basics}}$$

Determination Density and specific gravity

An empty washed and dried beaker was weighed on the top load weighing balance. The weight of the beaker was recorded. Exactly 50 cm³ of each of the oil sample were measured and pour into the beaker and weighed. The weights of the 50cm³ of the samples were recorded. The procedure was repeated with water and the weight of 50cm³ of water was obtained. The density and the specific gravity were calculated thus

$$\text{Density of oil} = \frac{\text{Weight of oil sample}}{\text{Volume of oil sample}}$$

$$\text{Specific gravity of oil sample} = \frac{\text{Weight of oil}}{\text{Weight of equal volume of water}}$$

Determination Acid Value

1g of refined oil was weighed separately in 250ml conical flasks. 5ml of isopropyl alcohol was added into the conical flasks containing the oil samples with thorough stirring. Three drop of phenolphthalein indicator was added and titrated against 0.1N of KOH solution while shaking constantly until a faint pink persist for 30s. The end point was recorded and the acid value was calculated as;

$$A.V = \frac{\text{Titre value} + \text{molar Conc. of KOH} + 56.1}{\text{Weight of oil sample}}$$

$$\% \text{ of FFA} = \frac{\text{Titre value} + \text{molar Conc. of KOH} + 56.1}{\text{Weight of oil sample}}$$

Determination of Saponification Value

2g of the samples were weighed separately in 250ml conical flasks. 50 ml of ethanoic potassium hydroxide was added into the conical flasks containing the oil samples with thorough stirring. The resulting mixtures were boiled until the oil dissolves. Three drops of phenolphthalein indicator was added and titrated against 0.1N of KOH solution while shaking constantly until a faint pink persist for 30s.

$$S.V = \frac{(B - R) + \text{Molar Conc. Of HCl} + 56.1}{\text{Weight of oil sample}}$$

Determination of Iodine Value

0.4g of the samples was weighed into a conical flasks and 20ml of carbon tetra chloride was added to dissolve the oil samples. Then 25ml of Dam's reagent was added to the flasks using a safety pipette in fume chamber. Stoppers were then inserted and the content of the flasks were vigorously swirled. The flasks were then placed in the dark for 2 hours 30 minutes. At the end of this period, 20ml of 10% aqueous potassium iodide and 125ml of water were added to each sample using a measuring cylinder. The contents were titrated with 0.1M sodium-thiosulphate solutions until the yellow colour almost disappeared. Few drops of 1% starch indicator was added and the titration continued by adding thiosulphate drop wise until blue coloration disappeared after vigorous shaking. The same procedure was used for blank test and other samples. The iodine value is given by the expression.

$$I.V = 12.69 \frac{C (V_1 - V_2)}{M}$$

Where C = Concentration of sodium thiosulphate used; V₁ = Volume of sodium thiosulphate used for blank; V₂ = Volume of sodium thiosulphate used for determination, M = Mass of the sample

Determination of Refractive Index

Refractometer was used in this determination. Few drops of the samples were transferred into the glass slide of the refractometer. Water at 40°C was circulated round the glass slide to keep its temperature uniform. Through the eyepiece of the refractometer, the dark portion viewed was adjusted to be in line with the intersection of the cross. At no parallax error, the pointer on the scale pointed to the refractive index. This was repeated and the mean value noted and recorded as the refractive index.

Determination of Viscosity

A clean, dried viscometer with a flow time above 200 seconds for the fluid to be tested was selected. The samples were filtered through a sintered glass (fine mesh screen) to eliminate dust and other solid material in the liquid samples. The viscosity meter was charged with each of the samples by inverting the tube's thinner arm into the liquid samples and suction force was drawn up to the upper timing mark of the viscometer, after which the instrument was turned to its normal vertical position. The viscometer was placed into a holder and inserted to a constant temperature bath set at 40°C and allowed approximately 10 minutes for the sample to come to the bath temperature at 40°C.

The suction force was then applied to the thinner arm to draw the samples slightly above the upper timing mark. The afflux time by timing the flow of the samples as it flow freely from the upper timing mark to the lower timing mark was recorded.

RESULTS AND DISCUSSION

The result obtained for various tests carried out on *Moringa Oleifera* seed oil the analysis of essential oil. Table 1 show some of the properties of *Moringa Oleifera* seed oil (Crude Oil).

Table 1. Some of the properties of *Moringa Oleifera* seed oil (Crude Oil)

Percentage oil yield (%)	85
Free fatty acid (%)	6.7
Acid value (mg NaOHg-1 of oil)	0.7
Saponification value (mg KOHg-1 of oil)	49
Bulk Density (gcm ⁻³)	8.44
Specific gravity (40°C)	0.9
Iodine value (gI ² /100gof oil)	0.8
Refractive index at 40oC	5.21
Viscosity at 40°Cmm ² /s	4.4

Conclusion

The oil from *Moringa oleifera* seed was extracted using n-hexane as a solvent by soxhlet apparatus and the transesterification of this oil into biodiesel was then carried out using methoxide and magnetic stirrer. The oil from *Moringa oleifera* seed was extracted using n-hexane as a solvent by soxhlet apparatus and the transesterification of this oil into biodiesel was then carried out using methoxide and magnetic stirrer. Table above shows some of the properties of *Moringa oleifera* seed oil. The percentage yield values for both crude oil were (39%). The Free fatty acid value was found to be 6.7. The specific gravity for crude oil were respectively 0.9. The value of the viscosity of the crude oil (4.4mm²/s) was found to be outside the recommended standard range 4.1 mm²/s. This may be attributed to the fact that some impurities and other components were removed during refining. The refractive index of the value obtained for crude oil, 5.21. The chemical properties analysis shown in Table 1 indicates that the acid value of crude oil was 0.7mg NaOH/g of oil respectively. The results for the saponification value of the crude oil that were found to be 49mg KOH/g of oil respectively. The saponification value of crude oil, are the result specified for quality *Moringa* oil. Also, the result obtained for the Iodine value of crude oil is 1.13.

REFERENCES

American Oil Chemist's Society (AOCS). 1989. Official and Recommended Practices of the American Oil Chemists Society. 5th ed., AOCS Press, Champaign.

- Dalziel, J.M. 1955. The Useful Plants of West Africa. Grown for Oversea Government and Administrations (London: 4 mill Bank,) 186-88.
- Fuglie, L.J. 2006. Combating Malnutrition with Moringa, in J. Lowell, L.J. Fuglie (Ed.), The Miracle Tree: The multiple attributes of Moringa (Wageningen, the Netherlands: CTA publication.) 117-36.
- Hsu, R., Midcap, S., Arbainsyah, M., De Witte, L. 2006. *Moringa oleifera*; Medicinal and socioeconomic uses. International Course on Economic Botany. National Herbarium Leiden. The Netherlands.
- Irvine, F.R. 1961. The woody Plants of Ghana with special references to their uses. 2nd ed. (London: Oxford University Press) 868.
- Joshi, R.M. and Pegg, M.J. 2007. Flow properties of biodiesel fuel blends at low temperatures. Journal of Fuel. 86: 143-51.
- Krawczyk, T. 1996. Biodiesel - Alternative fuel makes inroads but hurdles remain. INFORM, 7: 801- 829.
- Machell, K. 1994. Report on the Extraction of Moringa oil from Moringa oil seeds. Intermediate Technolgy Zimbabwe, Harare, Zimbabwe.
- Makkar, H.P.S. and Becker, K.1997. Nutrient and anti-quality factors in different morphological parts of the Moringa oleifera tree, Journal of Agricultural Science, 128, 311-322.
- Onwuka, G.I. 2005. Food Analysis and Instrumentation: Theory and Practice (Lagos: Naphthali Prints) 1-219.
- Pearson, D.A. 1976. The Chemical analysis of foods, 7th ed. (Edinburgh: Churchill Livingstone).
- Premi, M., Sharma, H.K., Sarkar, B.C., Singh C. 2010. Kinetics of drumstick leaves (*Moringa oleifera*) during convective drying. African journal of plant science. 4: 391-400.
- Sarwatt, S.V., Milang'ha, M.S., Lekule, F.P., Madalla, N. *Moringa oleifera* and cottonseed cake as supplements for smallholder dairy cows fed Napier grass, Livestock Research for Rural Development,
- Sayyar, S., Abidin, Z.Z., Yunus, R., Muhammad, A. 2009. Extraction of Oil from *Jatropha* Seeds- Optimization and Kinetics. American Journal of Applied Sciences. 6: 1390-1395.
- Welcher, F.J. 1958. The Analytical uses of Ethylenediaminetetraacetic acid, (New York: D. Van Nostrand Company Inc.).