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Preliminary Studies on Storage of Coconut Oil

by

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Coconut oil is one of the important edible oils in India, chiefly on the West Coast and in Bengal. Besides the production in the country, India imports annually about 30,000 tons of coconut oil valued at over 4 crores of rupees. Coconut oil is obtained by crushing the dried kernal of the mature coconut known as 'Copra'. Copra is generally prepared by drying the broken nuts (i. e., nuts cut into halves) in the sun and the oil is extracted by crushing the copra in the village 'Ghani' or in power driven expellers. The major, if not, almost the entire quantity of the copra of commerce is made and oil is extracted during the summer months of February to May as the weather in that period is bright (thus favourable for copra making) and the largest yield of nuts and outturn of copra and oil are obtained during these months. Practically no crushing of copra for oil is done during the rainy season. It, therefore, becomes necessary to store the coconut oil for pretty long periods and as it easily becomes rancid, a proper method of storage has to be found out. The conditions of storage vary widely. Apart from using numerous containers, substances like jaggery are added to the oil. Perkins (1919) has studied the rancidity of Philippine coconut oil and found out that the oil of low initial acidity remained sweet during two years exposure to air and light. He has further stated that the first stage in rancidity is hydrolysis, the rapidity of which varies with initial acidity and seems to be accelerated by the action of air, light and fat soluble enzymes. But no systematic study seems to have been made so far, on the deterioration of the quality of oil under various conditions. Preliminary studies were therefore conducted to study the deterioration of the oil, at the Oilseeds Laboratory at Coimbatore.

Materials and Methods: The oil intended for the study was obtained from the Agricultural Research Station, Nileshwar where it was made by crushing the copra prepared at the the station itself. One tin of 36 pounds of oil was received in 1949 as well as in 1952. Immediately on receipt the oil was kept inside the laboratory to allow it to settle. The studies were conducted under three main conditions viz., (1) stored in containers of various metals (2) stored in bottles covered with cellophane paper of different colours (3) stored

after addition of different materials. Samples of oil intended for the study were prepared by drawing small quantities of the oil at different depths in the tin and the oil was then stored in the different containers. One sample was boiled and kept in a 1 lb. bottle. The metal containers were of aluminium, tin and earthern jar. Red, blue, green, yellow, orange and pink coloured cellophane papers were used for the colour treatments. Materials added to the different bottles were salt and jaggery. About $\frac{1}{4}$ lb. of these materials were used for each bottle of oil. The sample oil stored for the investigation was cloudy and opaque. The oil to which jaggery and salt was added, got clarified in 24 hours.

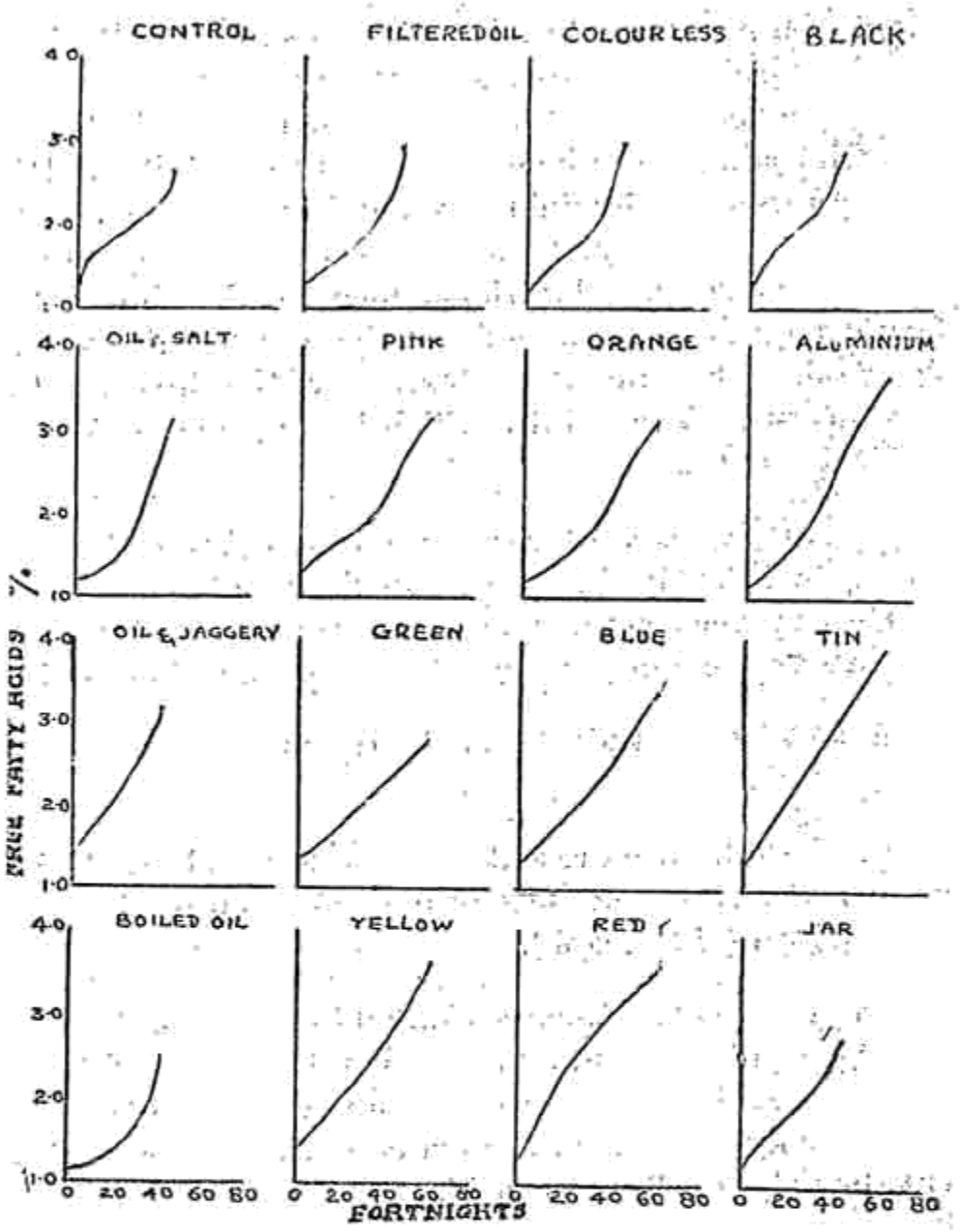
Samples of 10 c. c. of oil were drawn from the different treatments at fortnightly intervals and the free fatty acids content estimated. The other characters like smell, refractive index, colour etc., were noted both at the commencement and termination of the study.

The first series of studies was started in 1949 and the second in 1952.

Results: Results are presented in table I and II. Taking free fatty acids formation as a measure of deterioration of the quality of oil, it may be stated (vide graph).

1. Among the various treatments viz., additions of salt or jaggery and boiling or filtering oil, addition of salt was found to improve the keeping quality upto more than 20 fortnights. Boiled oil was also equally good from the point of view of low fatty acids content, but the smell was rancid.
2. While none of the colours was found preferable to control, red coloured paper covers was found to accelerate the deterioration in quality to a considerable extent.
3. Aluminium containers depressed the rate of deterioration to a greater extent than tin while the jar container comes in between the two.

Discussion: It was found that addition of salt or jaggery reduced the rate of free fatty acid production keeping the quality good for, as long as 20 fortnights. Similarly boiling the oil was found to keep the free fatty acid content low. It is found in natural fats of vegetable origin that there is an induction period during which there is negligible oxygen absorption and as such acidity is not developed. Addition of salt or similar substances is likely to still



further reduce the rate of oxidation by neutralizing the free fatty acids developed. The above said induction period is prolonged by either addition of certain organic compounds or inhibitols or washing in boiling water (Hilditch and Sleight Holme) (1922). Regarding red coloured light, accelerating the deterioration in quality, findings are not in line with various workers like Emery and Henley (1922). In general when wave length of light becomes less than 490 mλ the catalytic activity is increased and rancidity is lowered at wavelength higher than 490 mλ. It is not clear how red light with a wave length of about 767 mλ is found to increase the activity rendering the oil more rancid than light with lower wave length. Further experiments in coloured bottles instead of using coloured paper over ordinary bottles, may give dependable results. Certain metals like

copper are found to accelerate the onset of rancidity (Lea) (1936). It is not clear how aluminium comparatively lowers the rate of rancidity. A study on comparative deleterious effects of various metals on the onset of rancidity may throw some light on the property of aluminium in lowering the rate of rancidity.

Summary : Studies were conducted on the keeping quality of coconut oil by storing them under different conditions viz., various metallic containers, glass containers covered with cellophane paper of different colours, and also adding various substances like jaggery, salt etc. Fortnightly samples were drawn for determination of free fatty acids content, as a measure of the quality. Addition of salt was found to be good and helped to reduce the rate of deterioration considerably. Addition of jaggery was also fairly good.

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TABLE I.

Percentage of Free Fatty Acid.

S. No.	Date	Months interval	Control	Oil and salt	Oil and jaggery	Boiled oil	Filtered oil	Pink	Green	Yellow	Colourless	Orange	Blue	Red	Black	Aluminium	Tin	Jar
1.	12—7—49	0	1·19	1·18	1·20	1·19	1·25	1·21	1·25	1·25	1·17	1·21	1·26	1·32	1·26	1·12	1·20	1·20
2.	9—8—49	1	1·28	1·17	1·30	1·17	1·27	1·30	1·25	1·31	1·23	1·24	1·37	1·30	1·30	1·23	1·35	1·41
3.	4—10—49	2	1·57	1·28	1·55	1·20	1·43	1·50	1·48	1·55	1·44	1·37	1·49	1·48	1·55	1·44	1·61	1·49
4.	29-11—49	2	1·78	1·32	1·78	1·33	1·58	1·54	1·56	1·66	1·51	1·42	1·72	1·94	1·65	1·56	1·85	1·62
5.	24—1—50	2	1·82	1·44	1·80	1·40	1·72	1·74	1·64	1·84	1·64	1·56	1·91	2·15	1·93	1·76	1·99	1·96
6.	21—3—50	2	1·90	1·48	2·22	1·42	1·68	1·76	1·64	1·84	1·64	1·64	1·80	2·12	1·94	1·78	2·10	1·82
7.	16—5—50	2	1·96	1·52	2·36	1·46	1·72	1·78	1·80	1·99	1·72	1·80	1·94	2·35	2·00	1·96	2·38	1·95
8.	11—7—50	2	2·00	1·66	2·43	1·50	1·76	2·01	1·88	1·98	1·74	1·90	1·98	2·34	2·17	1·99	2·36	1·94
9.	5—9—50	2	2·08	1·98	2·43	1·54	1·95	1·98	1·96	2·01	1·88	1·94	1·98	2·73	2·20	2·18	2·56	2·19
10.	31-10—50	2	2·12	2·21	2·73	1·63	2·00	2·10	2.00	2·52	2·03	1·94	2·16	2·87	2·20	2·32	2·36	2·20
11.	26-12—50	2	2·24	2·57	2·88	1·72	2·19	2·15	2·20	2·50	2·37	2·14	2·25	2·92	2·72	2·40	2·48	2·49
12.	20—2—51	2	2·62	2·84	3·18	2·44	2·42	2·29	2·45	2·69	2·89	2·22	2·43	3·01	2·87	3·34	2·71	2·64
13.	30-11—51	9	2·85	4·72	4·68	4·65	4·59	3·19	2·85	3·64	5·01	3·20	3·43	3·55	4·25	3·70	3·97	4·59
14.	23—3—56	5½ Years	11·58	10·75	8·65	10·48	12·25	9·80	8·43	8·28	11·19	7·85	10·05	9·84	9·60	8·66	6·78	10·24

TABLE II.

Treatments	Final Refractive Index	Smell		Taste	
		Start	Final	Start	Final
Control	1·4520	Normal	Rancid	Good	Rancid
Oil and Salt	1·4530	Normal	do	Good	do
Oil and Jaggery	1·4535	sweet smell	do	Fresh	do
Boiled oil	1·4525	sweet smell	do	Fresh	do
Filtered oil	1·4530	Normal	do	Fresh	do
Pink	1·4525	Normal	do	Fresh	do
Green	1·4530	Normal	do	Good	do
Yellow	1·4530	Normal	do	Good	do
Colourless	1·4530	Sweet	do	Good	do
Orange	1·4530	Normal	do	Good	do
Blue	1·4535	Normal	do	Good	do
Red	1·4535	Normal	do	Good	do
Black	1·4535	Normal	do	Good	do
Aluminium	1·4535	Sweet	do	Fresh	do
Tin	1·4530	Sweet	do	Fresh	do
Jar	1·4530	Normal	do	Fresh	do
	Refractive Index at Start 1·4534				