The Use of Kamala as an Antioxidant of Ghee

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THE problem of prevention of rancidity in natural fats and food preparations containing fats is one which has received considerable attention. The conditions responsible for or favourable to fat deterioration have been well studied. The remarkable variations in the resistance of butterfat to rancidity, and of the vitamin A in the fat to destruction by heat and oxygen, have been attributed to the presence in different amounts of protective substances (Banerjee[1]). Antioxidants and pro-oxidants (promoters) for the control of autoxidation are being increasingly applied in industries. Investigations in the oil and rubber industries in particular have discovered a large range of substances which may be employed to modify the reaction velocity or totally to prevent the deterioration of a product by oxidation or polymerisation.

The work of Olcott and Mattil[2] has shown that three types of substances have a protective action on the oxidation of animal fats (lard): (i) the acid type inhibitors, (ii) the unsaponifiable matter obtained from various vegetables and vegetable oils, and (iii) the phenolic type, *e.g.*, hydroquinone, α-naphthol, pyrogallol, catechol and others. Substances of type (i) can scarcely be added to sensitive foodstuffs like butterfat to help preservation, whilst the use of substances in concentrations exceeding 0·01 or 0·02% of the other types is likely to interfere with taste, flavour, etc.

A search for a substance of such nature that little objection could be taken from these points, has revealed that Kamala dye is satisfactory. It is of vegetable origin, is harmless, odourless and very stable. When dissolved in fats in small amounts it gives a light yellow colour, which is natural to butterfat of good quality. The dye is not soluble in water, but an alcoholic solution dissolves easily in fat.

The effect of the addition of this substance in small concentrations on the oxidation of fat as measured by oxygen absorption at 95° C. is summarised in Table I.

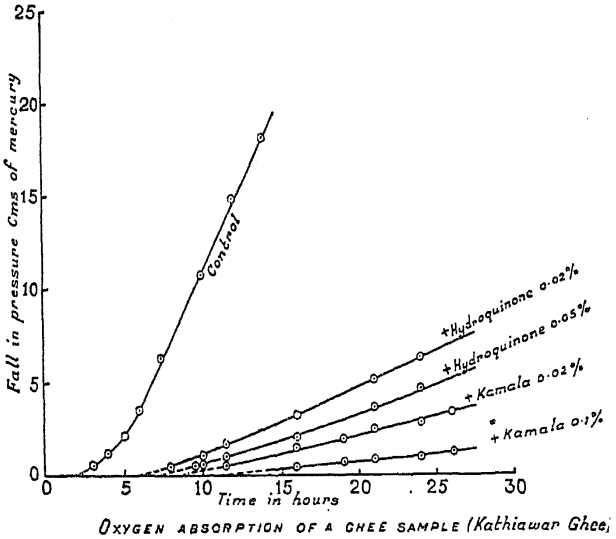
It is seen that the induction period is considerably increased by the addition of even 0·02% of Kamala dye. The rate of oxygen absorption is also reduced by the addition of this inhibitor (Fig. 1).

TABLE I

Substrate Kathiawar Agmark Ghee

Inhibitor added %		Induction period* with inhibitor hours	Anti-oxidative index
0·02	Hydroquinone	6·0	3·0
0·05	,, ...	7·0	3·5
0·02	α-naphthol	5·0	2·5
0·02	Kamala dye	8·5	4·25
0·05	,, ...	9·5	4·75
0·10	,, ...	11·0	5·5
0·02	Citric acid	2·0	1·0
0·20	,, ...	4·5	2·25
0·02	Tartaric	2·0	1·0
0·20	,, ...	3·5	1·75
0·20	Lactic acid	2·5	1·25
0·50	,, ...	1·5	0·75
0·20	Oleic acid	1·5	0·75
0·50	,, ...	1·0	0·5

* Induction period for control 2 hours.



OXYGEN ABSORPTION OF A GHEE SAMPLE (Kathiawar Ghee)

Graph 1

Several substances such as oxalic acid,[3] maleic acid,[4] sulphuric acid and phosphoric acid and their salts[5] and lecithin[6] have been suggested as antioxidants for vegetable fats. Addition of organic acids like citric, tartaric and lactic acids does not increase the period of induction in butterfat, while oleic acid has been found to shorten it. But, when the acids are added along with the inhibitors, a considerable increase in the

antioxidative activity is noted. This synergetic effect is particularly noticeable with oleic acid (Table II).

TABLE II

Synergetic effect of organic acids and inhibitors

Substrate Kathiawar Agmark Ghee

Inhibitor mixture %	Induction period* with inhibitor hours	Anti-oxidative index
0·2 Oleic acid +0·02 Hydroquinone ..	23	11·5
0·5 Oleic acid +0·02 Hydroquinone ..	36	18
0·2 Oleic acid +0·02 Kamala dye	78	39
0·5 Oleic acid +0·02 Kamala dye	>86	>43
0·5 Oleic acid +0·05 Kamala dye	>86	>43
0·02 Citric acid +0·02 Kamala dye	9	4·5
0·2 Citric acid +0·02 Kamala dye	19·5	9·75
0·02 Tartaric acid +0·02 Kamala dye	12	6
0·2 Tartaric acid +0·02 Kamala dye	26	13

* Induction period for control 2 hours.

This behaviour resembles that observed by Olcott and Mattil[2] who found that mixtures of orcinol and phosphoric acid prolong the period of induction in lard to a greater extent than either substance individually. It seems likely that the observation of Holmes, Corbet and Hartzler[7] on the superior stabilizing effect of combinations of lecithin and hydroquinone on vitamin A over that of either alone, is a case not dissimilar to the one recorded here. The advantages of using mixtures like oleic acid and Kamala instead of the abovementioned antioxidant mixtures of lecithin, phosphoric acid and other objectionable compounds are obvious.

The sample of Kamala dye was provided by Dr. S. Krishna, Biochemist, Forest Research Institute, Dehra Dun, to whom the authors' thanks are due.

[1] Banerjee, *Agric. & Livestock in India*, 1938, **8**, 153.
[2] Olcott and Mattil, *J. Amer. Chem. Soc.*, 1936, **58**, 2204.
[3] Rogers, *C.A.*, 1932, **26**, 613 : *U.S. Patent*, **1**, 826, 258.
[4] Greenbank and Holmes, *Ind. Eng. Chem.*, 1934, **26**, 243.
[5] Eckey, *U.S. Patent*, **1**, 982, 907.
Richardson, Vibrans and Andrews, *C.A.*, 1935, **29**, 518, 2770.
[6] Bollman, *Ibid.*, 1923, **17**, 3234.
[7] Holmes, Corbet and Hartzler, *Ind., Eng. Chem.*, 1936, **28**, 133.

OBITUARY

Dr. Gopal Chandra Chakravarti

IT is with deep regret that we record the tragic and premature demise of Dr. Gopal Chandra Chakravarti—a former Lecturer in the Department of Organic Chemistry, *Indian Institute of Science*, Bangalore. He was practically bed-ridden since 1934 on account of paralytic attack and was staying in Calcutta. On 20th October 1939, he died of burns caused by an accidental fire in his bed chamber.

Born in June 1897, he was the son of Mr. Chandra Kumar Chakravarti. He took the B.Sc., B.A., M.Sc. and D.Sc. degrees of the Calcutta University with distinction. He was the recipient of a Silver Medal in 1921, Nagarjuna Gold Medal in 1924, and also a Premchand Roychand Scholarship. He was Demonstrator in Chemistry in St. Paul's College, Calcutta, 1920–21, Sir T. N. Palit Research Scholar in the University College of Science, Calcutta, 1921–24, and Professor of Chemistry, Serampore College, 1925–27. He joined the *Indian Institute of Science*, Bangalore, as a lecturer in 1927 and held that position till July 1934 when, for reasons of health, he had to resign from service.

Dr. Chakravarti's field of researches comprised both of synthetic chemistry and chemistry of natural products. His papers on the colour of complex diazoles and on sulphur-containing dyestuffs are of great interest. He studied the colouring constituents and the waxy product of the alkannet root and also suggested a constitutional formula for alkannin. His papers on mercaptans and thiophthalic acids deserve special mention.

Dr. Chakravarti was a devoted researcher. But for his ill-health he would have made still more valuable contributions to the science of chemistry. B. H. IYER.