THE RELATION BETWEEN THE IODINE VALUES AND REFRACTIVE INDICES.

PART III

Hardened Safflower Oil

By

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INTRODUCTION.

It has been previously shown by Sudborough, Watson and Athawale (This Journal, 1922, **5**, 47–69) that the relationship between the iodine value and refractive index in vegetable oils which have been hydrogenated to different extent can be expressed by the equation :

$$n_{\mathrm{D}}^{60} = 1.4468 + 1.03 \times 10^{-4} \times (\mathrm{I. V.}) + 7.3 \times 10^{-8} \ (\mathrm{I. V.})^2,$$ to an accuracy of about 0.0005, in the case of cottonseed oil, linseed oil, sardine oil, mohua oil, castor oil, hongay oil and coconut oil. This investigation was further extended to argemone, mustard, rocket, rape, cod liver, groundnut, sesame, soya, cashew, olive, seal, poppy, rayan and palm oils, in which the relation between the iodine value and refractive index was not so regular (Watson and Sudborough, This Journal, 1924, **7**, 81–95). Athavale and Jatkar (This Journal, 1938, **21A**, 295–306) showed that the relationship between the iodine value and refractive index of ethyl oleate hydrogenated by the continuous process at different temperatures, was linear only after the iodine value had decreased by 25%, the variation of the refractive index with iodine value in the initial stages being comparatively greater, due to the formation of iso-oleic acid.

In the course of our experiments on the hydrogenation of safflower oil by the continuous method it was necessary to know the relationship between the refractive index and the iodine value for this oil in order to ascertain the percentage of hydrogenation. A search in

the literature failed to reveal any previous data about this oil. We have therefore recorded in this paper the results obtained by us.

EXPERIMENTAL.

The safflower oil used was obtained from Bijapur and had the following constants after refining :

$$n_D^{60} = 1.4618.$$
Acid value $= 0.3$,
Iodine No. (Wijs) $= 141$,
and SCN No. $= 78.5$.

The composition of the oil was calculated from the formulæ :

Percentage linoleic acid $= 1.104$ (I. No.—SCN No.)
,,   oleic acid $= 1.112$ (2SCN No.—I.No.)

The percentage of linoleic acid in the oil was 68.9 and that of oleic acid 17.8.

These results are different from the analysis of the American safflower oil, which contains 63% linoleic acid and 24.6% oleic acid (Jamieson, p. 261). As the oil contains appreciable quantities of linolenic acid, it is necessary to analyse the Indian safflower oil more accurately. Work on this line is in progress.

Hydrogenation of Safflower oil.—The method of hydrogenation was similar to that followed by Athavale and Jatkar (This Journal, 1937, **20A**, 95–109). The details of the measurements will be reported in a subsequent communication.

The iodine values were determined by the Wijs' method. The refractive index was determined at 60°, using the Abbe's refractometer. The results are recorded in Table I and are shown graphically in Fig. 1.
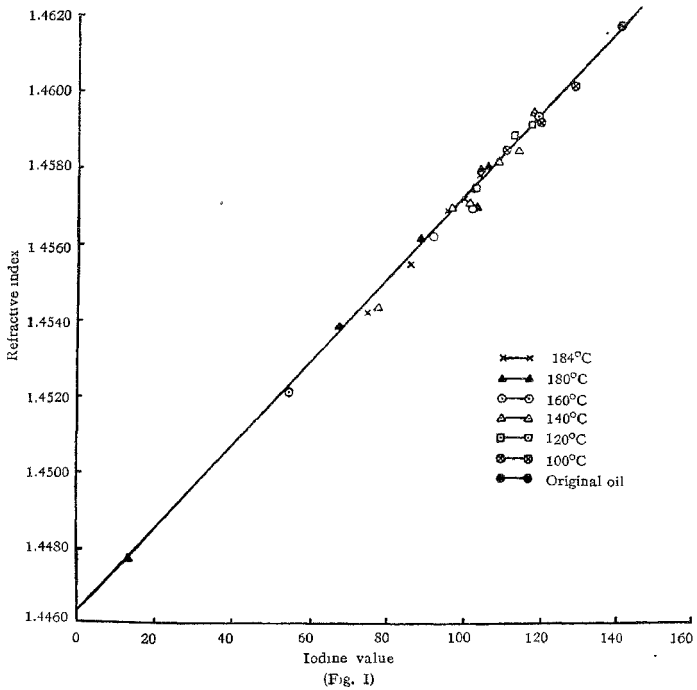
(Fig, I)

TABLE I.

SAFFLOWER OIL.

Relation between Iodine Value and Refractive Index.

No. of sample	Iodine value Wijs	$n_D^{60°}$ observed	$n_D^{60°}$ calculated	Difference 10^4
Original oil	141.0	1.4618	1.4623	+ 5
18	128.8	1.4602	1.4608	+ 6
17	120.3	1 4592	1.4597	+ 5
15	118.8	1.4592	1.4596	+ 4
12	118.8	1 4595	1.4596	+ 1
8	118.8	1 4594	1.4596	+ 2
25	114.0	1.4585	1.4590	+ 5
28	113.3	1 4580	1.4587	+ 7
14	112.8	1.4588	1.4589	+ 1
16	110.9	1 4585	1.4586	+ 1
10	107.8	1.4582	1.4582	0
22	106.3	1.4581	1.4581	0
30	105.3	1 4580	1.4579	− 1
5	104.8	1.4578	1.4579	+ 1
23	104.2	1.4580	1.4578	− 2
13	103.8	1.4575	1.4578	+ 3
20	103.1	1.4569	1.4577	+ 8
26	102.0	1.4570	1.4576	+ 6
24	101.4	1.4571	1.4575	+ 4
29	100.3	1.4572	1.4574	+ 2
11	96.63	1.4569	1.4569	0
4	95.76	1 4569	1.4568	− 1
7	92.06	1.4562	1.4564	+ 2
19	89.58	1.4561	1.4557	− 4
2	85.92	1.4555	1.4557	+ 2
9	77.69	1.4543	1.4546	+ 3
1	74.69	1.4542	1.4544	+ 2
21	67.38	1.4539	1.4536	− 3
6	54.14	1.4521	1.4521	0
C	13.0	1.4477	1.4476	− 1

It is obvious from the figure that the relationship between iodine value and refractive index is approximately linear, and is more accurately given by the expression

$$n_D^{60} = 1.4463 + 1.03 \times 10^{-4} \times (I.V.) + 7.3 \times 10^{-8} (I.V.)^2$$

(cf. Sudborough *et. al.*)

The samples hydrogenated at different temperatures are indicated in the figure by different marks. The iodine values of the samples are not sufficiently accurate to indicate whether the deviations of the observed values of refractive indices from those calculated, are due to the formation of iso-oleic acid [cf. Athavale and Jatkar (loc.cit.)]. A study of the dispersion of these samples might throw some light on the question of isomerisation. Work on these lines is in progress.

SUMMARY.

It has been shown that the relationship between the iodine value and refractive index of safflower oil hardened by the continuous process is given by the expression

$$n_D^{60} = 1.4463 + 1.03 \times 10^{-4} \times (\text{I.V.}) + 7.3 \times 10^{-8}(\text{I.V.})^2.$$

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