THE INFLUENCE OF NON-GLYCERIDIC CONSTITUENTS ON AUTOXIDATIVE RANCIDITY OF SESAME OIL

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SESAME oil used in these experiments unless otherwise stated, was specially pressed from good quality seed in a local wooden ghany. Storage stability tests were done by exposing 0·5 gm. of the oil sample in each of a series of clean pyrex test tubes 5¾" × ¾", selected for uniformity of diameter to diffuse daylight and examining two tubes every few days. The test tubes were plugged loosely by cotton wool. Peroxide values were determined by a modification of Wheeler's method described in detail by the authors in a recent paper.[4] The smell was observed by two different workers and classified according to the classification used by John, McConnell and Esselen.[5]

Expt. (1) Effect of Suspended Mucilaginous Matter

Stability test runs carried out on the settled unfiltered oil as well as on oil filtered through a hot water jacketed glass funnel showed that both samples were free from any rancid smell after a period of 57 days, but smelled blank. The peroxide value increased from 2·2 to 14 in the case of unfiltered oil and from 7·7 to 34·7 in the case of filtered oil. The former retained its original bright yellow colour, but the latter, which was lemon yellow at start, became lighter after 4 days and then progressively increased in colour to an orange red.

Expt. (2) Effect of the Constituents Present in the Husk

Sesame seed was freed from the husk by soaking in water for two days in the dark and rubbing same between two layers of rough cloth. Oil from the de-husked seed as well as from the un-dehusked seed was solvent extracted with petroleum ether (60-80° C.) and dried under vacuum. The former was much lighter in colour and had a less distinctive smell. Storage stability tests carried out on both samples showed that the P.V. of the oil from the un-decorticated seed increased from 2·2 to 9·6 in 39 days while the oil from the decorticated seed increased from 2·2 to 9·4. Both oils lost part of the colour, and the smell after 39 days was blank.

Expt. (3) Effect of Removal of Sesamin

50 Grams of sesame oil dissolved in 50 c.c. petrol ether (60-80° C.) was extracted repeatedly (10 times) with 20 c.c. portions of 90 per cent. acetic acid by shaking in the cold, the acid layer being separated each time. The petrol ether portion was washed free from acid, the solvent removed by distillation under vacuum and the oil dried. Storage stability tests were carried out on part of this oil which was expected to be comparatively free from sesamin.[2]

During a period of 41 days P.V. increased from 5·1 to 11·2 and the oil lost part of its colour. Organoleptically the sample smelled good at the start, became blank after 15 days and continued to be so till the end.

Expt. (4) Effect of Removal of Sesamin and Sesamol

The oil free of sesamin (Expt. 3) was cold extracted by shaking it with equal quantities of alcohol repeatedly (12 times) to remove sesamol[6] and any fatty acids. The oil freed of the solvent under vacuum was examined for storage stability with results as given in Table I.

Table I

Storage time in days	Peroxide values	Organoleptic condition	Appearance
0	12·9	Very good	Light yellow
6	25·7		
11	77·3	Blank	
15	176·3	Rancid	White, clear, transparent
18	262·0	,,	,, viscous
21	314·7	,,	,, ,,
24	439·4	,,	,, ,,
28	537·9	,,	,, ,,
33	724·6	,,	,, very viscous
38	729·5	,,	,,

Expt. (5) Effect of Treatment of Sesamin- and Sesamol-free Oil with Calcined Alumina

After the alcohol treatment in Expt. 4, the rest of the oil, which may now be expected to be free from sesamin and sesamol was taken up in petrol ether and shaken with an excess of specially prepared tested alumina with a view to remove any vitamins[7] as also most of the residual colouring matter. The alumina was prepared by calcining pure aluminium hydroxide at 700° C. in an electric furnace for one hour. The oil, freed of the solvent and calcined alumina, was examined for storage sta-

bility. After 41 days, its peroxide value had gone up to only 29·1 from an initial value of 8·4. Organoleptically the oil smelled good at start and became blank after 41 days with no smell of rancidity. The colour, which was light yellow at start, became lighter after 15 days and was nearly bleached at the end.

Expt. (6) Effect of Treatment with Bone Char

The oil obtained in Expt. 5 after treatment with calcined alumina was treated in petroleum ether solution with bone charcoal for 6 hours, filtered, freed of the solvent and dried under vacuum. The oil which was very faintly yellow and free from odour was tested for storage stability as before with results as given below:

Table II

Storage time in days ..	0	6	11	15	18	21	24	28	33	38	41
Peroxide value ..	5·8	22·2	47·5	67·4	82·6	105	121	157	227	364	307

Discussion

With the removal of sesamol by means of alcohol in Expt. 4 the oil shows marked deterioration in stability which confirms the findings of H. A. Mattil[3] that sesamol has antioxidant properties.

The subsequent treatment with calcined alumina was intended to remove any vitamins left in the oil[7] in addition to removing most of the residual colouring matter. Thus, as a result of the first three treatments, the sesame oil would be free to a great extent from mucilaginous matter, sesamin, sesamol, vitamins, colouring matter and odoriferous compounds. One would have expected that with this treatment with calcined alumina the oil would have further deteriorated. But surprisingly enough, this is not the case and the oil shows a remarkable recovery. In this connection it may be noted that the calcination was done at 700° C. in an electric furnace on chemically pure aluminium hydroxide, a temperature at which complete conversion to alumina takes place. One possible explanation for this interesting phenomenon is that the treatment besides taking away the vitamins has also removed any pro-oxidants existing in the oil. But if this were so, then the subsequent treatment with bone charcoal should have further improved its stability since bone charcoal is a good adsorbent. Actually this is not the case and the oil deteriorates quickly.

The work done also confirms the observation made by the authors[4] and others during recent times that under normal conditions of exposure to air and light, the peroxide value does not always correlate with organoleptic rancidity. Thus the oil sample had no rancid smell up to a peroxide value of 175·3 in Table I and 364 in Table *II*, while in other cases (unpublished data) under similar conditions of exposure to air and light, the smell of rancidity has been noticed at very much lower levels of peroxide value.

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