

CHEMICAL EXAMINATION OF THE FATTY OIL FROM THE SEEDS OF *STECULIA URENS* ROXB.

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HILDITCH, *et al.*, in their investigation¹ on the fatty oil from the seeds of *Sterculia fætida* Roxb. have reported that the oil contains over 70% of a branched chain polyethenoid acid of C₁₉ series. The observation is rather unusual in that a branched chain fatty acid has been found in nature as a major component of a seed fat and that too it is reported to consist of an odd number of carbon atoms. In this connection it has been also reported by Hilditch (*loc. cit.*) that the seed fats of *S. fætida*, *S. platonifolia* and *Theobroma cacao* (fam. Sterculaceæ) show great diversity in composition in contrast to the general rule of similarity in component acids between seed fats from the same botanical family. It was, therefore, thought worthwhile to investigate the component fatty acids of the oil from the seed kernels of the indigenous *Sterculia* species, *Sterculia urens* Roxb. particularly to see if like *S. fætida*, it also yields a large quantity of a polyethenoid acid and proves to be a valuable paint oil, if not at least a good edible or a soap stock oil.

2. *Sterculia urens* is a large deciduous gregarious tree² commonly found in the dry forests of Northern India throughout Central India and the Deccan and on the West Coast in the Konkan and Kanara. The gum which exudes from the tree or which is tapped from it is known as gum Karaya or gum Katira and is already a well known commercial article and a good dollar earner, being used as a substitute for gum tragacanth. The seeds are said to be roasted and eaten by the aboriginal tribes of Madhya Pradesh.

Samples of *Sterculia urens* air dry seeds received through the courtesy of the Forest Departments of Vindhya Pradesh, Madhya Pradesh, Madhya Bharat and Bombay consisted of 43.3% peri-carp and 56.7% kernel. The latter yielded 25% of a light yellow non-drying oil, both by petroleum ether and ethyl ether extraction. The petroleum ether extracted oil was lighter in colour, but otherwise there was hardly any difference in the physical and chemical properties of the two oils.

TABLE I
Chemical and Physical Constants of the Fatty Oil

Specific gravity at 30° C.	0.9143
Refractive index at 30° C.	1.4587
Optical rotation	Nil
Acid value	1.8
Saponification value	195.8
Ester value	194.0
Iodine value	74.2
Acetyl value	45.0
Helmer value	91.4
Unsaponifiable matter	0.55%

The usual technique as described in the previous papers³ from this laboratory for the preparation of the mixed fatty acids, removal of the unsaponifiable matter from them, their separation mainly into "solid" and "liquid" acids by Twitchell's⁴ modified lead salt-alcohol method⁵ has been followed. The "solid" and "liquid" acids were also worked up in the usual manner to isolate and identify the constituent acids. The following data has been recorded:—

TABLE II
Chemical and Physical Constants of the mixed Fatty Acids

Neutralisation value	198.47
Mean molecular weight	282.1
Iodine value	77.4
Softening point	34.5° C.
Melting point	38.5° C.

TABLE III
Separation of the Mixed Acids by Twitchell's Method

Acids		Iodine value
(S) Solid	23.3%	6.4
(S) Semi-solid	4.0%	29.8
(L) Liquid	67.7%	94.0
(R) Resin	4.95%	..

SOLID ACIDS

The solid fatty acids (62 g.) were converted into their methyl esters in the usual manner with 3% methyl alcoholic hydrochloric acid. The methyl ester (55 g.) thus obtained was fractionated under reduced pressure (5 mm. of mercury) in Claisson flask as follows:—

TABLE IV

Fraction	B.P.	Weight of ester fraction	Iodine value	Weight of fatty acids	Mean Mol. wt. of fatty acids
S1	154° C-174° C	3.16 g.	2.23	4.48 g.	244.8
S2	174° C-179° C	3.30 g.	2.25		
S3	179° C-182° C	18.65 g.	2.72	16.90 g.	290.2
S4	183° C-187° C	11.80 g.	4.38	10.39 g.	250.8
S5	188° C-192° C	4.80 g.	6.87	6.59 g.	259.1
S6	193° C-199° C	3.87 g.	10.75		
Residue	..	6.17 g.	38.7	38.36 g.	
Loss	..	3.25 g.	..	5.45 g.	
				43.81 g.	
				..	

All these fractions were saponified separately and the corresponding acids liberated by hydrochloric acid. Each of the acid fraction was fractionally crystallized from dilute acetone and subsequently from benzene to isolate the individual acids. These have been identified as myristic, palmitic, stearic and lignoceric acids by their neutral equivalent and mixed melting points with authentic samples.

Calculating from the above data the composition of the solid acids turns out to be as follows:—

Myristic acid	..	..	..	17.85%
Palmitic acid	..	..	..	68.49%
Stearic acid	..	..	..	7.71%
Lignoceric acid	..	..	..	6.04%
				100.00%

LIQUID ACIDS

3.2836 g. of the liquid fatty acids were dissolved in 60 c.c. of dry ether and brominated according to the method of Lewkowitch.⁶ No hexa bromides separated out, which indicated the absence of linolenic acid.

The ethereal solution was washed free of excess of bromine by aqueous solution of sodium thiosulphate, washed with water, dried with anhydrous

magnesium sulphate, filtered into a weighed flask and the ether distilled off. The yield of the brominated product was 5.2147 g. (Bromine by Carius' method 37.01%).

The mixed crude bromides were dissolved in petroleum ether and cooled in a refrigerator to crystallise linoleic acid tetra-bromide. The pure crystals were filtered and recrystallised from petroleum ether (m.p. = 114° C.) Calculating from the above data the composition of the liquid acids found to be as follows:

Oleic acid	96.5%
Linoleic acid	3.5%

Based on the above results for solid and liquid acids the composition of the mixed acids works out as follows:—

Acid	
Myristic (Saturated acids lower than palmitic) ..	4.65%
Palmitic	17.82%
Stearic	2.01%
Lignoceric	1.57%
Oleic	66.59%
Linoleic	2.42%
Resin	4.95%

UNSAAPONIFIABLE MATTER

The unsaponifiable matter, obtained from the sodium soaps of the mixed acids by extraction with ethyl ether when crystallised from alcohol (95%) melted at 123° C. On recrystallisation twice from the same solvent crystals melting at 129° C., $[\alpha]_{D}^{20} - 77.4^{\circ}$ (C = 0.4520% in carbon tetrachloride) were obtained. The acetyl derivative of the product melted at 121° C., $[\alpha]_{D}^{20} - 38.0^{\circ}$ (C = 0.7688% in carbon tetrachloride). The product appears to be sitosterol, the common phytosterol found in seed fats.

DISCUSSION AND CONCLUSION

The major component acids of the fatty oil have been found to consist of oleic and palmitic acids and the minor ones of linoleic, lignoceric, stearic and saturated acids lower than palmitic. This distribution does not agree with the components of the fatty oils of other *Sterculiaceae* genera and species so far analysed, namely *S. fetida*, *S. parviflora*, *S. platanifolia*, *S. tomentosa*, *Brachychiton deversifolium* and *Theobroma cacao*. This supports the finding of Hilditch⁶ that "Sterculiaceae is one of the comparatively few botanical families in which seed fats of different genera and even species are

markedly dissimilar in their component acids". One of the objects of this investigation was to see if the fatty oil from *S. urens* seeds contained the polyethenoid acid similar to that reported in the oil of *S. fetida*. This has, however, not been found to be the case.

The fatty oil belongs to the non-drying class and could be either used for edible purposes or for soap making.

SUMMARY

1. The chemical and physical constants of the fatty oil, its component fatty acids and its Sterol from the unsaponifiable matter are described.
2. The oil has been found to consist of the glycerides of palmitic, stearic, lignoceric, oleic and linoleic acids besides small qualities of resin acids and of glycerides of acids lower than palmitic.
3. The unsaponifiable matter yielded sitosterol, the common phyto-sterol found in seed fats.
4. The oil did not contain any polyethenoid acid similar to that reported in the fatty oil from the seeds of *S. fetida* by Hilditch.

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