African Journal of Biotechnology Vol. 7 (9), pp. 1344-1346, 2 May, 2008
Available online at http://www.academicjournals.org/AJB
ISSN 1684–5315 © 2008 Academic Journals

Short Communication

Production and refining of *Dacryodes edulis* "native pear" seeds oil

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Accepted 1 February, 2008

The suitability of native pear *Dacryodes edulis* seeds as a source of good quality vegetable oil was investigated. Oil was extracted from the dried seeds by simple solvent extraction process with hexane. Extracted oil was degummed using 0.2% H_3PO_4 or Na_2CO_3 solutions, and then bleached with activated carbon. Chemical (acid value (AV), saponification number (SN), peroxide value (PV), and iodine value (IV)) and physical (smoke point (SP), flash point (FP), melting point (MP) and freezing point) analyses were carried out on both the crude and refined oils. Results showed that the crude oil had AV of 9.6 mg KOH/g, SN of 72.8. Degumming (with 0.2%Na_2CO_3 and 0.2%H_3PO_4) and bleaching gave oils with lower AV (7.45 mgKOH/gfat) and higher acid value (9.4 mgKOH/gfat), respectively. Iodine value (48.78 ml/g) of the 0.2% Na_2CO_3 degummed oil was higher than that of the seed oil degummed with 0.2% H_3PO_4 (25.35 ml/g). Bleaching of 0.2% Na_2CO_3 degummed oil resulted in oil with peroxide value of 20 mgEq/Kg which was higher than that of 0.2% H_3PO_4 degummed and bleached (19.4 mgEq/Kg) oil.

Key words: Native pear, seeds, degumming, bleaching, deodorizing, extraction, vegetable oil.

INTRODUCTION

Oil extraction from oil bearing seeds and mesocarps can be done with the use of non-polar solvents such as hexane, diethyl ether and carbon tetra chloride. The expressed oils usually are composed of fatty acids (triglycerides), some mucilaginous, proteinaceous, pigments, resins and other fat oxidation substances which when left in oil will result in the production of off flavours, odours and colours and may reduce the shelf life of the oil. These substances are usually removed during refining processes (degumming, bleaching and deodourization).

Native pear, *Dacryodes edulis*, is consumed traditionally in Nigeria raw, roasted or boiled in hot water and is eaten alone, or used in garnishing fresh maize. It is widely found in many sub-Saharan countries including Nigeria, Liberia, Cameroons and Zaire (Boungou, et al., 1991). It may be available for up to 6 months of the year according to Eka (1977), Omoti and Okiy (1987) and Lam (1985). *D. edulis* can be a source of vegetable oil and the seeds of the fruit contain up to 18 - 70% oil (Gunstone and Norris, 1982). However, not much has been done in the characterization and refining of the oil. This study was done to investigate the possibility of producing good quality oil from the seeds of native pear (usually discarded after the consumption of the mesocarp). This will increase the economic value of the crop and add to the varieties of vegetable oils available to consumers.

MATERIALS AND METHOD

The ripe native pear fruits purchased from a local market in Abia state of Nigeria were cleaned and cut to remove the seeds, which were cut into small pieces and sun dried (during hammarttan) for 48 h. The seeds were milled with a corona traditional corn mill REF 121 (100 µm mesh size). After milling the powder was packed in

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Table 1. Chemical and physical characteristics of native pear seeds oil.

Parameter	Content
Oil content (%)	50.00±0.416
Iodine value (ml/g)	32.40±0.158
Acid value (mgKOH/g)	9.60±0.0 47
Saponification (mgKOH/g)	172.80±0.206
Peroxide value (meq/Kg)	6.00±0.047
Freezing point (0°C)	21.00±0.163
Melting point (0°C)	30.00±0.082
Smoke point (0°C)	198.00±0.047
Flash point (0°C)	270.00±0.094

Means of triplicate determinations.

cellophane bags and stored in a refrigerator for use. 70 g of the milled seed sample was weighed into a 500 cm^3 beaker and thoroughly washed with 300 cm^3 of hexane and filtered through filter papers until every trace of oil was extracted from the sample. The oil-hexane mixture (miscella) was separated by distillation using a distillation apparatus. The oil was further heated over a Gallenkamp hot air oven model OV160 at 78°C for 2 h to ensure the complete evaporation of traces of hexane in the oil. This procedure was used to extract oil from all the milled 'native pear' *D. edulis* seeds.

The degumming method described by Weiderman (1981) was used with 0.2% phosphoric acid or sodium carbonate. 100 cm^3 of the crude 'native pear' seed oil was degummed at 70°C with 10 cm^3 of 0.2% H_3PO_4 or Na_2CO_3 solutions.

Aliquots of the degummed oil were bleached with 2% fuller's earth (activated carbon) at 110°C for 30 min (Jawad et al., 1983).

The acid value (AV), saponification number (SN), peroxide value (PV), and iodine value (IV) determinations were carried out as described by AOAC (1984) on triplicate basis, on both crude and refined oil samples. The freezing points were determined as was described by Mondy (1980). The temperature at which 2 cm^3 of the oil in a 5 cm^3 test tubes started to freeze in ice-salt mixture was determined. The flash and smoke points were also determined using a procedure described by Mondy (1980). Enough oil to cover the bulb of a thermometer was poured into a 50 cm^3 conical flask covered with a rubber stopper with two holes on it (one for the thermometer and the other to let in air into the flask). The flask was heated until the oil just started to smoke (SP), and at that point the temperature was taken. Melting point (MP) determination was according to the method described by Ihekoronye and Ngoddy (1985). Frozen oil sample in a capillary tube was heated slowly in a water bath and the temperature at which the oil started to melt was taken.

RESULTS AND DISCUSSION

The characteristics of the crude 'native pear' seed oil is presented in Table 1. The oil content of the 'native pear' seed was 50% as shown in the table. This makes the seed to compare favourably with other oil bearing seeds such as palm kernel (40%), peanuts (49%), cotton seed (36%), and soybean (20%) (Abraham and Hron, 1992). The crude oil analyses showed that the oil had IV of 32 ml/g, SN of 172.8 mgKOH/g, PV of 6 meq/Kg and AV of 9.6 mgKOH/g. The oil can be classified as a non drying oil which the predominating fatty acid is oleic acid because of its range of iodine value (Heiman, 1980). The acid value of 9.6 mgKOH/g is within the range acceptable for crude palm kernel oil in the processing industry. The saponification number showed that the oil will be good for the manufacture of soaps. The smoke point (198°C) and flash point (270°C) meant that the oil will be good for frying and will not dry out easily. The freezing point (21°C) of the oil explains the fact that the oil is liquid at room temperature.

Table 2 showed that degumming with Na_2CO_3 resulted in oil with higher IV (48.78 ml/g) while H_3PO_4 degummed oil had 25.35 ml/g IV. Bleaching also increased the iodine value of the degummed oil. The SN of the oil increased drastically both for the degumming and bleaching processes. These increases in the iodine and saponification number could have been as a result of the removal of phosphatides, proteinaceous compounds, resins and other impurities from the oil during the above mentioned processes. Degumming increased the peroxide value of the oil (14.20 meq/Kg for Na_2CO_3 degummed oil). The increase in the peroxide value of the degummed oil could have been due the addition of water which must have resulted in acceleration of rate deterioration (rancidity) in the oil. Degumming and bleaching however resulted in oil of lower acid value in accordance with Kordylas, (1991).

Table 3 showed that all the treatments resulted in oils of lower freezing point than the crude. This could have been as a result of the removal of the impurities in the oil. The melting points of the oils from the various treatments (28°C for H_3PO_4 degummed oil) were also lower than that of the crude except for that of Na_2CO_3 degummed oil (32°C). Degumming with Na_2CO_3 and bleaching yielded oil of lower smoke point of 176°C but degumming with H_3PO_4, and bleaching same gave oils with smoke point of 220°C. This shows that the oil produced had the same smoke point with refined palm kernel oil and that the oil will be good for frying since it will not smoke the temperature used in frying. This smoke point is within the range of that for palm oil degummed with different concentrations of Na_2CO_3, H_3PO_4 and NaOH (Iwuoha, et al., 1996). The flash point of the oils were within the range of 210 and 290°C which is high showing that the oil will not catch fire easily at the range of temperatures used in frying.

Conclusion

'Native pear' seeds contain high percentage of oil (50%). The refining of extracted oil yielded better quality oil. Therefore, instead of discarding the seeds, as is presently done, they can be processed into valuable vegetable oil.

Table 2. Chemical characteristics of refined native pear seeds oil.

Treatment (ml/g)	Iodine value (mgKOH/g)	Saponification Number (meq/Kg)	Peroxide value (mgKOH/g)	Acid value
Na_2CO_3 degummed oil	48.78±0.039	292.36±0.014	14.20±0.025	7.45±0.047
H_3PO_4 degummed oil	25.35±0.141	238.40±0.163	16.00±0.480	9.40±0.163
Na_2CO_3 degummed and bleached oil	51.27±0.253	166.50±0.408	4.60±0.245	3.31±0.253
H_3PO_4 degummed and bleached oil	47.97±0.237	183.20±0.108	5.20±0.163	3.80±0.033

Table 3. Physical characteristics of refined native pear seeds oil.

Treatments	Freezing point (°C)	Melting point (°C)	Smoke point (°C)	Flash point (°C)
Na_2CO_3degummed oil	18±0.428	32±0.243	176±0.327	210±0.294
H_3PO_4degummed oil	18±0.422	28±0.455	220±0.249	280±0.411
Na_2CO_3degummed and bleached oil	18±0.450	20±0.330	176±0.340	280±0.166
H_3PO_4degummed and bleached oil	19±0.205	22±0.374	220±0.083	290±0.163

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