PART XI. THE OIL FROM THE SEEDS OF ANONA SQUAMOSA (Linn.).

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Anona squamosa (Linn.), the custard apple tree, is a native of tropical America but has long been naturalised in India and occurs commonly in Southern India, being cultivated for its fruit. The seeds, leaves and immature fruits are stated to contain an acid resinous principle which is destructive to insect life (*Pharm. Indica*, I, 44). The oil in the seeds has not been investigated and a detailed study of the fatty acids obtained on its hydrolysis forms the subject of this communication.

EXPERIMENTAL.

The seeds were obtained from the fresh, ripe fruits and after air drying consisted of husks and shells 30 per cent., kernels 70 per cent. The seeds dried at 110° (loss in weight 33·3 per cent.) yield on extraction with light petroleum (b.p. 40–60°) 30 per cent. of an oil. The hot petrol extract on standing deposited a small quantity of a resin (1·2 per cent.); this was separated and, after removal of the solvent, an oil remained which had the constants given in Table I. It may be classed as a non-drying oil.

TABLE I.

$d_{15°}^{15°}$	0·9126
$n_d^{60°}$	1·4558
Acid value	0·8
Saponification value	188·3
Unsaponifiable matter	0·2 per cent.
Acetyl value	18·5
Iodine value	85·6
Polenske value	0·1
Reichert-Polenske value	0·6
Hehner value	93·8

The mixed fatty acids obtained on hydrolysis of the oil had, after removal of the unsaponifiable matter, the constants given in Table II.

TABLE II.

$n_d^{50°}$	1·4470
Iodine value	84·8
Titre test	31·8°
M.W	276·3

The properties of the saturated and unsaturated acids obtained after separation by the Twitchell process are summarised in Table III.

TABLE III.

	Saturated acids (26·6 per cent.)	Unsaturated acids (73·3 per cent.)
$n_d^{60°}$	1·4382	1·4511
Iodine value	3·0	112·7
M.W.	271·9	281·6

The Unsaturated Acids.—From an examination of the bromo-acids only linolic acid (24·7 per cent.) and oleic acid (75·3 per cent.) appear to be present. This percentage composition agrees well with the observed iodine value (found, 112·7 ; calc., 112·5).

TABLE IV.

Bromo-derivatives of Unsaturated Acids.

Quantity brominated	4·406 g.	3·739 g.
Yield of di- and tetrabromo-acids ..	7·550 g.	6·400 g.
Br_2 in crude bromo-acid	41·5 per cent.	41·4 per cent.
M.P. of tetrabromo-acid	112–113°	112–113°

The Saturated Acids.—The saturated acids were separated by fractional distillation of the methyl esters, composition of the various fractions being determined in the usual manner.

By the hydrolysis of the individual fractions it was found possible to separate palmitic and stearic acids in a pure state. From fraction 1 a liquid acid was isolated with an equivalent of 126·5. Owing to the limited quantity of material available it could not be identified. From fraction 8 a small amount of an acid was obtained which after repeated crystallisation had m.p. 78–79°, M.W. 392. This acid is possibly cerotic acid which is stated to melt at 78° and has M.W. 396. The percentage composition of the saturated acids is (see cols. VII to X) lower fatty acids (1·2), palmitic acid (55·4), stearic acid (40·1) and cerotic acid ? (3·3).

TABLE V.

No. of Fraction	I B.P	II Yield per cent.	III M. W. of ester	IV Titre of ester	V M.P. of acid	VI Titre of acid	VII	VIII	IX	X
							Percentage of Palmitic acid from			
							III	IV	V	VI
1	161–166°/3mm.	9·7	255·7	18·5–19·2°	55–56°	...	89·0	...	...	...
2	166–169°/3mm.	7·2	267·8	22·5–23°	58·5–59·5°	.	98·3	...	...	...
3	170–173°/3mm.	23·8	275·4	24·2–24·5°	56·5–57·5°	...	80·7	75·0	80·0	...
4	175–178°/3mm.	3·8	278·4	26–26·6°	55·5–56·5°	54·9°	70·0	65·0	65·0	70·0
5	185–187°/4mm.	7·0	280·5	26·4–26 6°	56–56·5°	55·3°	62·5	58·0	60·0	65·0
6	190–192°/4mm.	36·8	287·9	29·5–29·8°	62·5–63°	60·7°	36·1	30·0	30·0	33·0
7	193–195°/4mm.	5·3	297·5	35–35·5°	66–66·5	...	1·8	5·0	15·0	...
8	Residue ..	6·4	341·3	...	65–68°	...	48·9*	...	...	...

* Assumed to be a mixture of methyl stearate and methyl cerotate.

Unsaponifiable Matter.—The oil contained 0·2 per cent. of unsaponifiable matter which on treatment with digitonin gave 15·9 per cent. of a sterol. This was identified as sitosterol by the preparation of the acetyl derivative, m.p. 128–129°.

SUMMARY.

The seeds of *Anona squamosa* contain 14 per cent. of a non-drying oil and 0·56 per cent. of a neutral resin. The oil is composed of the glycerides of oleic acid (18·1 per cent.), linolic acid (55·2 per cent.), palmitic acid (14·7 per cent.), stearic acid (10·7 per cent.) and cerotic acid ? (0·9 per cent.). An unidentified liquid saturated acid (0·3 per cent.) was also present. The unsaponifiable matter (0·2 per cent.) contains sitosterol (15 per cent.).

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