FIXED OIL FROM *JATROPHA CURCAS* (LINN.)

BY A. R. SUKUMARAN KARTHA AND K. N. MENON
(*Maharaja's College, Ernakulam*)

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Jatropha curcas or the angular-leaved physic nut flowers in May–June and the fruits ripen during the monsoon. The oil from the seeds has been analysed by many investigators and only two have published complete analysis of the component acids, the others only separating the soild and liquid acids and in some cases determining the proportion of the oleic and linoleic acids in the latter. Kajuka, Hata and Fujikawa[1] gave the component acids of the Formosan oil, of iodine value 130, as 14·4% palmitic, 9·6% stearic, 53·2% oleic and 22·8% linoleic acid. These results are not in agreement with the recorded iodine value and can be accepted only with caution. The same trouble arises in accepting the values recorded by Cruz and West.[2]

For the present investigation the seeds were collected locally and the oil obtained shows a higher density and lower iodine value than all other samples hitherto examined. The analytical constants of the Malabar oil together with the constants of other curcas oils are shown in Table I. The mixed acids (96·4%) gave 24·57% of solid acids and 75·43 of liquid acids. Complete analysis has shown that the constituent acids are myristic 1·37%, palmitic 15·61%, stearic 9·69%, arachidic 0·35%, oleic 40·9% and linoleic 32·08%. The Euphorbiaceæ oils in general contain only very small amounts of saturated acids and Jatropha oil is the first in the whole of the family which has been shown to contain more than 18% of saturated acids. The component acids of some typical Euphorbiaceæ fats are shown in Table II for comparison.

The component glycerides of Euphorbiaceæ have recieved very little attention. Hilditch and Priestman[3] records the glyceride composition of the fruit coat fat of *Stillingia sebifera*, and the present is the first report on the glyceride composition of the seed fat in this group. The analysis of the azelao glyceride mixture has already been published[4] and in this paper the data relating to the trisaturated glyceride content is reported. It is interesting to note that this oil does not obey the rule of even distribution.

The studies of Ivano and others[5] have resulted in the conclusion that a given plant species, capable of existence in different climates, produces, when

TABLE I

Authority		Density	Refr. Index	Acid Value	Sapon. Value	Iod. Value	Unsaponified %	Locality
Siam Govt. Laboratory	(1) ..	0·924	1·4640	7·5	192·6	101·1	..	Siam
	(2) ..	0·923	1·4623	12·84	202·9	98·2	..	Do.
Kinzo and Chinta	(3) ..	0·9152	1·4695	2·86	195·22	102·31	1·25	Formosa
Simon et Droit	(4) ..	..	1·4720	6·4–9·6	188–190	93·00	..	Barbadoes
	(5) ..	..	1·4730	4–8	176–180	97·98	..	Do.
Francis et Droit	(6) ..	0·9168	1·4720	4·5–5·5	176·00	93·00	..	Do.
	(7) ..	0·9205	1·4733	4·0–9·6	190·00	98·00	..	Do.
L. A. Drians	(8) ..	0·9106	1·4722	38·68	196·32	106·90	1·15	Belgian Congo
	(9) ..	0·9219	1·4675	2·91	193·20	96·20	0·50	Do.
Cruz and West	(10) ..	0·9820	1·4665	5·10	192·40	94·80	0·45	Philippine
Present work	(12) ..	0·9849	1·4669	26·27	196·10	90·84	0·20	Malabar

TABLE II. *Component Acids of the Euphorbiaceæ*

No.	Name	C_{16}	C_{18}	Ol	Linol.	Others	Authority
1	*Alewrites cordate*	6·5		19·4	..	74·1 Elæo-stearic	Mc. Kinney and Jameson[1]
2	*Croton tiglium*	1·3	0·5	55·8	28·8	11·3 C_{14} and 2·3 C_{20} acids	Flaschentragger and Wolffersdorff[2]
3	*Euphorbia lathyris*	5·8		91·9	2·3		Zoleol[3]
4	*Hevea brazilinsis*	8·3	8·6	23·6	43·3	14·7 Linolenic	Griffiths and Hilditch[4]
5	*Ricinodendron africanum* ..	10·4		17·0	12·0	44·0 X elæo-stearic*and 11% linolenic	Steger and Van Loon[5]
6	*Ricinus communis*		0·3	7·2	3·6	87·8 Ricinoleic	Panjutin and Rapport[6]
7	*Stillingia sebifera*	4·7	1·5	8·1	59·4	25·9 Linolenic	Jamieson and Mc. Kinney[7]
8	*Jatropha curcas*	15·61	9·69	40·9	32·08	0·35 C_{20} 1·37, C_{14}	Present work

1. Mc. Kinney and Jamieson, *Oil and Soap*, 1937, **14**, 2.
2. Flaschentragger and Wolffersdory, *Hebe. Chem. Acta*, 1934, **17**, 1444.
3. Sobol and others, *Maslob. Shir. Delo*, 1935, **11**, 132.
4. Griffiths and Hilditch, *J. Soc. Chem. Ind.*, 1934, **53**, 75 T.
5. Steger and Van Loon, *Rec. Trav. Chim.*, 1935, **54**, 988.
6. Panjutin and Rapport, *Chem. Unschan*, 1930, **37**, 130.
7. Jamieson and Mc. Kinney, *Oil and Soap*, 1938, **15**, 295.

grown in a cold climate, more unsaturated acids in its seed fats than when it is grown in a warmer climate. A perusal of the literature connected with Jatropha oils shows that probably more important than the general climatic condition, the minimum temperature to which the plant is subjected, influences the degree of unsaturation of the oil. The oil of curcas from Belgian Congo, practically on the equator and subject to extremes of heat and cold, has an iodine value of 97–102, Malabar (8° N.) oil has 90·84, Philippine (15° N.) has 95·00, Formosa (23° N.) has 103·0. The Belgian Congo seeds are subjected to much greater variations in respect of heat and cold so much so that the oil shows higher unsaturation than the Malabar oil or Philippine oil, and its unsaturated nature is on a par with Formosan oil from seeds grown in a much colder climate.

Experimental

450 Grams of clear dry oil were obtained by extraction of 972 grams of the crushed seeds, and gave the following constants :—

Density (30° C.)	0·9849	Refractive Index	1·4669
Acid value	26·27	Saponification value	196·1
Acetyl value	Nil	Iodine value	90·84
Water insoluble acids	96·4%	Non-saponifiable matter	0·2%

Constants of Mixed acids.—

Titre	26°	Refractive index	1·4583
Mean Molecular weight	277·2	Iodine value	94·85

The mixed acids were separated into solid and liquid acids showing the following constants :—

(*a*) *Solid acids.*—(24·57% of the mixed acids).

Titre	52·5°	Mean molecular weight	268
Iodine value	0·65	Refractive index	1·4496

(*b*) *Liquid acids.*—(75·43% of the mixed acids).

Mean molecular weight	282·1	Refractive index	1·4650
Iodine value	117·0		

The solid and liquid acids were converted into their esters, fractionated and worked up as usual. Careful fractionations followed by hydrolysis and analysis gave the following values :—

Solid acids :—

C_{14}—0·25; C_{16}—14·11; C_{18}—9·69; C_{20}—0·35;
Oleic—0·07; Linoleic—0·10

Liquid acids :—

C_{14}—1·12; C_{16}—1·50;
Oleic—40·83 Linoleic—31·98

Thus the composition of the total acids is found to be myristic 1·37%, palmitic 15·61%, stearic 9·69%, arachidic 0·35%, oleic 40·90% and linoleic 32·08%.

Permanganate Oxidation

120 Grams of the neutral oil gave 3·41 grams of neutral non-oxidisable portion corresponding to 2·84% of saturated glycerides.

Confirmation of the above value by an independent method could not be attempted due to lack of suitable methods. The oil is miscible in all proportions with dry acetone and could not be crystallised from it. The estimation of tristearin in the completely hydrogenated fat would be useless firstly because the oil contains nearly 10% of stearic acid and secondly because it contains nearly 16% of palmitic acid. The tristearin value will thus be about 55 and it has been proved[6] that this method is unreliable when the value lies between 40 and 75. The estimation of tri-C_{18}-glycerides by the partial hydrogenation method would not give any accurate results since the oil contains nearly 10% of stearic acid.

Summary

The constants, mixed acid composition and the trisaturated glyceride content of the oil from the seeds of *Jatropha curcas* (Linn.) are recorded.

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6. *The Chemical Constitution of Natural Fats*, p. 194.