

THE PACKING AND KEEPING QUALITIES of DESICCATED COCO-NUT.*

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1. Moisture.

The keeping qualities of desiccated coco-nut, like those of copra, depend almost entirely upon its moisture content. In the presence of more than a minimal amount of moisture, both desiccated coco-nut and copra become a prey to the attack of moulds, increasing in severity with increase of moisture content.

It is possible to illustrate this by an actual test carried out by the writer. Samples of desiccated coco-nut of different moisture content were kept for two months in sealed containers, after which they were opened and examined:—

Original Moisture Content.	Appearance after two months.
1.8	White, free from mould. Odour good
3.65	Fair
4.73	Traces of mould growth. Odour distinctly rancid
6.73	Considerable growth of green, pink and brown coloured moulds. Odour strongly rancid

Desiccated coco-nut exposed freely to the air even if well dried initially will, under Ceylon conditions of humidity, absorb fairly rapidly up to 6 per cent. of moisture. It is clear therefore that:—

- (a) The initial moisture content must be low, certainly below 3 per cent.
- (b) Packing must be such as to prevent absorption of moisture from the air.

2. Packing.

Desiccated coco-nut is exported usually in plywood chests holding 130 lb. The chests are lined with suitable paper or other material (see below). The desiccated coco-nut is sometimes packed with light baling pressure. Although this packing in chests is not a fundamentally water-proof one, in practice, the small surface actually exposed to the air makes it satisfactory enough if condition (a) is observed, i.e., the initial moisture content is low. Cases found spoiled by mould action on arrival at overseas destinations are, in the writer's opinion, more often the result of packing originally imperfectly dried material, than of moisture absorption in transit.

Cases have occurred, however, where locally made chests were employed made of improperly seasoned wood. The contents of the chest absorbed moisture from the damp wood and spoilage rapidly set in. The way to prevent this type of spoilage is obvious.

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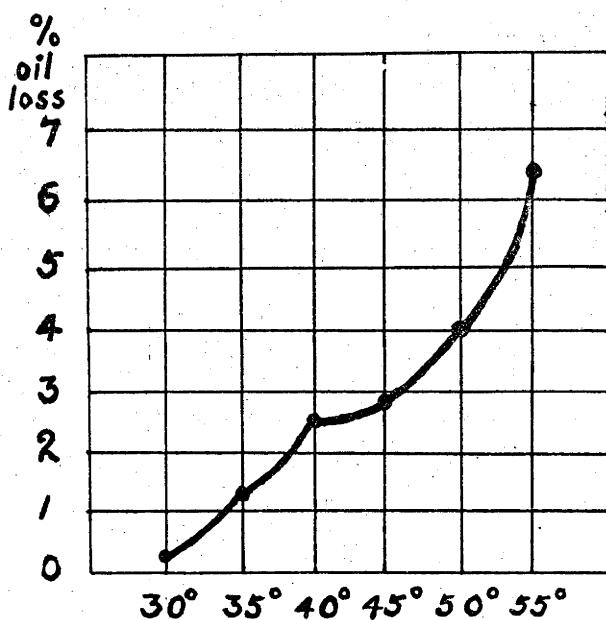
Linings.

For lining desiccated coco-nut chests, a grease-proof paper is commonly used. In general, it may be supposed that materials found satisfactory for lining tea-chests will serve well for desiccated coco-nut. There is however this difference, that desiccated coco-nut contains over 70 per cent. of oil, and that this may adversely effect certain lining materials. Hence the use of grease-proof paper, usually of the kraft type.

3. Case Staining.

At moderately high temperatures desiccated coco-nut loses oil, causing "case-staining". This is objectionable from the point of view of appearance but also because such oil acts as a focus of rancidity as it is exposed to the oxidative influence of light and air. (*See below, paragraph 4*). Loss of oil does not commence to be serious below 90° F., but above this temperature becomes increasingly severe with further rise. The following table shows the percentage of oil lost at different temperatures, based on even tests:—

Temperature	°C.	°F.	Loss.
..	30°	86°	Very small
..	35°	95°	1.5%
..	40°	104°	2.6%
..	45°	113°	2.8%
..	50°	122°	4.0%
..	55°	131°	6.2%



During shipment to the United Kingdom temperatures of above 90° F. for some days may be experienced, particularly in the Red Sea. But the problem becomes more serious in the climate of parts of India, and needs particular attention when attempts are being made to foster sales of desiccated coco-nut in that country.

Consequently, trials have been carried out of packing in tins. These are mentioned in paragraph 5.

4. Other Types of Spoilage.

Before discussing packing materials further, it will be as well to describe briefly the types of spoilage to which desiccated coco-nut is liable. It was mentioned in paragraph 1 that excessive moisture was a prime factor in deterioration. Desiccated coco-nut containing fat, sugars, protein and mineral salts is an excellent medium for growth of moulds, yeasts and bacteria, if moisture is present.

By reason of its high fat content (over 70 per cent.), desiccated coco-nut is chiefly liable to deterioration related to this fat as opposed, say, to meat, where spoilage is primarily due to bacterial decomposition of the proteins. Even if kept satisfactorily dry and free from the action of micro-organisms, it is therefore liable to rancidity (using this word in its widest general sense) due to atmospheric oxidation. Such spoilage may be roughly described as "ageing."

Factors which increase the rapidity of this type of deterioration are air, light and heat. Traces of certain metallic impurities such as copper and iron also accelerate oxidation, but these are not usually serious in the case of desiccated coco-nut.

Exclusion of air by the use of air-tight as well as water-tight packing is therefore advantageous.

ACTION OF HEAT.

The rate of oxidation of fatty substances increases rapidly with rise of temperature, and so high temperatures are to be avoided if possible for this reason as well as for the reasons given in paragraph 3. Desiccated coco-nut should be stored under as cool conditions as possible.

ACTION OF LIGHT.

Exposure to light has a marked effect in accelerating the development of rancidity. This is of no account in the case of bulk transport, but becomes of considerable importance in packing for retail use.

The effect of light may obviously be eliminated by the use of opaque wrappers such as metallic foil. For attractive appearance it is often desired to use transparent or semi-transparent wrapping.

It is found that the most active wave-lengths of light are the shorter rays—blue, violet and ultra violet—so a wrapper excluding these is desirable. A coloured cellophane or paper meets the case—yellow, red or brown.

It may be added that there is no advantage in using coloured paper or wrapping in containers that are already perfectly opaque.

5. Examination of Old Samples.

The statement in the previous paragraph that the spoilage of desiccated coco-nut is largely related to its high fat content may be illustrated by the results of the examination of two samples in 1906, which had remained until 1935 in the Economic Museum, Peradeniya, and were sent to the writer by the courtesy of the Economic Botanist. These were analysed in 1935 and again in 1938.

	Fresh D.C.N. Typical Analysis.	1906 Sample Fine.		1906 Sample Coarse.	
		1935.	1938.	1935.	1938.
Moisture	1.5	13.9	49.2	11.6	13.5
Oil	69.5	32.3	19.6	39.1	40.2
Oil (dry weight)	70.6	37.5	38.6	43.7	46.4
Oil—					
F.f.a.	0.02	44.7	..	45.7	..
R.M. Value	7.8	..	..	..	4.1
Polenske Value .. .. .	..	..	..	..	13.9
Dry Poonac—					
Mineral matter	5.4	..	6.3	5.0	5.2
Nitrogen	3.7	3.8	3.8	4.0	4.0
Crude fibre	9.2	8.5	..	..	..
Cellulose .. .. .	..	..	..	..	30.8

These samples had been kept in bottles freely exposed to the light. They were dark brown in colour and of bad odour, but the deterioration was more of the type due to ageing than to moulds. As the analytical figures show, the oil content was about half normal, and the oil was extremely acid. That is, half the oil had been completely destroyed by oxidation, and the remainder consisted half of free fatty acid. The poonac remaining after the oil extraction gave, however, fairly normal values for nitrogen (protein), cellulose fibre and mineral matter, so these latter had not undergone drastic changes in 30 years.

6. Absorption of Taints.

Desiccated coco-nut, like most edible products of high fat content, readily picks up taints from odours given off in its vicinity. Packing cases made of unsuitable varieties of timber, particularly those of strong resinous odour, are very liable to impart undesirable flavour. Metallic foil, e.g., aluminium, is the best impervious wrapping to keep out undesirable odour. Grease-proof and waxed papers are often inefficient.

7. Small Wholesale and Retail Packing.

(a) PACKING IN TINS.

Packing in sealed tins should be satisfactory from all points of view: prevention of moisture absorption, exclusion of light and air, and prevention of tainting.

The desiccated coco-nut must be packed dry at a moisture content below 3 per cent., and preferably even lower than 2 per cent. Two tins of a proprietary brand packed in England were recently examined by the writer; the time since packing was not known but was probably considerable. The contents were brown tinged and slightly rancid in taste and odour; the oil expressed was acid (f.f.a. 1 per cent. as lauric), moisture contents 3.3 and 4.4 respectively.

Tins to contain 28 lb. have dimensions $7\frac{1}{8}$ inches by $11\frac{3}{8}$ inches by $17\frac{7}{8}$ inches (i.e., internal volume about 1,500 cubic inches). They are lined with grease-proof paper, the desiccated coco-nut is weighed in, and the lids (of the press in type) are fitted and soldered. The desiccated coco-nut must not be packed hot.

This type of packing might suit the Indian market. The tins have resale value, which meets the objection that the value of a tin is almost equal to that of its contents—28 lb. of desiccated coco-nut. However, trade opinion does not seem altogether favorable.

(b) RETAIL PACKING.

Putting up desiccated coco-nut in retail packages of 4 oz. or $\frac{1}{2}$ lb. or so is a somewhat tricky business, especially for tropical climates. Small packets become spoiled with amazing rapidity in unsatisfactory wrappings. It may be said at once that cellophane (of the old type) or grease-proof paper packets are not satisfactory.

One small packet was kept for six weeks before analysis. At the end of this time the sample was mouldy and quite rancid and unfit for use. Moisture content was 13.6 per cent. and f.f.a. of extracted oil 6.6 per cent.

Considerable success has been attained by the use of lead or aluminium foil. Well prepared packets wrapped in aluminium foil are satisfactory. The foil excludes vapours, causing taints, light and moisture.

Transparent wrappings are sometimes desired. In this case red, yellow or brown are to be preferred. Most papers and ordinary cellophane are, however, by no means waterproof. A moisture-proof cellophane is marketed.

A new transparent material of considerable interest is Pliofilm.

Plioilm is a rubber hydrochloride; it is a material of a similar appearance to cellophane and is used in the manufacture of raincoats, umbrellas, packing material for perishable goods, oil cartons, and ribbons for florists and speciality stores. It is claimed that Plioilm has properties such as resistance to moisture, elasticity, strength and an attractive appearance surpassing those of other material.—(The *R.R.I. Planters' Bulletin*, No. 8, 1939.) The mechanical, physical and chemical properties of the material are described in *India Rubber World*, 1938, 98, No. 3, pp. 46-47.

Tea Packing.—The Tea Research Institute found Plioilm very satisfactory for tea packing, even the thinner grades being sufficiently strong for the purpose of lining tea chests. At the time of their tests in 1937, the cost of the thin grades was about equal to that of the normal aluminium foil.

The writer has carried out a preliminary test on 4-oz. packets of desiccated coco-nut in Plioilm. The desiccated coco-nut was in good condition after nine weeks.

Plioilm is definitely waterproof and has the advantage of being readily heat-sealed.

(c) EFFECT OF OIL ON WRAPPINGS.

In paragraph 2, reference was made to this. Plioilm underwent no apparent change after complete immersion for ten days in coco-nut oil.

(d) LABELLING PACKETS.

Difficulty is sometimes experienced in attaching labels to aluminium foil packets, the usual gums not adhering well to the metal surface. The following formula for an adhesive has been found very useful in actual practice:—

	Grams.
Dextrin ("British Gum"), soluble variety	64
Sodium silicate (water glass)	16
Glucose	8
Water	100
	<hr/> 188 <hr/>

8. Preservatives.

Desiccated coco-nut, properly dried and packed, should not require the addition of preservatives, and such additions would generally be undesirable. The use of sulphur dioxide has been tried, but this is not a particularly useful preservative for fats and fatty substances.

9. Analysis of Desiccated Coco-nut and Detection of Spoilage.

Good desiccated coco-nut should be of pure white colour, crisp, and with a fresh taste of the nut. It should contain 68.72 per cent. of oil, and the free fatty acid of the oil should be below 0.1 per cent.

Although acidity of the oil is not the same thing as rancidity, it goes more or less parallel with rancidity in the early stages and the free fatty acid of the oil is a useful indication when taste, odour and appearance are also taken into account.

OIL CONTENT.

Since one of the troubles experienced with desiccated coco-nut packing in hot climates is "Case Staining" (see paragraph 3), a suggestion for preventing this might be deliberately to reduce the oil content by gentle expression to provide a "tropical DCN" of lower oil content than the usual 68-72 per cent.

10. Conclusion.

The writer will be very glad to receive any comments on the foregoing memorandum, especially from those concerned in the desiccated coco-nut industry. Reports of actual experience will be especially welcome.