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THE FATTY ACIDS OF INDIGENOUS RESOURCES FOR POSSIBLE INDUSTRIAL APPLICATIONS

Part III. Investigation of Peganum harmala Linn Seed Oil

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Abstract. *Peganum harmala* Linn seeds have been shown to contain 12–14% of an oil. Vapour phase chromatographic analysis of this oil has shown that it is composed of the glycerides of oleic, linoleic and stearic acids with minor amounts of palmitic, palmitoleic and linolenic acids.

Peganum harmala Linn (N.O. Rutaceae), locally known as harmal, is a bushy herb, 1–3 ft in height and growing wild in all the provinces of West Pakistan. It is also distributed in other parts of the world particularly Arabia and Spain.[1]

No statistical data are available to show the extent and potential of the seeds that can be collected from this herb. However, it is known that during the summer months considerable quantities of the seed are collected by the village folks. These seeds are used in an indigenous system of medicine and their extract is also used as a red dye. So far the seeds have never been evaluated for their oil contents. In continuation of our previous publications, the present communication, therefore, deals with this aspect and its chemical composition.[2,3]

After having determined the chemical composition of this oil it was considered worthwhile to investigate its application as an edible oil. Experiments performed on rats in these Laboratories indicate that this oil has no toxic effects when fed in place of any other edible oil.

Experimental

The harmal seeds were crushed in a pestle and mortar and exhaustively extracted with petroleum ether (b.p. 60–80°C) in a soxhlet apparatus. The extracts were dried (Na_2SO_4) and then filtered. From the filtrates the solvent was removed under nitrogen atmosphere and reduced pressure to yield a transparent, yellow oil (12–14%). Various physical properties and chemical characteristics of this oil as determined by standard methods[4] are: refractive index at 35°C, 1.464; specific gravity at 35°C, 0.5906; saponification value, 178.8; iodine value, 123.7; acid Value, 6.0; maleic anhydride value, 2.6; saturated acids, 7.0%; unsaturated acids, 93.0%; unsaponifiable matter, 5.5%.

Neutralisation of the Oil. The oil (10.0 g) was dissolved in chloroform (40 ml) and then passed through a column of activated alumina (12 g) (May & Baker). The solvent was removed from the eluates (750 ml) and the residual neutral oil was kept under nitrogen at 0°C.

Component Acids of Peganum harmala *Seed Oil.*

The oil was saponified with 0.5N alcoholic KOH under reflux with occasional shaking for 5 hr. The alcohol was removed under reduced pressure and the soap was dissolved in water and extracted with diethyl ether to remove the nonsaponifiable matter. The fatty acids were recovered by splitting the soap with dil H_2SO_4 (4N) and then extracted with ether. The ether extracts were washed with water, dried and then freed from the solvent under nitrogen and kept at 0°C.

The fatty acids were esterified with methanol in the presence of H_2SO_4. Alternatively the natural triglycerides were also refluxed with a solution of sodium (0.1%) in methanol for 5 min. The mixture, when cold, was poured in cold water and extracted with ether. The solvent on removal, yielded methyl esters.

Methyl esters, prepared by both the procedures, were analysed quantitatively on a W.G. Pye Model 104 gas chromatogram units fitted with hydrogen flame ionisation detector. Standard glass column (5 ft long and $\frac{1}{4}$ in dia), packed with a Gas Chrom Z support (60/80 mesh) coated with 15% diethyl glycol succinate as a stationary phase was employed. The column was operated at 190°C with nitrogen as carrier gas at a flow rate of 140 ml/min. The identity of the fatty acids was established from the plot of the retention time versus the carbon number of the standard mixture of myristic, palmitic, oleic and linoleic acid methyl esters. The percentage of the fatty acids was measured by the triangulation method and are: palmitic 16:0, 5.67; stearic 18:0, 0.66; palmitoleic 16:1, 0.67; oleic 18:1, 33.07; linoleic 18:2, 58.84; linolenic 18:3, 1.09.

Discussion

The harmal seed oil has been shown to be semidrying in nature with linoleic and oleic acids as the major constituents (93%) and stearic and palmitic acids as the minor components (7%). This composition compares favourably with such commonly cultivated and commercially exploited seed oils as tobacco, saflower and sunflower.[5] In all such oils the saturated acids are present in rather small amounts (9–13%). (Table 1). In view of this harmal seed oil can be used as a substitute for these oils as salad and cooking oil.

TABLE 1. COMPONENT ACIDS (wt%) OF TOBACCO, SAFLOWER AND SUNFLOWER SEED OILS.[5] (U.S.A. origin)

Name	T. Satd	Unsatd	Oleic	Linoleic
Tobacco	8.4	91.6	17.1	74.5
Saflower	9.0	91.0	13.0	78.0
Sunflower	9.12	88.91	21.40	51.68

Small amounts of the harmal oil have been subjected to hydrogenation in these laboratories and it has been found that the hydrogenated product has properties similar to most of the commonly available Vanaspati products. A laundry soap prepared from this oil also showed good performance when tested in composition with any of the common brands. As such this oil is not suitable for use in paints. However, it may prove to be a good material for the manufacture of oil modified alkyl resins and other similar products.

Harmal seeds are thus a rather interesting source of a good quality semidrying oil that can find many useful applications. It is, therefore, suggested that efforts be made to cultivate this herb and extract a valuable commodity from its seeds.

In view of the serious shortage of vegetable oils in the country tapping of such a source, though unconventional, is essentially called for.

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