COMPOSITION OF MAZRI (NANNORHOPS RITCHIEANA) SEED OIL

IHSAN-UL-HAQUE, M. I. QURESHI, M. K. BHATTY AND KARIMULLAH

West Regional Laboratories, Pakistan Council of Scientific and Industrial Research, Lahore

(Received August 23, 1962)

Mazri seeds have been analysed for their oil, proteins, ash, moisture, fibre and carbohydrate contents. Various physicochemical characteristics of mazri seed oil have been determined. Saturated acids have been identified to be capric, caprylic, caproic and lauric acids while the unsaturated acids include C_8, C_{10}, C_{12} acids. Their relative amounts have been determined by means of vapour phase chromatography.

Nannorhops ritchieana N.O. Palmae, locally known as mazri, grows wild in the arid and semiarid zones of West Pakistan, especially in the districts of Dera Ismail Khan, Dera Ghazi Khan and parts of the former Sind and Baluchistan provinces. The leaves of the shrub find use in the cottage scale production of mattings, bags, baskets, fans, etc. Mazri leaves are used in diarrhoea and dysentery and also find application in veterinary medicine.[1]

Present investigations deal with our attempts at the proper utilization of mazri seeds which do not so far find any use and are a complete waste. The seeds are hard, stone-like spherical nuts having 1.3-2 cm. diameter. The yield of the seed per tree varies from 3-4 lbs. per annum. Keeping in view the abundance of the seeds, studies have, been pursued, first of all, to understand the chemistry of these seeds. Our first step in this direction has been the study of the chemical composition of the seed oil which constitutes over 10% of the total seeds.

Experimental

The seeds, being very hard, were crushed first in a jaw crusher and then pulverised in an iron pestle and mortar. The meal was then extracted with petroleum ether (62-82 °C.) in a Soxhlet apparatus. The extract, after drying with anhydrous sodium sulphate and filtering, was freed of the solvent on a water bath under reduced pressure.

Physical characteristics and chemical values of the oil were determined by the standard methods.[2,3]

Physicochemical Characteristics of the Oil.—Refractive index, 1.454 at 31.5 °C.; specific gravity, 0.94208 at 36.5 °C.; colour (Lovibond tintometer), 7.9 Y & 1.7 R; saponification value, 259.9; iodine value, 8.6; acid value, 0.186; R.M. value, 2.09; Polenske value, 9.50; Kirschner value, 0.309; Hehner value, 90.5%; saturated acids, 85%, and unsaturated acids 15% of the total acids; and nonsaponifiable matter, 0.997%.

Resolution of the Oil into Various Acid Fractions.—The oil was saponified with 0.5 N alcoholic potassium hydroxide under reflux with occasional shaking for 4 hours. The alcohol was distilled under reduced pressure. The residual soap was diluted with water and extracted with diethyl ether to remove the nonsaponifiable matter (0.997%). Fatty acids were recovered by splitting the soap with dilute hydrochloric acid and then extracting with diethyl ether. After washing the fatty acids free of mineral acids, and after removal of the solvent, the acids were weighed and found to form 90.5% of the oil. They were next separated into saturated and unsaturated acids by Twitchel's lead salt alcohol method as adopted by Hilditch.[4] Saturated and unsaturated acids were found to be 85% and 15%, respectively.

The saturated acids, after esterification with methanol and sulphuric acid, were injected into Griffin and George vapour phase chromatograph, packed with celite (30-80) and coated with silicone elastomer (E301) at 200°. Four clear peaks were obtained. The esters of the unknown fatty acids characterised by these peaks were then identified by the method of addition of supposed constituents.[5] The percentage amounts of the individual acids were determined by calculating the areas under the peaks, and are noted as follows:

Capric acid	=	0.43%
Caprylic acid	=	23.39%
Caproic acid	=	21.40%
Lauric acid	=	54.70%

The unsaturated acids obtained by the lead salt method were esterified (methanol + H_2SO_4) and then again run through the vapour phase chromatograph and four peaks were obtained.

The unsaturated acids were hydrogenated over Raney nickel in a Parr medium pressure apparatus.[6] The hydrogenated acids were shown to have been completely saturated by determining their iodine value (0.05) and run through vapour phase chromatography which revealed the presence

of C_8, C_{10} and C_{12} esters only. Two unsaturated acids are, therefore, of the same chain-length, as the fourth peak, due to hydrogenation of the unsaturated acids, had disappeared.

The percentages of the unsaturated acids calculated as before are given below:

Unsaturated acids of C_8 series	=	7.6%
Unsaturated acids of C_{10} series	=	69.5%
Unsaturated acids of C_{12} series	=	22.9%

The overall analysis of fatty acids is given in the following:

Capric acid	=	0.30%
Caprylic acid	=	19.90%
Caproic acid	=	18.20%
Lauric acid	=	46.60%
Unsaturated acids of C_8 series	=	1.15%
Unsaturated acids of C_{10} series	=	10.42%
Unsaturated acids of C_{12} series	=	3.43%

The composition of the seed was determined according to the standard methods, and is presented in the following:

Oil	=	10.6 %
Fibre[7]	=	4.18%
Proteins	=	7.0 %
Moisture	=	4.63%
Ash	=	7.03%
Carbohydrates	=	66.56% (by difference).

The ethanolic extract (95%) of the defatted seeds was found to contain about 1% of sucrose which was identified by conversion to its octaacetate (m.p. 89 °C. which was undepressed by admixture with a known sample).

Discussion

The oil is non-drying and has been found to contain lauric acid predominantly. It is, therefore, much suited for making good quality soap. There are, however, certain factors which are likely to hamper its industrial utilization. The seeds are extremely hard and very difficult to crush. Solvent extraction of the oil is the only method which seems practicable. This factors alone will make its large scale utility rather doubtful. Further, because of the low molecular weight fatty acids, the yield of soap is always low. Obviously a high proportion of such acids in the mazri seed oil is disadvantageous from the soap production point of view. Furthermore, even if soap is produced with this oil, the product might not be acceptable because of the fact that soaps of short chain fatty acids are irritant to the skin.

The individual fatty acids in the oil have been determined by the application of vapour phase chromatography which has now come to be regarded as the most versatile technique. Various workers have established the accuracy of this technique and it can be safely assumed that results presented here are fairly reliable.

Not much work has yet been done on the oilseed cake. However, if the cake can be found of some value, which may be realised from the nature of its carbohydrates, it might be possible that an utter waste product in the country finds a useful application. The study of the chemistry of the seed carbohydrates is in hand and results will be communicated in due course.

Acknowledgement.—Thanks are due to Mr. Iftikhar Ahmad and Mr. Nasir Ahmad Mirza for help and useful suggestions.

References

1. K. R. Kirtikar and B. D. Basu, *Indian Medicinal Plants* (Lalit Mohan Basu, Allahabad India, 1933-35), Vol. IV, second edition, pp. 2566-2567.
2. *Official Methods of Analysis of A. O. A. C.*, 8th edition (1955), pp. 462-467.
3. K. A. Williams, *Oils, Fats and Fatty Foods* (J. & A. Churchill Ltd., London, 1950), third edition, pp. 76-111.
4. T. P. Hilditch, *Chemical Constitution of Natural Fats* (Chapman & Hall Ltd., London, 1956), third edition, p. 574.
5. A. I. M. Keulemans and C. G. Verver, *Gas Chromatography*, (Rheinhold Publishing Corporation, Chapman & Hall Ltd., London), second edition, p. 27.
6. I. Arthur Vogel, *A Textbook of Practical Organic Chemistry including Qualitative Analysis* (Longmans, Green & Co., Ltd., London, 1956), third edition, pp. 866-874.
7. V. C. Mehlenbacher and T. H. Hopper, *Official and Tentative Methods of the American Oil Chemists' Society*, second edition, A.O.C.S. Official Method No. Ba 6-49.