Fenugreek Seed Oil

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FENUGREEK (*Trigonella foenum graecum L.*), known also as Greek hay and, in German, Bockshornklee, is a member of the Leguminosae family which, in one form or another, has filled for centuries some pharmaceutical, medicinal or alimentary need of man. In this instance its first recorded use[1] occurred some time during the first century for it was then that Dioscorides, a Greek herbalist, had recommended that poultices be made of the crushed seeds. The Arabs, too, are credited with an early use of the several parts of this plant and countless aromatic fenugreek preparations in the older literature of India attest to its long-time popularity in this country. It is cultivated in France and Germany for its seeds, which have a strong, peculiar odor and an oily, somewhat farinacious taste. They contain saponifiable and volatile oils, mucilaginous material, bitter extractives, a yellow coloring matter, and the bases, choline and trigonelline.

In Europe the seeds are employed in the preparation of poultices, enemata, ointments, and plasters. Ground up they are much used in the manufacture of cattle or conditions powders. For human consumption they form part of the condiment known as curry powder, and most formulæ for the preparation of imitation maple flavors contain, along with numerous other ingredients, a fluid extract of these seeds.

The fatty oil has been little examined. It was probably first studied by Grimme in 1911[2]. The best information to date is, in substance, that quantitatively palmitic and linoleic predominate here over oleic and linolenic acids. We have extended the list of chemical constants of the oil and have obtained evidence which indicates that the elaboration of saturated fatty acids in this oil has not ended with palmitic but has continued by even steps in unbroken succession to behenic acid. Chemical tests do not indicate that this oil holds much promise, if any at all, as a source of vitamin A.

For this investigation 50 lb. of cleaned, washed seeds were extracted with low-boiling petroleum ether. A yellow oil (30 yellow, 5 red in Lovibond units) was obtained in 6.7 per cent yield. Its physical and chemical constants are given in Table I together, for purposes of comparison, with those previously reported by others.

TABLE 1.—ANALYTICAL CONSTANTS OF FENUGREEK SEED OIL

	New data	Older data	
Specific gravity 25°/25°	0.9219	0.9280	0.9471[1]
Refractive index 25°	1.4789	1.4738[2]	1.4774[3]
Iodine number (Wijs)	158.4	81.9	137.8
Saponification number	184.6	183.4	189.5
Reichert-Meissl number	0.20	.....	1.5
Polenske number	0.22	.....	.....
Hydroxyl number	3.2	.....	.....
Acid number	2.4	.....	.....
Insoluble acids (Hehner number)	88.21	94.7	93.8
Soluble acids *pct.*	0.78	.....	.....
Saturated acids *pct.*	11.37	.....	.....
Unsaturated acids			
content *pct.*	77.11	.....	.....
iodine number	176.9	.....	.....
thiocyanogen number	100.1	.....	.....
Unsaponifiable matter pct.	3.75	2.6	0.9

[1] at 15°.
[2] at 30°.
[3] at 22°.

Saturated Acids

The saturated acids, separated from the unsaturated group by a modified Twitchell method, were converted into their methyl esters. These were then fractionally distilled under diminished pressure in the usual manner. Three sharply defined fractions were obtained besides the inevitable residue. The latter, after hydrolysis, was separated into four fractions by crystallization from ethyl alcohol under varying conditions of temperature and dilution of solvent. From the analysis of the aforesaid fractions and crystal crops, it was calculated that the approximate composition of the saturated acid fraction of this oil, based upon the weights of esters and acids recovered is palmitic 6.46 per cent, stearic 21.5 per cent, arachidic 8.5 per cent, and behenic 5.3 per cent.

Unsaturated Acids

Representatives of the three common types of unsaturated fatty acids were identified by means of their bromo derivatives which, after isolation in the usual manner, were characterized from halogen content and melting point. The residual bromide in the scheme of separation employed was an oily liquid, the chief physical characteristic of the dibromo derivative of oleic acid. Its bromide content, however, was such as to suggest admixture, to a small extent, with isomers of either the tetrabromide or the hexabromide or both. The occurrence of an acid in the linolenic series yielding an oily hexabromide has been reported in the literature. It is not improbable that this situation exists here also. Lack of material stopped further investigations in this direction, however.

The approximate order of magnitude of the respective amounts of these acids in this fraction is indicated by the values calculated from iodine and thiocyanogen numbers with the aid of the conventional formulae fitting this type of mixture. These values become oleic 24.15 per cent, linoleic 42.60 per cent, linolenic acid 21.88 per cent.

Summary

Comparison of the heretofore known analytical constants of the fatty oil with those herein reported show that the order of magnitude thereof is substantially the same. The list has been increased, however, to include values not previously recorded. A separation of the fatty acids of this oil has been made with the following approximate results: palmitic acid, 7.3 per cent; stearic acid, 2.4 per cent; arachidic acid, 0.9 per cent; behenic acid, 0.6 per cent; oleic acid, 21 per cent; linoleic acid, 37 per cent; and linolenic acid, 19 per cent.

LITERATURE CITED

1. Tschirch, Handbuch der Pharmacognosie. Leipzig, 1912. Vol. II, p. 342.
2. Grimme. Chem. Rev. Fett-u. Harz-Ind., *18*, 77-82 (1911).

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