Technology Section

Pakistan J. Sci. Ind. Res., Vol. 24, No. 1, February 1981

THE RECOVERY AND EVALUATION OF MANGO STONE KERNEL FAT

M.Y. Raie, Manzoor Ahmad S.A. Khan and M.K. Bhatty

PCSIR Laboratories,Lahore

(Received January 19, 1980; revised June 21, 1980)

A technique for processing mango kernel fat from mango fruit is described. After removal of the fruit pulp the stones are dried, subsequently disintegrated in a locally designed and fabricated disintegrator, after which the kernel are separated from the shells. The fat is extracted from the powdered kernels with hexane. The average fatty acid composition of the fat of seven local varieties was determined by GLC to be C16:0 (10.7%) C18:0 (47.8%) C18:1 (37.2%) and C18:2 (4.3%).

INTRODUCTION

There is an acute shortage of edible and industrial fats in Pakistan, the quantity of edible oil imported in 1977-78 was 2,70,000 tons [1] to meet the demand of the country. Pakistan Council of Scientific and Industrial Research has initiated a programme of research indicating various wastes and bye-products of agriculture and industry which are potential sources of oils and fats. Efforts have been made to investigate new oil-bearing seeds of better quality and utilisation of waste materials like rice bran [2,3] peelu seeds [4] and mango stone kernels [5] as a source of oils and fats.

Keeping in view the shortage of oils and fats in the country, recently thorough studies have been carried out, for the first time, on the processing of mango stones for fat by the application of a locally designed and fabricated disintegrator on the physicochemical characterization of the fat and on the determination of its fatty acid composition. The fat contents of the dried kernels of seven varieties of Pakistani mango fruit [6] known as langra, ungrafted varieties (Desi), Anwar Retaul, Sindhri, Samar Bahisht Chaunsa, Dusehri Aman and Soharani have been determined. According to one of the reports [7] the production of mangoes in Pakistan is 600950 metric tons. So it has been estimated that 1622 metric tons of fat worth Rs. 16.22 million could be produced.

MATERIALS AND METHODS

1. *Processing of Mango Fruit for Fat*

1.1 *Processing of the Fruit.* About 4 kg of mango fruit (equal weights of each variety studied) was processed for fat. After removal of the fruit pulp and the skin, the mango stones were washed to remove unwanted material and dried in the sun. The stones were disintegrated and kernels were separated from the shells by sieving vibrator. The pieces of kernels were powdered and extracted with hexane.

1.2 *Disintegration and Separation of Hulls and Kernels.* A locally designed and manufactured disintegrator (Fig. 1) was used for crushing of the mango stones, the hourly capacity being 58 kg/hr. The crushed kernels were separated from the hulls, dried in the sun and powdered.

1.3 *Extraction of the Oils.* About 100 g of powdered mango stone kernels was extracted in soxhlet with re-distilled hexane. The oil was dried over sodium sulphate, and filtered. Hexane was distilled off to get a yellow coloured fat which was stored under nitrogen [8].

2. *Characterisation of the Mango-kernel Fat*

2.1 *Physicochemical Characterisation.* Physicochemical characteristation was carried out according to the procedure given by Cocks and Van Rede [9].

2.2 *Saponification, Methylation and GLC.* The fatty acid composition of the mango stone kernel fat was determined by analysis of the methyl esters by GLC. Saponification of the fat and methylation of the fatty acids was carried out as described earlier [9,10,11]. The GLC was carried out using a column (152.4 cm x 0.95 cm) at 200°, prepared by coating polyethylene glycol succinate 10% on diatomite 'C' (80-100 mesh), and a Pye Unicam 204 series

Table 1. Names of local varieties and their fat percentage.

Varieties of mangoes	Percentage of fat on the weight basis of dried kernel
Langra	9.8
Ungrafted varieties (desi)	12.6
Anwar retaul	12.0
Sindhri	12.1
Samar bahisht chaunsa	7.9
Dusehri aman	12.7
Soharani	8.5
Average	10.8

kernels (wet and dried) and fat on the weight-basis of the preceding products and of mangoes respectively (Table 2). The percentage of fat (0.33%) and (10.8%) was based on the weight basis of mangoes and of the preceding products (dried kernels), respectively.

In Table 3 is given the physicochemical characterisation of a sample of mean composition, obtained by taking an equal weight of each species. The low iodine value (41.0) indicates a relative high saturated fatty acid content. The saponification value (193) gives an idea of the mean chain length of the fatty acids which is compatible with the composition of the fat due to the presence of the constituting acids having the chain length C16:0 – C18:0.

In Table 4 the fatty acid composition of sample of mean composition is given as determined by GLC and compared with a previous study by Narassimha *et al.* [5]. The small differences in fatty acid composition may be

Table 2. Average Percentage of of various products of seven species of mangoes (4000 g).

Sl. No.	Products	Wt. (g)	Percentage on the weight basis of the preceding products	Percentage on the weight basis of mangoes	Products counting for percentage composition.
1.	Fruit and skin	3519	88.0% of mangoes	88.0	88.0
2.	Stones (wet)	481	13.7% of fruit and skin.	12.0	–
3.	Stones (dried)	250	51.9% of wet stones	6.2	–
4.	Moisture	231	48.0% wet stones	5.8	5.8
5.	Hulls	91	36.4% of dried stones.	2.3	2.3
6.	Kernels (wet)	159	63.6% of dried stones	3.9	–
7.	Kernels (dreid)	122	76.7% of wet kernels	3.0	3.0
8.	Moisture	37	23.3% of wet kernels	0.9	0.9
9.	Fat	13.18	10.8 of dried kernels	0.33	–

GLC. Nitrogen was used as a carrier gas at a flow rate of 40 ml/min.

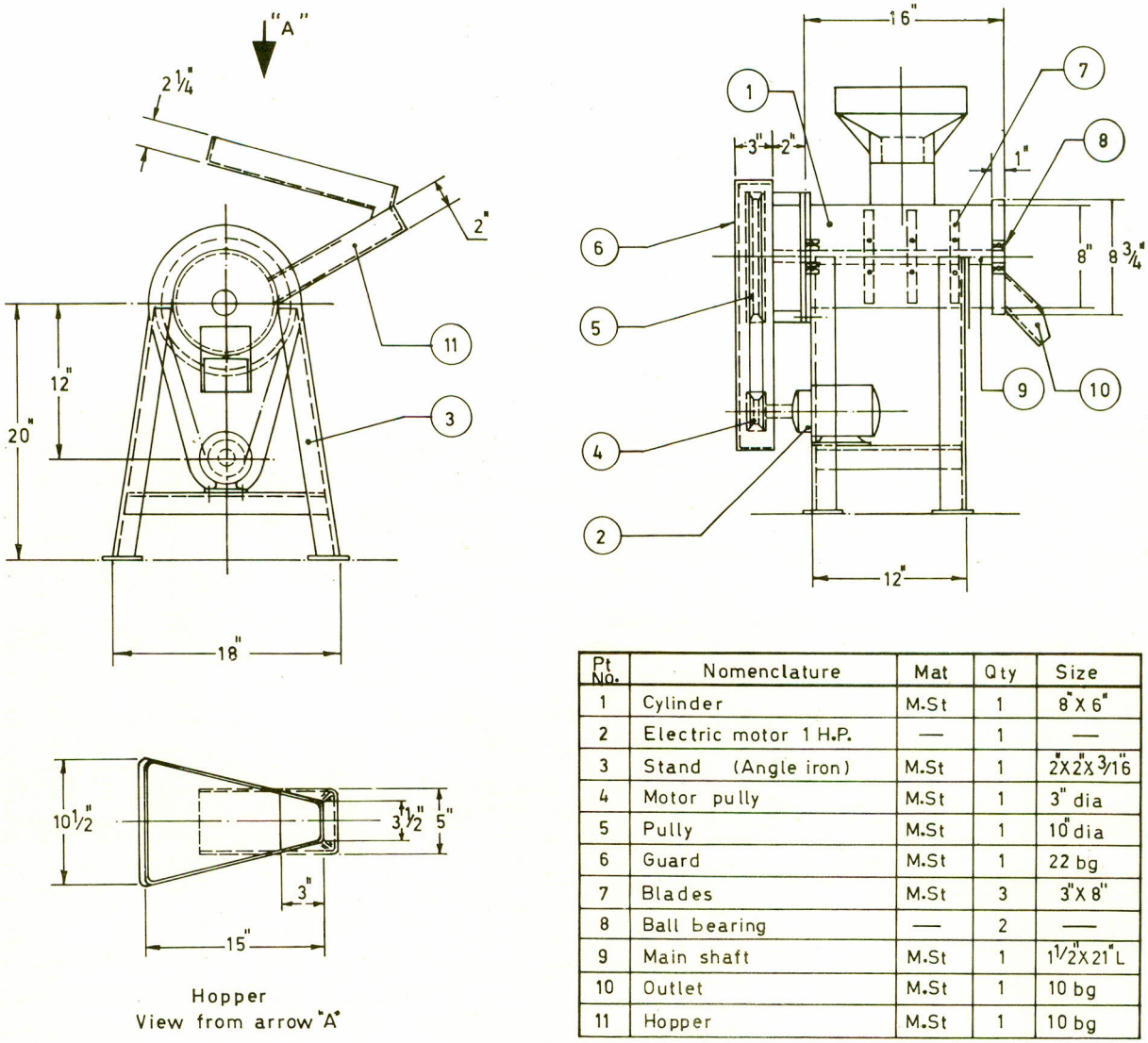
RESULTS AND DISCUSSIONS

The fat content of the seven well known varieties of Pakistani mangoes (Langra, Desi, Anwar Retaul, Sindhri, Samar Bahisht Chaunsa, Dusehri Aman and Soharani) were determined on the basis of kernels and are given in Table 1.

The total weight of the seven species was made up by taking an equal weight of each species to calculate the percentage of fruit and skin, stones (dried and wet), hulls.

Table 3. Physicochemical characterization of fat from mango stone kernel.

1.	Iodine value	41.0
2.	Slip point	25-26°
3.	Ref. index at 40°	1.4623
4.	F.F.A. as oleic	7.1%
5.	Unsaponifiable	1.10%
6.	Moisture content	0.15%
7.	Sap. value	193



Pt No.	Nomenclature	Mat	Qty	Size
1	Cylinder	M.St	1	8"X 6"
2	Electric motor 1 H.P.	—	1	—
3	Stand (Angle iron)	M.St	1	2"X2"X 3/16"
4	Motor pully	M.St	1	3" dia
5	Pully	M.St	1	10" dia
6	Guard	M.St	1	22 bg
7	Blades	M.St	3	3"X 8"
8	Ball bearing	—	2	—
9	Main shaft	M.St	1	1½"X21"L
10	Outlet	M.St	1	10 bg
11	Hopper	M.St	1	10 bg

Fig. 1. Mango stone desintegrator.

attributed to the growth conditions, climatic and varietal differences in the parent trees.

Table 4. The fatty acid compositon of mango kernel fat by GLC.

S.No.	Methyl esters	Present study %	Narassimha [5] %
1.	C_{16}:O	10.7	8.6
2.	C_{18}:O	47.8	42.2
3.	C_{18}:1	37.2	45.8
4.	C_{18}:2	4.3	3.4

REFERENCES

1. The Pakistan Times (18th March, 1978).
2. M.Y. Raie and M.A. Saeed, CENTO Scientific Programme Panel on Regional Problems of Edible Oil and Fats held at Lahore, December 9-11 (1975).
3. M.Y. Raie, S.A. Khan, M.A. Saeed and M.K. Bhatty (Pak. Patent No: 126263, 25th June, 1978).
4. S.A. Khan, M.I. Qureshi, M.K. Bhatty and Karimullah, Pakistan J. Sci. Ind. Res., **13**, 41 (1961).
5. B.L. Narasimha, B.R. Reddy and S.D. Thirumala Rao. J. Am. Oil, Chemists Soc., **54**, 494 (1977).
6. *A Treatise on Horticulture* (Bureau of Agriculture Information, Publication Division, Department of Agriculture, Lahore, Government of Pakistan 1968) p. 167.

7. Food and Agriculture Division (Planning Unit), Ministry of Food Agriculture and Cooperatives, Agricultural Statistics of Pakistan, 1976, Islamabad, Government of Pakistan.
8. M. Latif Iqbal, M.Y. Raie, Darbar, H. Gilani, and M.K. Bhatty, Pakistan J. Sci. Ind. Res., **20**, 124 (1977).
9. L.V. Cocks and C. Van Rede, *Laboratory Hand Book for Oils and Fats Analysis,* (Academic Press, London and Newyork, 1966) p. 118
10. R.J. Hamilton, M.Y. Raie, I. Weatherstone, J. Am. Oil Chemists Soc., **53**, 748 (1976).
11. R.J. Hamilton, M.Y. Raie, I. Weatherstone, C.J. Brooks and Juliet Borthwick Jr., Chem. Soc. Perkin Transaction, **1**, 354 (1975).