

CAUSE AND PREVENTION OF RANCIDITY IN PALM NUT KERNEL CAKE.

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ONE of the most common complaints of users of palm nut kernel cake is that it is liable to become rancid on keeping. Rancidity developing in an oil-seed residue like palm nut kernel cake is likely to be due to splitting of the fats of the cake by a fat-splitting ferment or enzyme—a lipase—formed under certain conditions. The resting seeds do not contain lipase, but they are likely to contain a zymogen from which under suitable conditions lipase is formed. The lipase would then split the fats or oils with the formation of rancid-smelling fatty acids. According to Reynolds Green, lipases act most rapidly at 55° C. Their activity is slowed at 60° C. At 72° C. the lipase is destroyed, and, of course, its action ceases.

The following experiments show that rancidity in palm nut kernel cake is due to the formation of a lipase. A quantity of cake was finely ground, and portions placed in a number of bottles. Some were kept dry, others moistened with water. To the moistened samples a little toluene was added to prevent putrefaction. The bottles were well stoppered to prevent evaporation, heated in a water bath as described below, and afterwards kept at various temperatures in an incubator.

These experiments show that palm nut kernel cake when kept warm and moist for some time becomes rancid, but that it keeps well at the ordinary temperature if dry. The production of rancidity is prevented by heating for a long time to 60° C., or for a short time to 70° C. These facts are in accord with the conclusion that the rancidity is caused by the action of a lipase set free from a zymogen present in the seed. The important practical point is that rancidity is prevented by heating for a short time to 70° C.

Sample No.	Treatment	Result
1	Kept dry at ordinary temperature for 10 weeks.	No trace of rancidity.
2	Heated dry for 1 hour at 75° C., then kept for 10 weeks at room temperature.	No trace of rancidity.
3	Moistened and incubated at 25° C.	Rancid in 3 days.
4	Moistened and kept at room temperature.	Rancid in a few days.
5-8	Moistened, incubated at 22° C. for 24 hours to change zymogen to lipase. Then heated to 30° C $\frac{1}{2}$ to 3 hours. Then replaced in incubator.	Rancid in a few days.
9-12	Same as 5-8, but heated at 40° C.	Rancid in a few days.
13-16	Same as 5-8, but heated at 50° C.	Rancid in a few days.
17-20	Same as 5-8, but heated at 60° C.	Sample heated only $\frac{1}{2}$ hour, became rancid in a few days. Samples heated for 1 hour or longer remained sweet.
21-24	Same as 5-8, but heated at 65° C.	Half hour sample rancid, others remained sweet.
25-28	Same as 5-8, but heated at 70° C.	All samples remained sweet for 10 weeks.
29-32	Same as 5-8, but heated at 75° C.	All samples remained sweet for 10 weeks.
33-36	Same as 5-8, but heated at 80° C.	All samples remained sweet for 10 weeks.
37-40	Same as 5-8, but heated at 90° C.	No rancidity, but sample heated for 3 hours had a smell, possibly due to decomposition by long heating.

A second set of experiments was then carried out as follows. Some ground cake was kept warm and moist until it became rancid. It was then ground up with 5 per cent. common salt solution and incubated at 25° C. for 24 hours. The liquid part was then separated by filtration under pressure. It was a brown opalescent liquid with an acid reaction. It was divided into halves, one of which was boiled for 10 minutes.

Emulsions of castor oil, palm nut kernel oil, and coconut oil were made by means of water and gum arabic. Several tubes of each were treated with boiled and unboiled extract of rancid cake as prepared above. Each tube was exactly neutralised with sodium carbonate solution after addition of neutral litmus. All the tubes were then placed in the incubator at 25° C. After a few days all the tubes containing boiled extract were still neutral, whilst those containing unboiled extract had all become acid in 12 hours. This experiment shows that it is possible to dissolve the lipase out of rancid palm nut kernel cake. The lipase thus dissolved will turn other oils rancid if brought into contact with them under suitable conditions.

Finally boiled and unboiled extract were added to six samples of the cake which had been heated to 70° C. and incubated for some time without turning rancid. After a few days in the incubator all the samples (with one exception) to which unboiled extract had been added became rancid, whilst the samples mixed with boiled extract remained perfectly sweet. This experiment shows that extracted lipase can turn cake rancid.

To determine if rancidity is preventable by heating the dry powdered cake, samples were treated as follows:

Sample No.	Treatment	Result
1-3	Dry powdered cake heated at 30° C. for 1 hour, moistened, toluene added and placed in incubator at 28° C.	In less than a week all three samples became quite rancid.
4-7	Heated at 40° C. for 1 hour, otherwise treatment same as 1-3.	Ditto
8-11	Same, but heated at 50° C.	In a week, three quite rancid, one only slightly so. In 10 days the fourth sample also was quite rancid.
12-15	Same, but heated at 60° C.	Three quite sweet after 17 days, one had a slight trace of rancidity.
16-19	Same, but heated at 75° C.	No rancidity in any case after three weeks.
20-23	Same, but heated at 80° C.	Ditto
24-27	Same, but heated at 90° C.	No rancidity after a fortnight in three samples, but the fourth was slightly rancid.
28-32	Same, but heated at 100° C.	No rancidity in any case after a fortnight.

CONCLUSION.

Palm nut kernel cake, if kept dry and cool, remains sweet for at least 10 weeks. If kept moist and warm it becomes rancid in a few days. The cake contains a zymogen which under the influence of warmth and moisture forms a lipase. The lipase then turns the oil rancid. The lipase can be destroyed by heating the moistened cake to 70° C. for a short time. If the dry cake is heated the zymogen is usually destroyed, but dry heating is not so certain to destroy it as heating when moist.

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