the oils became rancid, but the shape of the curve was different from that in which the rancidity was accelerated by aeration at 100° C. Time was apparently a factor in the destruction of vitamin A, since the vitamin was destroyed at lower peroxide values when rancidity developed slowly than when the development of rancidity was accelerated (Chart 2).

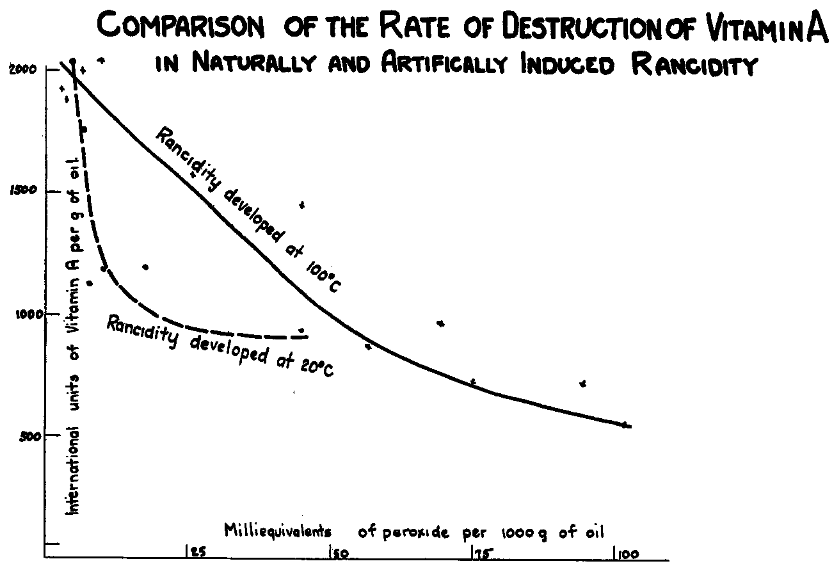

CHART II.

This fact indicated that rancidity produced artificially was not the same as that produced under natural conditions. It may also be noted that so-called "natural conditions" vary widely, and that the rate of destruction of vitamin A may be found to vary with other conditions. It is possible that not only vitamin A but other biological properties of oils are not equally affected by rancidity produced in different ways. The curve of peroxide value may not necessarily be parallel to that of other changes which take place during the development of rancidity.

The vitamin A potencies of the cod liver oils collected in the surveys showed great variability. It was not possible to correlate vitamin A potency with peroxide value. This was probably due to the fact that rancidity was not uniformly produced in all samples, and in addition, the original vitamin A values of this heterogeneous collection varied widely.

The fact that in the laboratory it was possible to keep cod liver oil in good condition, and the further fact that in the survey of homes a number of samples of cod liver oil representing the "last dose in the bottle" were found in as good condition as when the original bottle was opened, was convincing proof that the observance of a few simple precautions could entirely eliminate the difficulty of feeding infants and children a rancid cod liver oil.

Rancid oil is an undesirable food for infants and children for several reasons other than its low vitamin A potency. It has been previously demonstrated in this laboratory (4) (5) that rancid fat caused a serious and fatal disease in dogs when it constituted the sole dietary fat given the animal. The etiology of this "oxidized fat syndrome" has been attributed in part, if not in whole to the destruction of the linoleic and linolenic acids by the oxidative process of rancidity.

In addition to the fact that rancid fats and oils are poor sources of the nutritionally essential fatty acids it is generally believed that rancid fats are gastric irritants. The ingestion of even slightly rancid cod liver oil may well be the cause of the frequent digestive disturbances so often attributed by mothers to cod liver oil. Rancid cod liver oil has a disagreeable taste and odor. At times a child's dislike of this food may be due to the fact that he has been offered a rancid oil.

SUMMARY

1. Vitamin A was destroyed in cod liver oil as rancidity developed.

2. Vitamin A was destroyed at lower peroxide values when rancidity developed at room temperature than when it was accelerated by aeration at 100°C.

3. It is suggested that not only vitamin A, but other biological properties of oils are not equally affected by rancidity produced in different ways and at different rates, and that peroxide value may not necessarily be parallel to that of other changes which take place in an oil as rancidity develops.

BIBLIOGRAPHY

1. Whipple, Dorothy V. Rancid Cod Liver Oil in the Diet of Children. Amer. Journ. Pediatrics, June, 1936.
2. Friderica, L. S. Inactivating Action of Some Fats on Vitamin A in Other Fats. Journ. Biol. Chem. 62, 471 (1925).
3. Powick, W. C. Inactivation of Vitamin A by Rancid Fat. Journ. Agric. Research, 31, 1017 (1925).
4. Whipple, Dorothy V. A Syndrome Produced in the Dog by the Inclusion of Oxidized Fat in the Diet. Pro. Soc. Exp. Biol. & Med., 30, 319 (1932).
5. Whipple, Dorothy V. The Comparative Nutritional Value of Diets Containing Rancid Fat, Neutral Fat and No Fat. Oil & Soap, 10, 288 (1933).

RICE OIL

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RICE OIL is an oil obtained from rice meal by expression or extraction. Rangoon rice contains about 15% of oil but other varieties show about 8-9%.

Oil from fresh rice bran is practically neutral, but on standing, the free fatty acid content increases very rapidly, owing to the action of an enzyme, as shown by Browne (J. Soc. Chem. Ind., 1903, 1137). The action of this lapse can be arrested by heating to 100° C. Due to its high acidity, the oil can only be used for soap.

Attempts were made in Louisiana to produce the oil but, probably due to the low prices of all fats, the project disappeared. Recently, however, the industry has been revived abroad and commercial quantities are now available.

The oil has a rather pale greenish yellow color, and upon analysis

gave the following results:
Specific Gravity @ 15.5—0.9192.
Iodine Value (Wijs)—103.5.
Thiocyanogen-Iodine Value—68.8.
Saponification Value—188.8.
Unsaponifiable Matter—4.89%.
Acid Value—101.5.
Free Fatty Acids (Oleic)—51.05%.
Titre—23.9° C.
Color Lovibond (1-in. cell)—
35 Yellow-6.0 Red.
Color (FAC)—Not darker than 21.
Halphen Test (for cottonseed oil)—
Negative.
Villavechia Test (for sesame oil)—
Negative.
Bellier Test (for peanut oil)—
Negative.

Assuming the absence of linolenic acid in this sample, these figures would indicate the following composition:
Oleic Acid—39.56%.
Linoleic Acid—39.91%.
Saturated Acids—15.64%.
Unsaponifiable Matter—4.89%.

Expressed Kapok Seed Oil

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KAPOK seed from which the commercial oil is obtained is a by-product of the kapok fiber industry. For those not familiar with kapok it may be mentioned that the fiber or down is not only impermeable to moisture but also very buoyant. On account of these properties, it is used in life preservers of various types as well as for stuffing cushions, pillows, and mattresses. Although Java produces about 90 per cent of the kapok fiber grown, increasing quantities are being produced in India, Malaya, and the Philippines.

There are 54 species of tropical trees that produce seed fiber. These are grouped under the genera of Ceiba, Bombax, Chlorisa, and Gossampinus. At the present time only two of these trees yield fiber of commercial importance. On account of the superiority of its fiber, Ceiba pentandra (also commonly known as Eriodendron anfractuosum) is the most important. The other species, Bombax malabaricum, is called Indian kapok and is found throughout tropical India and Ceylon. Its seed oil gives iodine numbers ranging from 74 to 78, whereas that from C. pentandra, with which the present investigation is concerned, gives values from 86 to 98. The oils from both species, as is well known, give a more intense Halphin color test than does cottonseed oil.

Several years ago, Dr. C. L. Alsberg, during a visit to Java, collected a small quantity of kapok seed, the oil of which was examined by us (E. P. Griffing and C. L. Alsberg, Ind. Eng. Chem. 23, 908, 1931). Owing to the small quantity of oil available, only a partial investigation of it was possible. This oil, which gave an iodine number ot 94.1 by the Hanus method, was found to contain 17.15 per cent of saturated and 76.32 per cent of unsaturated acids. From these data it was calculated that the oil contained 49.6 per cent of oleic acid and 26.7 per cent of linoleic acid.

About the same time A. O. Cruz and A. P. West (Phil. J. Sci. 46, 131-137, 1931), reported the results of an extensive investigation on the oil of Ceiba pentandra expressed from Philippine seed. This oil, which gave an iodine number (Hanus) of 95.6, contained 18.6 per cent of saturated and 75.7 per cent of unsaturated acids. From the data obtained they calculated that the oil contained the following percentages of fatty acids: Oleic 49.8, linoleic 29.3, myristic 0.3, palmitic 15.9, stearic 2.3 and arachidic 0.8. The unsaponifiable matter amounted to 0.8 per cent.

In view that from time to time considerable quantities of kapok seed from Java are pressed for oil by various mills in California, it became of interest to make an investigation of this particular product. The oil to be described was expressed with Anderson oil expellers at the mill of the Pacific Vegetable Oil Company, Inc., San Francisco, from seed imported from Java during the winter of 1934. This firm also furnished us with a pound sample of the seed. The seeds were found to contain 24.6 per cent of oil and 7.16 per cent of moisture. It should be mentioned that this non-drying oil, after refining, is used for edible purposes for which it is well adapted. In contrast to crude cottonseed oil, crude kapok oil contains but little non-oil constituents. On this account it would be expected to have a correspondingly smaller refining loss. However, no laboratory refining tests were undertaken by us.

The chemical and physical characteristics, determined on the crude expressed oil, are given in Table I.

TABLE I.
Chemical and Physical Characteristics of Kapok Seed Oil.

Refractive index at 25°	1.4696
Iodine number (Hanus)	96.0
*Thiocyanogen value (Kaufmann)	75.9
Saponification value	190.7
Acid value	3.7
Acetyl value (Andre-Cook)	12.9
Unsaponifiable matter, per cent	0.8
Saturated acids (corrected) per cent	19.0
Unsaturated acids (corrected) per cent	74.3

*For an unknown reason this value is abnormally low and not in proportion to the iodine number of this oil and the percentage of the saturated acids. During the course of the investigation, the thiocyanogen value was determined in duplicate three times and all the results were in good agreement.

Unsaturated Acids

The percentages of oleic and linoleic acids were calculated in the customary manner from the iodine number of the oil, taking into consideration the actual quantity of the unsaturated acids present.

The results are given in Table II.

TABLE II.
Unsaturated Acids.

	Per cent	Per cent in Oil
Oleic	57.88	43.0
Linoleic	42.12	31.3
	100.00	74.3

Saturated Acids

The saturated acids, which were separated from the saponified oil by the lead-salt ether method, were esterified with anhydrous ethyl alcohol in the presence of dry hydrogen chloride (J. Amer. Chem. Soc. 42, p. 1200, 1920). The esters, amounting to 75.45 grams after being freed from solvent and moisture, were fractionally distilled under a pressure of 3 mm. from a Ladenburg fractionation flask. Five fractions, distilling from 168° to 215° C., were collected, and from