

Organoleptic Study on Butter and Ghee Prepared from Cream with Added Copper.*

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Pasteurized cream (heated to 85°C for 20 seconds and cooled to 4°C) was taken in 400 kg quantity for each trial. Such five trials were conducted. The cream was divided into four batches each amounting to 100 kg. To each batch of cream, copper was added at the rate of zero, (Cu_0), 100 (Cu_1), 200 (Cu_2) and 500 (Cu_3) ug Cu/kg of cream as copper sulphate (200 ug Cu/ml) solution. Salted butter (2%) was prepared from these copper treated cream in Silkeborg Stainless steel butter churn with 15 per cent final moisture in butter. The butter was packaged in 250 gm slabs in "Cryovac" packaging material. Butter samples were stored at two different storage temperatures viz., $-10 \pm 2^\circ C$ and $6 \pm 1^\circ C$ for 20 weeks storage period.

For the preparation of ghee, butter samples of about 2 kg from each treatment viz., Cu_0 , Cu_1 , Cu_2 and Cu_3 level were used. The butter was converted into ghee using a temperature of 115°C. Ghee samples were stored at $6 \pm 1^\circ C$ and at room temperature (RT) for 20 weeks.

Flavour score of butter at $-10^\circ C$:

The initial flavour score of all butter samples varied from 8.4 to 8.2. The flavour score decreased with the duration of storage period. The rate of decrease of flavour score was not similar in all butter samples. The fall in flavour score was highest having Cu_3 level while it was lowest, having Cu_0 level at $-10^\circ C$ during twenty weeks storage. Even addition of 100 ug Cu/kg (of cream) in samples stored at $-10^\circ C$ did not cause appreciable deterioration for 20 weeks, mostly because of the low storage temperature. However, when the copper content of butter increased, the fall in flavour score was also increased. Cu_0 , Cu_1 and Cu_2 level samples showed normal flavour throughout twenty weeks while Cu_3 level samples showed slight rancid flavour at the end of twenty weeks.

Flavour score of butter at $6^\circ C$:

Cu_0 level samples showed normal flavour upto 15 weeks but at 20 weeks they showed slightly rancid flavour. Samples containing Cu_1 and Cu_2 levels showed normal flavour upto 10 weeks but showed slightly rancid at the end of 15 weeks. Cu_1 level samples showed slightly rancid at the end of 20 weeks but Cu_2 level samples showed definite rancid flavour at the end of 20 weeks storage period. Samples containing Cu_3 level showed normal flavour upto 5 weeks after that it was easy to detect the rancidity and at the

Part of M.Sc. (Dairy Technology) thesis submitted by first author to Gujarat Agricultural University (1979).

TABLE 1

Organoleptic score and favour of butter as affected by copper content, storage temperature and storage period (Mean of five replications)

Storage period	Storage temperature							
	-10° ± 2° C (T ₁)				6° ± 1° C (T ₂)			
	Copper treatment to cream							
	Cu ₀	Cu ^I	Cu ₂	Cu ₃	Cu ₀	Cu ₁	Cu ₂	Cu ₃
S ₀	8.4	8.4	8.3	8.2	8.4	8.4	8.3	8.2
	N	N	N	N	N	N	N	N
S ₁	8.2	8.1	8.1	7.9	8.0	7.7	7.2	6.2
	N	N	N	N	N	N	N	N
S ₂	7.9	7.6	7.5	7.2	7.3	7.2	6.8	5.5
	N	N	N	N	N	N	N	SR
S ₃	7.7	7.7	7.4	6.8	6.3	5.6	5.3	3.0
	N	N	N	N	N	SR	SR	R
S ₄	7.3	7.1	6.8	5.5	4.8	4.0	2.8	1.3
	N	N	N	SR	SR	SR	R	R

N = Normal SR = Slightly Rancid R = Rancid

end of 20 weeks storage it was highly rancid. Pont and Britwistle (1966) observed that copper was a determining factor in deterioration of butter. El-sadek (1973) reported that induction period of butter decreased as the

added copper to butter increased.

Flavour score of ghee at 6° C

The initial flavour score of ghee samples varied from 8.4 to 8.1. The flavour score decreased with the increased duration of storage period.

TABLE 2

Organoleptic score and flavour of ghee as affected by copper content, storage temperature and storage period (Mean of five replications).

Storage period	Storage temperature							
	6° ± 1 C (T ₂)				RT			
	Copper treatment to cream							
	Cu ₀	Cu ₁	Cu ₂	Cu ₃	Cu ₀	Cu ₁	Cu ₂	Cu ₃
S ₀	8.4	8.1	8.1	8.2	8.4	8.1	8.1	8.2
	N	N	N	N	N	N	N	N
S ₁	8.0	8.0	7.7	7.7	7.8	7.8	7.6	7.3
	N	N	N	N	N	N	N	N
S ₂	7.7	7.5	7.5	7.3	7.6	7.2	7.2	6.5
	N	N	N	N	N	N	N	N
S ₃	7.4	7.0	6.5	6.3	6.8	6.4	5.5	4.7
	N	N	N	N	N	N	N	SO
S ₄	6.5	6.2	5.3	4.8	6.0	4.6	3.4	1.1
	N	N	SO	SO	SO	SO	SO	O

N = Normal SO = Slightly Oxidized O = Oxidized

Cu_0 and Cu_1 level samples having no added copper and 100 ug added copper per kg of cream showed normal flavour throughout the storage period of 20 weeks, but samples having Cu_2 and Cu_3 levels showed slight oxidized flavour at the end of 20 weeks. The Cu_3 level samples positively scored less organoleptic also indicating flavour score 4.8 compared to Cu_2 level samples which scored 5.3 at the end of 20 weeks storage period.

Flavour score of ghee at room temperature :

It was observed that as the copper content in ghee samples increased the rate of decrease in flavor score was also increased. Cu_0 and Cu_1 level samples showed normal flavour up to 15 weeks storage and showed slightly oxidized flavour at the end of 20 weeks storage. Cu_2 and Cu_3 showed normal flavour up to 10 weeks but showed slightly oxidized at the end of 15 weeks storage period. Cu_2 showed slightly oxidized flavour at the end of 20 weeks but Cu_3 showed highly oxidized flavour.

It can be concluded that lower temperature helps to suppress the ef-

fect of copper upto certain extent in ghee during storage. Al-sokkary and Ghoneim (1952) reported that objectionable flavour and taste were always detected on storage with higher copper content in samna and these defects were more pronounced as the copper content of samna was increased.

ACKNOWLEDREMENT

The first author is thankful to the Indian Council of Agricultural Research, New Delhi for award of Junior Fellowship.

(Received on Dec. 20, 1979)

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