Ricinoleic Acid in *Artocarpus integrifolia* Seed Oil

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Seed oil of *Artocarpus integrifolia* syn. *Artocarpus heterophyllus* belonging to the Moraceae family contains a small amount of ricinoleic acid (7.2%). The identification was made on the basis of TLC, IR, NMR, MS and chemical degradation. The major components of the oil are linoleic acid (40.2% and palmitic acid (30.2%).

Jackfruit, *Artocarpus integrifolia* syn. *Artocarpus heterophyllus,* is a large tropical fruit tree. The plant is indigenous to India. The fruits are rich in starch and are eaten after roasting or boiling them. The timber is used in making musical instruments. The wood yields a coloring matter (1).

An exhaustive survey of the literature revealed that no information is available on the fatty acid composition of this seed oil. The prsent investigation describes the occurrence of ricinoleic acid (7.2%) in the genus *Artocarpus* and a high content of palmitic acid (30.2%).

EXPERIMENTAL

Materials and methods. The air-dried seeds of *Artocarpus integrifolia* were powdered and extracted with light petroleum ether to yield the oil. The analytical values of the oil were determined according to AOCS Methods (2). The oil did not respond to Halphen test (3) and picric acid thin-layer chromatography (TLC) test (4), indicating the absence of cyclopropenoid and epoxy fatty acids, respectively.

Direct TLC of the oil revealed the presence of oxygenated acids. The IR of oil and its methyl esters showed a characteristic band at 3450 cm^{-1}, indicating the presence of hydroxyl groups. IR spectra were recorded on a Hitachi 270-30 model. The NMR spectra were recorded on a Varian T-60 MHz instruments. Gas liquid chromatography (GLC) of silylated methyl esters was carried out on a Perkin-Elmer Sigma Unit with a column containing 15% DEGS. The temperatures at the injection port, detector port and oven were 240, 240 and 190°C, respectively. The nitrogen flow was 30 ml per minute.

Silylation of methyl esters was done by treating them with hexamethyl-disilazane and trimethyl chlorosilane (5). The isolation of mixed fatty acids from the oil, purification of hydroxy esters and hydrogenation were carried out as reported (6).

RESULTS AND DISCUSSION

The infrared spectrum of the hydroxy ester showed strong absorption at 3450 cm^{-1}, indicating the presence of the hydroxyl group. Saponification of the oil was effected by stirring it overnight at room temperature with 0.8 N alcoholic potassium hydroxide. Unsaponifiable matter was removed and mixed fatty acids, after acidification, were recovered by extraction with ether. The hydroxy acid obtained by preparative TLC showed IR absorption bands at 715 cm^{-1} and 1620 cm^{-1} for the presence of *cis* double bonds. The hydroxy acid isolated from *Artocarpus integrifolia* had the same R_f value as that of the oxygenated acid obtained from castor oil. The unsaturated hydroxy acid on oxidation with potassium permanganate in acetic acid (7), gave azelaic acid (m.p. 106–7°C) and heptanoic acid (p-bromophenacyl ester, m.p. 66–7°C). The NMR spectrum exhibited signals at δ 5.4 (2H, $-C\underline{H}=C\underline{H}$), δ 3.6 (3H, $COOC\underline{H}_3$), δ 3.3 (1H, $C\underline{H}-OH$), δ 2.75 (1H, $-CH-O\underline{H}$) (disappeared on addition of D_2O), δ 2.2 (6H), overlapping signals ascribable to allylic protons and protons α to the particle carbonyl, δ 1.2 (chain $-CH_2$) and δ 0.88 (3H, terminal, CH_3). After shaking the ester with D_2O, the signals at δ 2.75 disappeared with a small change in the signal at δ 3.3

TABLE 1

Analytical Data of Jackfruit Oil

Oil content	6.1%
Unsaponifiable matter	2.1%
Iodine value	108
Saponification value	198.5
Halphen test	Negative
Picric acid TLC test	Negative
Infrared (IR)	3450 cm^{-1}
Silylated methyl esters composition % by GLC	
14:0	3.3
16:0	30.2
18:0	3.3
18:1	6.4
18:2	40.2
18:3	9.4
18:1-OTMSi	7.2

The mass spectrum of the trimethyl silyl (TMSi) derivative of the hydroxy olefinic ester was identical with the TMSi derivative of authentic methyl ricinoleate. The structure—revealing ions were observed at m/z 187 and 299, and a TMSi rearrangement ion (8) at m/z 270 unequivocally established the position of the hydroxyl group at (C-12) and indicated the double bond at (C-9). Thus the isolated oxygenated fatty acid was characterized as 12-hydroxy-*cis*-octadec-9-enoic acid (ricinoleic acid). The results are given in Table 1.

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