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ORIGINAL ARTICLE

EXTRACTION AND CHARACTERISTICS OF SEED KERNEL OIL FROM MANGO (*MANGIFERA INDICA L.,*)

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ABSTRACT: Sudanese mango seeds were collected as wastes after the processing of the fruits in canning section of Food Research Centre, the kernels were separated and dried. This study was carried out on mango seed kernels to clarify their proximate composition and the characteristics of the extracted oil including free fatty acids, peroxide value, iodine value, saponification number and unsaponifiable matters. Mango seed kernel oil was found to be rich in unsaponifiable matter and can thus find its application in cosmetic industry. The high saponification value of the oil is an indication that it might be suitable for soap making. Mango oil seems promising as a food additive for extending the shelf life of a variety of Sudanese edible oils.

KEYWORDS: Mango seed kernels; mango seed kernel oil; proximate composition; physicochemical properties.

INTRODUCTION

Mango (*Mangifera indica L.,*) family Anacardiaeae, trees are one of the oldest tropical fruit bearing plants. They represent one of the best fruits in the world market, due to its excellent flavor, attractive fragrance and delicuious taste (Salunke *et al.*, 1992).

Mango trees are thriving well in Asia and Africa. In Sudan, mangoes represent one of the most popular fruits that cultivated almost along the Nile valley. There are several cultivars that grown in Sudan. After the consumption or industrial processing of the fruits, considerable amounts of mango seeds are discarded as waste (Puravankara *et al.*, 2000). According to mango varieties, the seeds represents from 10% to 25% of the whole fruit weight (Hemavathy *et al.*, 1988). The kernel inside the seed represents from 45% to 75% of the seed and about 20% of the whole fruit (Arogba, 1997). However, more than one thousand tons of mango seeds are being annually produced as wastes so that if such seeds could be utilized in some way, hazard could be eliminated and probably valuable products could be produced.

The present paper aimed to study the compositional quality of several Sudanese mango seed kernel oil (msko). Since no results or information concerning the Sudanese msko is available.

MATERIALS AND METHODS

2.1. Materials

About 100 kg of mango seeds as by products (waste) were collected from canning section of Food Research Center which represent eleven samples cultivated in Shandi region, Sudan.

2.2. Methods

2.2.1. Preparation of mango seeds kernel:

The seeds of eleven samples were washed, air dried and the kernels were removed manually from seeds. Then the kernels were dried, ground into a powder form, kept in a closed dark glass container and stored at 4°C until processed.

2.2.2. Oil extraction procedure:

About 150g of mango kernel powder were fed to a lab- scale soxchlet extractor fitted with a 1 L round- bottom flask and a condenser. The extraction was executed for 6 hours with 350ml of solvent n- hexane (b. p 60- 80°C).

2.2.3. Proximate composition of mango kernel and characteristics of mango oil:

Moisture, oil content, crude fiber and ash were determined in triplicate according to AOAC (2005). Chemical characteristics including peroxide value (PV), free fatty acid (FFA), iodine value (IV), saponification value (SV), unsaponificable matter and physical property (melting point) were determined according to AOAC (2005).

RESULTS AND DISCUSSION

Table (1) shows that the moisture content of msko was in the range 7.35- 8.88%, oil, fiber and ash content were found to be in the range of 3.05- 11.05%, 1.50- 4.06% and 1.94- 3.17%, respectively.

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These results were in agreement with the data obtained by Nzikou *et al.*, (2010) and Dhingra and Kapoor, (1985). They reported oil content in the range of 6.98- 13.0, crude fiber in the range of 1.65- 2.02 and ash content in the range of 2.47- 3.2. The low oil content of sample (3) and (10) 4.78 and 3.05%, respectively may be due to different mango varieties. Also sample (11) and (7) have high fiber content (4.6 and 3.7%).

The melting point of the samples showed a wide range 30- 44°C, which in agreement with result obtained by Ahmed et al 2007, 30- 50°C. But not matched with Shah *et al.*, (1983) and Maiti *et al.*, (1988) whom indicated 34- 43°C.

Table (1): Proximate analysis of eleven Sudanese mango samples

SN*	Oil (%) (M±S.D)**	Moisture (%)(M±S.D)**	Fiber (%)(M±S.D)**	Ash (%)(M±S.D)**
1	9.63^{c}±0.26	7.35^{d}±0.06	nd	3.10^{ab}±0.10
2	$9.50c^{d}$±0.16	7.47^{cd}±0.12	nd	3.17^{a}±0.05
3	4.78^{g}±0.38	8.77^{a}±0.09	2.10`±0.10	2.34^{bc}±0.57
4	9.00^{c}±0.00	7.80^{c}±0.13	1.50^{d}±0.44	2.55^{abc}±0.66
5	10.15^{b}±0.14	8.88^{a}±0.01	3.30^{h}±0.26	2.40^{abc}±0.53
6	$9.27d^{e}$±0.15	7.64^{cd}±0.21	nd	2.16^{c}±0.12
7	11.05^{a}±0.04	8.70^{a}±0.26	3.70^{b}±0.62	2.45^{abc}±0.48
8	8.05^{f}±0.04	8.61^{a}±4 . 2 0	2.20^{c}±0.26	2.16^{c}±0.05
9	9.63^{c}±0.16	7.59^{cd}±0.19	3.20^{h}±0.17	1.94^{c}±0.10
10	3.05^{h}±0.04	7.58^{cd}±0.39	2.03^{c}±0.06	2.70^{abc}±0.51
11	10.01^{b}±0.01	8.28^{b}±0.13	4.60^{a}±0.46	2.48^{abc}±0.50
Lsdo 05	0.2833	0.3213	0.5052	0.6920
SE±	0.09661	0.1095	0.1722	0.2359

Mean±value(s) bearing different superscript(s) within columns are differing significantly (p≤0.05).
*= Sample number; **= (M±S.D) Mean±Standard Deviation; nd= Not determined
Shanan East = Sample No. 1 Badr1 = Sample No.2
Badr2 = Sample No.3 Badr3 = Sample No.4
Badr4 = Sample No.5 Mudtherl= Sample No.6
Mudther2 = Sample No.7 Sanosi2 = Sample No.8
Sanosi4 = Sample No.9 Shanan4 = Sample No.10
Gaafr = Sample No.11

3.1. Characteristics of MSKO

The lipids extracted from all samples were yellow and solid at room temperature. Which indicate the presence of various carotenoid pigments (Ravern and Evert, 1981).

As shown in table (2) the FFA of all samples were in the range from 0.1- 0.09% as oleic acid. This low free fatty acids indicated that mango seed oil was almost free from hydrolytic rancidity brought almost by lipases so enables the direct use of such oil in industries without further neutralization as described by Arogba (1997).

The PV determines the extent to which the oil has undergone rancidity, thus it could be used as an indication of the quality and stability of fats and oils (Ekwu and Nwagu, 2004). As presented in table (2), the PV ranged from zero to 0.6ml eq O_2/kgoil which indicate the oil has good quality. Ahmed *et al.*, (2007) reported FFA 1.22% as oleic acid and PV as 0.96ml eq O_2/kg oil For Egyptian mangos.

Table (2): Free fatty acids and peroxide value of oil samples

SN*	Free fatty acids (% as oleic acid) (M±S.D)**	Peroxide value (ml eqO2/ kg oil) (M±S.D)**
1	0.01±0.00^{c}	0.00^{d}±0.00
2	0.03±0.02^{c}	0.00^{d}±0.00
3	0.20±0.10^{ab}	0.40^{bc}±0.10
4	0.10±0.00^{bc}	0.10^{d}±0.10
5	0.30±0.10^{a}	0.60^{a}±0.10
6	0.01±0.00^{c}	0.00^{d}±0.00
7	0.10±0.00^{bc}	0.00^{d}±0.00
8	0.09±0:00^{bc}	0.30^{c}±0.10
9	0.06±0:01^{bc}	0.00^{d}±0.00
10	0.08±0.01^{bc}	0.00^{d}±0.00
11	0.20±0.20^{ab}	0.50^{ab}±0.10
Lsd $_{0.05}$	0.1312	0.1197
SE±	0.04472	0.04082

Mean ±value(s) bearing different superscript (s) within columns are differing significantly (p≤0.05).
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The IV of the samples was ranged from 36.20 to 52.2 Table (3). These agreed with Mohamed and Girgis, (2005), whom reported a range from 39 to 53 for IV. The results indicate that the oils of the samples were highly saturated and therefore not susceptible to oxidation. However, the oil could be classified as non- drying oils, since IV of all samples are lower than 100.

The SV of samples 1, 6 and 10 were matched with the results obtained by Nzikou *et al.*, (2010); Ahmed *et al.*, (2007) and Dhingra and Kapool, (1985) whom reported SV as 210.0, 192.16 and 207.5, respectively. Also samples 3, 5 and 10 reported SV lower than many publications and sample 7 reported SV higher than many other publications. Anyhow, the high SV suggests the use of the oil in production of liquid soap.

The USM of the sample ranged was higher than the results of Ahmed *et al* but lower than the value reported by Nzikon *et al.*, (2010). The slightly higher value of usm for the elevn samples may be due to extraction of lipid associated substances like, sterols, fat soluble vitamins, hydrocarbons and pigments (Bastic *et al.*, 1978 and Salunke *et al.*, 1992).

Table (3): Physiochemical characteristics of oil samples

SN*	Iodine value (Wij's) (M±S.D)**	Saponification Value (mgKOH/gof oil) (M±S.D)**	Unsaponifiable Matter (% of oil) (M±S.D)**	Melting point°C
Shanan East	40.20^{de}±0.10	200.60^{c}±0.55	2.80±0.10^{a}	30- 36
Badr1	43.60^{cd}±0.50	190.40^{d}±0.69	2.00±0.00^{h}	32- 34
Badr2	50.20^{a}±0.10	83.200^{g}±1.59	1.02±0.01^{i}	35- 40
Badr3	48.40^{ab}±0.40	189.50^{d}±1.59	3.55±0.01^{d}	35- 39
Badr4	nd	70.100^{h}±0.10	3.61±0.01^{c}	37- 44
6	36.20^{c}±0.58	192.50^{d}±3.58	3.90±0.01^{a}	32- 36
7	40.07^{de}±0.03	220.40^{a}±3.76	3.72±0.01^{b}	35- 40
8	nd	nd	3.11±0.01^{f}	39- 41
9	52.40^{a}±1.44	164.10^{c}±5.18	3.68±0.01^{b}	34- 44
10	38.70^{e}±1.21	205.50^{h}±5.66	nd	34- 37
11	45.40^{bc}±1.51	93.70^{f}±0.52	3.48±0.01^{a}	33- 37
$Lsd_{o.o5}$	4.359	4.857	0.05355	
SE±	1.486	1.656	0.01826	

Mean ± value(s) bearing different superscript (s) within columns are differ significantly ($p \leq 0.05$).
*= Sample number, **= (M±S.D) Mean± Standard Deviation
nd= Not determined
Shanan East = Sample No. 1 Badr1 = Sample No.2
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CONCLUSION

MSKO has good quality and could be recommended suitable for industrial usage. High usm content guarantees the use of the oils in cosmetics industry the observations in this study are useful in commercial processing of mango fruits and utilization of mango kernel fat and meal. Our results in this study showed that physiochemical characteristics of msko similar to other commercial edible oils and has good quality, so it can be considered as a new and valuable source of edible oil. This base- line information would assist potential commercial handles of msko. Although more research is needed, the Sudanese msko as waste seems promising as a new and valuable source of edible oil.

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