

PHYSIOCHEMICAL PROPERTIES AND ORGANOLEPTIC QUALITY OF *M. OLEIFERA* SEED OIL

ABSTRACT

The studies were undertaken in order to determine the physico-chemical properties and sensory attribute of oils extracted from the seeds of *Moringa oleifera*. The oils were extracted from the seeds and analyzed for moisture content, specific gravity, saponification value, refractive index, peroxide value, acid number, iodine value and sensory quality. The fresh oil was also characterized for their sensory attribute using three different foods. The seed oil has the following physical and chemical parameters: the colour (yellow), moisture content (2.0%), specific gravity 1.0598 kg/dm³, refractive index (1.465 ± 0.04), acid values (0.67mg/KOH/g), iodine value (110g/100g), peroxide value (7.0meq/kg), saponification value (178.10 mg/KOHg), melting point (36.7), flash point (162) and acidity (14.0). Organoleptic scoring show that yam fried with *Moringa* seed oil had more taste, colour, aroma than yam fried with vegetable oil while chicken and egg fried with vegetable oil had higher taste, colour aroma and overall acceptance scoring than chicken and egg fried with *Moringa* seed oil. The study showed that *Moringa* seed oil can be used as nutritional oil, industrial raw material and nutraceuticals. The oil is a good source of edible oil.

Keywords: *Moringa oleifera* seed oil; physicochemical parameters; organoleptic assesment; oil extraction and characterization

INTRODUCTION

Fats and oil whether the source of animal or vegetable in origin represent the highest source of energy per unit weight that man can consume. Apart from being a source of reserved energy, fats deposits insulate the body against loss of heat and protect the vital organs against mechanical injury. They are an important food source for man, and are also extensively used for nutritional, cosmetic and industrial purposes. They are used for supplying essential fatty acids such as linolenic and arachidonic acids. Fats and oils are also used for producing drug dispersants in therapeutics (Ranften et al., 2003).

The high world demands for oils and fats to meet the multiplex human consumption and the multitudinous industrial needs are the reasons for the increase in the importance of oil seeds and make them play an important role in the national economy of the producing countries (Charley, 2002).

Nigeria has over 150 million people and estimated to be 170,123,740 as at July 2012 which are particularly used to palm oil, ground nut oil and soya beans oil as edible oil (Ottong, 2012). To ensure the increase of oils and fats, it is necessary to continue not only with the development of new varieties with improved oil yields, but also to search for new sources of oil (Fadlalla, 2000). In identifying new

42 source of edible oil, there is need to carry out the physicochemical parameters of
43 the oil so as to determine its edibility in terms of properties and composition

44 *Moringa oleifera* Lam. (Moringaceae) is one of the 14 species of family
45 Moringaceae, native to India, Africa, Arabia, Southeast Asia, South America, and the
46 Pacific and Caribbean Islands (Iqbal *et al*, 2006). Because *M. oleifera* has been
47 naturalized in many tropic and sub-tropic regions worldwide, the plant is referred
48 to by a number of names such as horseradish tree, drumstick tree, ben oil tree,
49 miracle tree, and "Mother's Best Friend"

50 The *Moringa* plant has been consumed by humans throughout the century in
51 diverse culinary ways (Iqbal *et al*, 2006). Almost all parts of the plant are used
52 culturally for its nutritional value, purported medicinal properties and for taste
53 and flavor as a vegetable and seed. The leaves of *Moringa oleifera* can be eaten
54 fresh, cooked, or stored as a dried powder for many months reportedly without
55 any major loss of its nutritional value (Arabshahi *et al*, 2007). Epidemiological
56 studies have indicated that *M. oleifera* leaves are a good source of nutrition and
57 exhibit anti-tumor, anti-inflammatory, anti-ulcer, anti-atherosclerotic, anti-
58 convulsant activities (Dahiru *et al*, 2006) and antianaemic effect (Hisham *et al*,
59 2012). Seeds of *M. oleifera* are also known as a great source of vitamins and
60 minerals including calcium, copper, sulphur, vitamin A and B-vitamins (Lowell,
61 2002). In this study, attempt was made to evaluate the physicochemical properties
62 and organoleptic quality of *M. oleifera* seed oil.

63

64 MATERIAL AND METHOD

65 Plant collection

66 *Moringa oleifera* seeds, were collected from Badeggi, Niger State Nigeria.
67 Taxonomic identification of the plant was conducted by a Botanist in the
68 Department of Biological Science, Federal University of Technology Minna, Niger
69 State. The seeds were then dried to constant weight in an oven at 60°C for 24
70 hours to remove moisture content and then ground using mechanical grinder, put in air
71 tight container and stored in a desiccators for further analysis (Ekpa, 1989).

72 Oil extraction

73 Oil from the *Moringa* seeds was extracted by continuous extraction in soxhlet
74 apparatus for six hours using petroleum ether (40-60°C) as solvent according to
75 the method described (A.O.A.C., 1990). At the end of the extraction, the extraction
76 solvent was evaporated in a rotary evaporator. The extracted oil was assayed using
77 standard methods.

78 Physicochemical Characterization

79 Standard procedures of American Oil Chemists Society were used for indices
80 values (A.O.A.C, 1990). The procedures were also applied for acid value, iodine
81 value, peroxide value and saponification value. Refractive index, color, melting
82 point and specific gravity were determined using the recommended methods.
83 Refractometer and tintometer were used to determine refractive index and color,
84 respectively. The saponifiable matter in the oil was determined using standard

85 methods (A.O.A.C, 1990), while the ester value was obtained by subtracting the
86 acid value from the saponification value.

87 **Organoleptic evaluation**

88 The *Moringa oleifera* seed oil was used to fried 3 different food (yam, egg and
89 chicken). The foods were evaluated for organoleptic properties (in comparison
90 with the same kind of food fried with vegetable oil) according to the method as
91 described by Stone (1985). The Organoleptic evaluations were carried out by
92 judges. All the judges formed the panel were conversant with the factor governing
93 the quality of the sample. The fried food was evaluated organoleptically for color,
94 taste, aroma and overall acceptability. The taste panelists were asked to rate the
95 samples for color, taste, aroma and overall acceptability on 1-7 point hedonic scale,
96 where, 7=like extremely; 6=like well; 5=like
97 4=neither like nor dislike; 3=dislike
98 2=dislike well; 1=dislike extremely.

99 **RESULTS**

100 **Physicochemical parameters**

101 The results of the physicochemical parameters of *Moringa oleifera* seed oil is
102 presented in Table 1: the seed oil have the following physical and chemical
103 parameters. The colour (yellow), moisture content (2.0%), specific gravity 1.0598
104 kg/dm³, refractive index (1.465 ± 0.04), acid values (0.67mg/KOH/g), iodine
105 value (110g/100g), peroxide value (7.0meq/kg), saponification value (178.10
106 mg/KOHg), Melting point (36.7) Flash point(0c) (162) and Acidity (14.0)

108 **Table 1** Physicochemical Characteristics of *Moringa oleifera* seed oil

Physicochemical Properties	<i>Moringa oleifera</i> seed oil
Specific gravity at 200C	1.0598± 0.12
Refractive index at 290C	1.465 ± 0.04
Acid value (mg/KOH/g)	0.67± 1.93
Iodine value mg/100g	110.89 ± 4.13
Peroxide value (meq/kg)	7.00 ± 0.12
Saponification value (mg-KOH/g)	178.10 ± 2.35
Free fatty acid (as oleic acid)	0.99 ± 0.02
Melting point	36.7± 3.04
Flash point(0c)	162 ± 7.32

Rancidity	14.0 ± 1.09
Colour	Yellow

109 Data are Mean±SEM of triplicate determination

110 ORGNAOLEPTIC SCORING

111 The results of the organoleptic scoring of foods fried with *Moringa* seed oil in
 112 comparison with foods fried with vegetable oil yam fried with *Moringa* seed oil
 113 had more taste, colour, aroma and overall acceptance than plantain fried with
 114 vegetable oil while egg and chicken fried with vegetable oil had higher taste, colour
 115 aroma and overall acceptance scoring than yam and egg fried with *Moringa* seed
 116 oil

117 **Table 2. Organoleptic assessment of *Moringa* seeds**

Sensory attribute	yam		egg		chicken	
	M.S.O	V.O	M.S.O	V.O	M.S.O	V.O
Taste	6.12±0.64	5.87±0.99	5.50±0.53	5.87±1.12	5.25±1.03	5.50±0.92
Colour	5.7±1.03,	5.12±1.35	5.50±0.92	5.62±1.30	5.25±1.28	5.37±0.51
Aroma	5.75±1.03	5.00±0.53	5.50±1.30	5.87±1.12	5.00±1.06	5.12±1.12
Overall.	6.12±0.83	5.69±0.74	5.50±.75	5.87±0.64	5.00±1.06	5.3±0.51
Acceptance						

118

119 Data are Mean±SEM (N= 8)

120 M.S.O = *Moringa* seed oil

121 V vegetable oil

122

DISCUSSION

123 The oil extracted from *Moringa* seed is yellow in colour. The colour of the oil is
 124 used preliminarily in judging the quality and in determining the degree of
 125 bleaching of the oil. The darker the colour, the poorer the quality Power (2008)
 126 Therefore the yellow colour of *Moringa* oil shows that the quality of the oil is good
 127 and confirms to Encyclopedia of Chemical Technology (Onimawo *et al.*, 2003).

128 The moisture content of the oil was 2.0% low moisture content of this seed oil is an
 129 indication of low perishability of the oil and this responsible for it relatively long
 130 shelf life (Kester and Kader, 1993).in addition, low The moisture content shows the
 131 presence of a lesser amount of dirt and impurities in the oil.(Edidiong, 2013). Thus
 132 low moisture content observed in this study is an Indication that the dirt and
 133 impurities in *Moringa* seed oil is very low however this value is lower than the
 134 moisture contents (10.9) of melon seed oil (Power, 2008).

135 Acid value give an idea of the free fatty acid composition due to enzymatic
 136 activities. The acid value obtained for *moringa* seed oil in this study (
 137 0.67mg/KOH/g) is very low as compared to the acid value (7.09mgKOH/g) reported
 138 for melon seed oil (Edidiong and Ubong, 2013) 1.68mgKOH/g for almond seed oil
 139 (Akpabio, 2012) and 2.37mgKOH/g for coconut oil (Peter, 2006). This implies that
 140 *Moringa* seed oils contain low level of free fatty acid

141 According to the (Kaly, 2008) oil with iodine value in the range of 100-150 have
 142 higher affinity for oxygen when expose to atmosphere and cannot be classify as
 143 drying oil, thus the result obtained in this study (110g/100g) compare with iodine
 144 value obtained for water melon (114.94g/100g) by (Edidong and Ubong 2013).
 145 The oil can form thicken, sticky but cannot develop into hard dry film. However
 146 this property makes them suitable for the production of soap (Kinkela, 2006).this
 147 findings indicate that Moringa seed oil can be use as a raw material for the
 148 production of soap

149 The value of saponification reflect the molecular weight of oil (Booth and Wickens,
 150 1988) in this study saponification value obtained for Moringa seed oil was found
 151 to be high (178.10 mg/KOHg) and are comparable with the saponification value
 152 reported for palm kernel (190-206mg/KOHg) and oil obtained from groundnut
 153 (188-196mg/KOHg) (Cock and Van Reed,1966). High saponification value implies
 154 greater proportion of fatty acids of low molecular weight. Thus the high
 155 saponification value of Moringa seed oil indicate that the oil contained higher
 156 proportion of low molecular weight fatty acids. High saponification is an additional
 157 properties that makes it suitable as a raw material for soap and lather industry
 158 (Nzikou *et al.*, 2007).

159 The peroxide value reflect the degree of oil oxidative rancidity (Ekpa and Ekpa
 160 2006), The peroxide values of fresh and stored *Moringa* seed oils were obtained
 161 to be 7.0. The peroxide values obtained for oil in this study is lower compared to the
 162 value (20.0meq/kg) reported for melon seed oil (Edidong and Ubong, 2013).
 163 Oxidative rancidity is the addition of oxygen across the double bonds in
 164 unsaturated fatty acids in the presence of enzyme or certain chemical compounds
 165 (Oyenuga, 2008). The odour and flavor associated with rancidity are due to
 166 liberation of short chain carboxylic acids. High peroxide values are associated with
 167 higher rate of rancidity. The low peroxide values of Moringa seed oils obtained in
 168 this study is an indication that they are less liable to oxidative rancidity at room
 169 temperature (Odoemelam, 2005). These oils are fresh because the content
 170 peroxide lower than 10 meqO₂/kg and oil grow rancid when the content peroxide
 171 lies between 22 and 40.0 meqO₂/kg (Ojeh, 2001).

172 The specific gravity of Moringa seed oil obtained in this study (1.0598 kg/dm³) is
 173 higher than the value (0.956kg/dm³) for *Blighia sapida* oil (Akpabio, 2012).
 174 However the refractive index (which reflect the purify the oil) obtained in this
 175 study (1.465) is similar to the reported value (1.462) for *Blighia Sapida* oil.
 176 (Akpabio, 2012). The results indicate that the moringa seed oils are of high purity

177 The panelist's assessment indicate that yam fried with Moringa seed oil have
 178 higher acceptability for colour, taste and flavor than the yam fried with commercial
 179 vegetable oil. However chicken and egg fried with commercial vegetable oil have
 180 more acceptable taste, colour and aroma than those fried with Moringa seed oil.
 181 This findings is an indication that the sensory attribute of oil depend on the kinds
 182 of food in which the oil is used to prepared and thus Moringa seed oil is suitable for
 183 frying yam

184 CONCLUSIONS

185 The data presented show that *Moringa oleifera* may be considered as Nigeria's
 186 potential asset in the seed oil for industrial application. The oil of the plant found in
 187 this area has a considerable high quality. The study also showed that *Moringa seed*
 188 *oil* can be used nutritive oil, industrial raw material and nutraceuticals. The oil is
 189 a good source of edible oil.

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