STABILITY OF FATS AND OILS UNDER DIFFERENT STORAGE CONDITIONS AS AFFECTED BY ANTIOXIDANTS

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Alpha tocopherol, Ascorbic acid and Lecithin retarded autoxidation in *ghee* while alpha tocopherol failed to stabilize the rapeseed oil. Ascorbic acid and Lecithin effectively checked autoxidation in rapeseed oil. Exposure to light, air and high temperature greatly catalysed the autoxidation.

INTRODUCTION

Fats and oils play an important role in human diet and are subject t deterioration known as rancidity. The problem of rancidity resulting fro prolonged aging of fats and oils is under the active consideration of ever consumer of fats and oils. Due to the serious economic losses of fats and oil or their products rancidity has received the attention of many investigators

The present paper reports the effect of Alpha tocopherol, Lecithin an Ascorbic acid on butter oil and rapeseed oil under different storage condition

REVIEW OF LITERATURE

The term rancidity is commonly applied to off-flavours and off-odour that involve the fatty part of foods. Sometimes fat absorbs flavours and odou from foods that are stored in close proximity to them. The main objectio to rancidity is the seriously unhealthy conditions that result on the consumptio of rancid fat. Some toxic symptoms in rats were recorded by Johnson *et a* (1956). These symptoms were not permanent, as these animals quickl recovered and grew normally to maturity on normal diet.

Factors governing the rate of ranciditification are many. Factors lik the traces of metals, unsaturation of fat or, more specifically, its contents c polyunsaturated fatty acids, reduce the stability of fats. (O'Conner *et al* 1948; Chalk and Smith, 1957; Nestrelayer, 1910). Other factors like ligh temperature, moisture and oxygen also catalyze the autoxidation, and fa that are exposed to them become rancid more quickly. Richmond (195 observed that butter remained indefinitely without any change when protecte from light and air, but when exposed, it was oxidized with very pronounce changes in its chemical composition. Henry (1915) suggested to keep fa

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as free as possible from water (moisture) and shield from light and air in order to prevent rancidity.

More natural fats contain minor constituents that retard the development of rancidity. Such constituents are named as antioxidants. In common vegetable oils, such antioxygenic constituents are tocopherols, which are cyclic alcohols, and may also appear in various animal fats as the results of the ingestion of vegetable materials by the animals (Barnes *et al.*, 1943). The tocopherols are relatively week antioxidants and contribute a flavour of their own when used for low stability fats (Swartling, 1949).

Lecithin is another naturally occurring material in edible products to be proposed as antioxidant in foods (Bollman, 1925). Evans (1935) observed that crude vegetable lecithin appreciably lengthened the induction period of vegetable oils.

The antioxidant effect of ascorbic acid and its derivatives can be ascribed partly to their capacity to bind metal ions and results of Morris *et al.* (1950) confirm its effectiveness against copper. Apart from this, it also regenerates the natural or added antioxidants (Zalewski and Karpinski, 1946). The antioxygenic activity of ascorbic acid is only restricted to the presence of another natural or added antioxidants. Golumbic and Mattil (1941) found the tocopherols free vegetable oils can no longer be stabilized by ascorbic acid. According to Isler (1938) the extent of a tocopherol oxidation was only 6 per cent in the presence of ascorbic acid.

MATERIAL AND METHODS

Butter oil (*ghee*) and rapeseed oil were purchased from the market and analysed for their quality. The samples were then treated with Alpha tocopherol, Lecithin, and Ascorbic acid (each at the rate of 0.10, 0.05 and 0.01 per cent and were studied for the following storatge conditions:

Light : Treated and controlled samples in glass flasks were daily exposed to sunlight for five hours. Another similar set of samples was stored in darkness (laboratory shelves) for comparison.

Air : To study the effect of air the samples were stored in 100 ml. culture tubes which were corked and sealed without any head space. These tubes were also stored in laboratory shelves.

Temperature : The samples were also stored at 122, 140 and 158°F. in thermostatically controlled electric ovens.

Methods of analysis employed were as outlined in A.O.C.S's official and tentative methods of analysis (1950.)

TABLE 1. *Showing peroxides (M. Eq./Kg.) in Ghee containing different antioxidants under different storage conditions.*

	Stored in Light *			Stored in Darkness*			Stored in Absence of Air*		
	0.10%	0.05%	0.01%	0.10%	0.05%	0.01%	0.10%	0.05%	0.01%
Control	95.30	95.30	95.30	63.58	63.58	63.58	9.01	9.01	9.01
Alpha-Tocopherol	56.11	60.88	61.38	47.55	45.00	48.97	3.21	3.09	3.61
Ascorbic acid	88.98	86.81	80.19	58.66	56.16	56.67	7.28	7.35	7.16
Lecithin	67.88	70.14	80.28	45.97	42.60	38.19	2.91	2.44	2.83
	Stored at 122°F †			Stored at 140°F†			Stored at 158°F†		
Control	84.85	84.85	84.85	92.29	92.29	92.29	113.56	113.56	113.56
Alpha-Tocopherol	38.29	41.54	48.39	40.77	48.87	52.14	53.83	65.87	68.88
Ascorbic acid	82.00	80.08	83.59	88.29	86.16	90.81	99.81	95.27	98.11
Lecithin	66.66	62.26	68.29	69.42	65.31	72.58	72.28	80.86	88.88

* After 20 weeks of storage.
†After 10 weeks of storage.

TABLE 2. *Showing peroxides (M. Eq./Kg.) in Rapeseed Oil containing different antioxidants under different storage conditions.*

	Stored in Light*			Stored in Darkness*			Stored in Absence of Air*		
	0.10%	0.05%	0.01%	0.10%	0.05%	0.01%	0.10%	0.05%	0.01%
Control ..	114.85	114.85	114.85	80.81	80.81	80.81	13.22	13.22	13.22
Alpha-Tocopherol ..	130.59	124.67	120.84	106.34	98.44	92.31	14.35	14.24	13.82
Ascorbic Acid ..	50.39	56.47	65.71	42.24	52.25	59.12	8.54	8.60	8.66
Lecithin ..	64.94	74.74	80.00	61.11	65.29	68.34	9.86	10.71	11.69
	Stored at 122°F†			Stored at 140°F†			Stored at 158°F.†		
Control ..	108.31	108.31	108.31	126.62	126.62	126.62	146.39	146.39	146.39
Alpha-Tocopherol ..	121.35	116.44	113.31	131.19	145.24	136.94	171.21	160.36	154.41
Ascorbic acid ..	44.81	48.47	56.32	52.45	57.52	62.23	81.86	89.39	92.53
Lecithin ..	52.74	57.34	66.63	68.23	72.44	75.31	103.91	108.83	121.35

* After 70 days storage.

†After 25 days storage.

RESULTS AND DISCUSSION

Butter Oil

Butter oil showed appreciable stability towards autoxidation. The peroxides developed in *ghee* as such, and containing different antioxidants under varying storage conditions are shown in Table I. All antioxidants when incorporated into *ghee* retarded peroxide formation to a greater or a lesser extent. Exposure to light, air and high temperature greatly accelerated the ranciditification, while samples protected from light and air exhibited a very low peroxides. Alpha tocopherol was the least effective antioxidant of the group while lecithin offered the maximum protection against autoxidation.

Rapeseed Oil

The peroxides formation in treated and untreated rapeseed oil under different storage conditions is given in Table 2. It is known that vegetable fats contain minor constituents that retard the development of rancidity and tocopherols are one of them. The level of its concentration is just near the optimum, and any addition to it will result in reduced stability (Dollear, 1952). Similar proxygenic activity of alpha tocopherol was observed in rapeseed oil at all concentrations, under all storage conditions. Ascorbic acid in this case exhibited maximum protection against autoxidation. Lecithin was second effective antioxidant studied in this case. Exposure to high temperature reduced the effectiveness of all the antioxidants.

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