Pakistan J. Sci. Ind. Res., Vol. 29, No. 3, June 1986

THE FATTY ACIDS OF INDIGENOUS RESOURCES FOR POSSIBLE INDUSTRIAL APPLICATIONS

Part IX. Chemical Investigations of *Prunus armeniaca* (Apricot) Fruit Stones – Kernel Oils

Muhammad Rafique, F.M. Chaudhary and S.A. Khan

PCSIR Laboratories, Lahore-16

(Received July 6, 1985)

The chemical composition of two samples of fatty oil as well as essential oil of apricot (*Prunus armeniaca*) fruit stone kernels has been determined. The fruit stones were obtained from the northern and southern areas of Pakistan, Peshawar and Quetta. The oil from the kernels of the respective samples obtained in 45.9 and 45.7 % yield, is composed of myristic (1.2, 5.39 %), palmitic (3.5, 3.04 %), palmitoleic (9.48, 11.07 %), stearic (0.84, 1.95 %), oleic (70.93, 64.68 %), linoleic acid (12.05, 11.83 %) and unsapoifiable matter (1.88, 2.02 %).

INTRODUCTION

Apricot trees (*Prunus armeniaca*) and (*Prunus domestica*) grow abundantly in the northern as well as the southern regions of Pakistan. These fruit trees grow from plains to an altitude of 3000 meters (Himalayas, Kilba range forest [1], Bashar, Gilgit Agency and Ziarat). The trees bear fruits in May-October depending upon the climatic region in which they grow. The pulpy portion of the ripened fruit contains (7.5 – 10.5 %) sugar [2]. The ripe fruits also contain almond like seed stones which are dicotyledonous. The seed kernel is generally consumed as an item of food along with other dry fruits.

In a recent survey it has been estimated that 43,700 tons [3] of apricot fruit were produced during 1982-83. In the northern areas of the country, particularly, apricot kernels are not only consumed as an article of food but also expressed in a primitive manner to obtain edible oil. In continuation of the earlier studies [4-11], aiming at screening of indigenous sources the kernel oil from *Prunus armeniaca* has now been evaluated. The evaluation of the oil from *Prunus domestica* has already been reported [12]. It has been estimated that almost 500 tons of the edible oil can be obtained from this source alone provided the kernel is suitably expressed to obtain the oil. Additionally 18 tons of benzaldehyde can also be recovered from the same kernel by steam distillation. It is, therefore, seen that apricot stones can be a good source of an edible oil and an aromatic essence and the seed meal can afterwards be used as an item of food.

MATERIALS AND METHODS

Fruit stones obtained from Food Processing Industries (FPI), Peshawar and fruit obtained from Quetta region were broken separately, The kernels were separated and crushed in an iron pestle mortar. The crushed kernels (100 g each) were extracted with petroleum ether (b.p. 40-60°) in a Soxhlet apparatus for 4 hr. The oil was dried over anhydrous sodium sulphate, filtered and the petroleum ether was distilled off to get pale yellow oils (45.9 g and 45.7 g respectively). Various characteristics of the oils, as determined by standard physico-chemical methods [13, 14], are given in Table 1.

Table 1. Physico-chemical characteristics of the oils.

Source		Peshawar	Quetta
1.	Percentage yield of kernels	32.07	27.3
2.	Percentage yield of oil	45.9	45.7
3.	Refractive Index at 25° (Abbe)	1.4710	1.4702
4.	Acid value	1.6	1.6
5.	Saponification value	187.7	187.25
6.	Iodine value	92.36	93.5
7.	Maleic anhydride value	6.8	5.7
8.	Sp. gravity at 25°	0.9192	0.9192

Saponification of the oil, liberation and methylation of the fatty acids. The oils (2 g each) were saponified separately with 0.5N ethanolic sodium hydroxide solution (20 ml

each) under reflux for ½ hr. The fatty acids were liberated from the saponified mass by 2N sulphuric acid (1.962 g, or 98.1 % and 1.9596 or 97.98 % respectively). The liberated acids were converted to their methyl esters by reacting with methanol in the presence of concentrated sulphuric acid.

i. Spectrophotometry and chromatography of the methylated acids. The purity of the fatty acid methyl esters was checked by infrared spectrophotometer (Beckman-18 Model 5A) at 1380 cm^{-1} (CH_3 bend), 1460 cm^{-1} (CH_2 bend), 2860 cm^{-1} (CH_3 stretch), 2940 cm^{-1} (CH_2 stretch) and 1760 cm^{-1} (C = 0 stretch).

ii. *Gas chromatography* [15]. Methyl esters of the total fatty acids were analysed on a Pye Unicam 104 gas chromatograph with a flame ionization detector using ¼" i.d. 4 ft glass column of 10 percent diethylene glycol succinate, coated on 80-100 mesh celite, column temp. 160°, injection temp. 200°, detector temp. 250° and with nitrogen as the carrier gas at a flow rate of 30 ml/min. The methyl esters were indentified by comparing their retention times and co-injection of standard esters. The percentage of various acids was determined using Pye Unicam DP 88 computing integrator and are recorded in Table 2.

Recovery of Benzaldehyde [16]. Apricot kernels meal (865 and 1285 g) respectively obtained from the samples from Peshawar and Quetta region was macerated with ten parts of water for about 12 hr. at temperature ranging from 50° to 60°. The emulsin, thus set free, hydrolysed the glycoside amygdalin to yield the benzaldehyde.

$$C_{20}H_{27}NO_{11} + 2H_2O \rightarrow C_6H_5CHO + HCN + 2C_6H_{12}O_6$$
(amygdalin)

The mass was cohobated to get volatile oil consisting entirely of benzaldehyde (8.82 g, 1.02 % and 15.93 g, 1.24 %). The oil was freed from hydrocyanic acid by adding sodium sulphite and redistilling the oil.

RESULTS AND DISCUSSION

The fatty oil from kernels was obtained by solvent extraction and the fatty acids from two samples obtained from Peshawar and Quetta were obtained by saponification. The low saponification value (187.25 and 187.7) of the oils indicate the presence of fatty acids having long-carbon chain. The oil contains a high proportion of unsaturated acids (iodine value, 92.36 and 99.5). The maleic anhydride value (6.80 and 5.7) predicts the presence of a low percentage of acids having conjugative structure. The methyl esters of the total fatty acids were subjected to gas chromatography and were found to consist of myristic acid, palmitic acid, stearic acid, palmitoleic acid and oleic acid (Table 2). The major constituents of the two oil samples is oleic acid (70.93 and 64.68 % respectively). Oleic and linoleic acid contents of the two apricot-kernel oils are in close agreement with those of almond oil [17] and Olive oil [18]. Thus apricot kernel oil can be a good supplement of almond oil as well as of olive and can be used for edible purposes.

After removing the fattty oil from the crushed kernels meal the mass was macerated and then steam distilled. Benzaldehyde thus obtained was treated with sodium sulphite and redistilled to get Hydrocyanic acid free natural benzaldehyde (yield, 1.13 %) which has its own undisputable place in food and cosmetic industry.

Table 2. Percentage of various acids present in the fatty portions of apricot oils.

Source	Myristic acid (5)	Palmitic acid (%)	Palmitoleic acid (%)	Stearic acid (%)	Oleic acid (%)	Linoleic acid (%)
Peshawar	1.2	3.5	9.48	0.84	70.93	12.05
Quetta	5.39	3.04	11.07	1.95	64.68	11.83

REFERENCES

1. R.N. Parker, *A Forest Flora for the Punjab with Hazara and Delhi* (Government of Pakistan Printing Press 1956) 3rd ed., p. 205.
2. V.I. Nilov and O.N. Palvenko, Biokhim, Kul, tur, Raslenii, 7, 208-16 (1940) C.A. 35, 2926.
3. Agricultural Statistics of Pakistan, Govt. of Pakistan, Ministry of Food Agriculture Co-operatives, Food and Agriculture Division, Islamabad, 97, (1983).
4. M. Salim, M. Ashraf, S.A. Khan and M.K. Bhatty, Pakistan J. Sci. Ind. Res., **9**, 347 (1966).
5. Muhammad Ashraf, S.A. Khan M.K. Bhatty, Pakistan J. Sci. Ind. Res., **14**, 399 (1971).
6. M.A. Javed, S.A. Khan, M.I. Qureshi and M.K. Bhatty, Pakistan J. Sci. Ind. Res., **15**, 247 (1972).
7. S.A. Khan M.I. Qureshi and M.K. Bhatty, Pakistan J. Sci. Ind. Res., **15**, 402 (1972).

8. M. Saleem, M. Sarwar, S.A. Khan, and M.K. Bhatty, Pakistan J. Sci. Ind. Res., **20**, 405 (1975).
9. M. Salim Din Mohammad, Manzoor Ahmed, M.Y. Raie, S.A. Khan and M.K. Bhatty, Pakistan. J. Sci. Ind., Res., **24**, 21 (1981).
10. S.A. Khan, Din Mohammad, J.I. Khan, and M.K. Bhatty, Pakisatan J. Sci. Ind. Res., 28, **27** (1984).
11. S.A. Khan, Khizar Hayat Khan, Shahina Zaka, Imran Waheed, M.Y. Rai and M.K. Bhatty, Pakistan J. Sci. Ind. Res. (In Press).
12. S.A. Khan and M.K. Bhatty, Pakistan J. Med. Res. No. 2, **5**, 169-175 (1966).
13. J. Devine and R.N. William, "*Edible Oils and Fats*" (Pergamon Press Oxford, London. Paris, New York, 1981), 1st ed. pp. 127-30.
14. K.A. William, "*Oils, Fats and Fatty Foods*", (J.A. Churchill Ltd., 1966). 4th ed., pp. 95, 123, 132-3, 137, 139.
15. A.I.M. Kulemans, "*Gas Chromatography*" (Reinhold Publishing Crop., New York, (1959). 2nd ed. p. 27.
16. E. Guenther, *The Eessential Oils*, (D. Van Nostrand Co., Toronto, New York, London, 1952). **5**, p 49.
17. T.P. Hilditch, P.N. Williams. *The Chemical Constituents of Natural Fats* (Chapman & Hall, 1964), 4th ed. p. 447.
18. *Idem, Ibid.*, 1. 196 (1964).