LACTOSE CONTENT AND PARTICLE SIZE DISTRIBUTION IN GHEE RESIDUE OBTAINED FROM DIRECT CONTACT HEAT EXCHANGE PROCESS

Lactose content of ghee residue obtained by direct contact heat exchange (DCHE) method, was approximately three times higher than in the conventional pan (CP) method. The residue particle size for DCHE and CP was 138 and 106 microns respectively.

The process feasibility of ghee making by direct content heat exchange was explored and reported[1]. This process appeared quite promising in respect of acceptability of the product, foaming and scale formation, energy requirements and fat recovery. Further investigations were carried out to determine the lactose content and particle size distribution in the ghee residue obtained from direct contact heat exchange process. The values were compared with those obtained for the residue from conventional process.

Lactose: Lactose was estimated according to Lane and Eyenon[2] with a slight modification in regard to the precipitation of proteins from the sample.

The lactose in ghee residue was estimated on fat free basis as the fat content in conventional process residue was found to differ from that of the direct contact heat exchange process.

Five samples of residue obtained from both the processes were analysed. In the samples from conventional method the lactose content varied from 7.76 weight percent to 7.94 weight per cent on fat free basis with an average value of 7.88. However the weight percent of lactose in the samples obtained from direct contact heating varied from 23.88 to 24.89 with 24.52 as the average value. From these results it is evident that the lactose content in the ghee residue obtained from direct contact heat exchange process is approximately three times higher than the sample obtained from conventional process. In the latter process most of the lactose is lost because of its reaction with proteins (*Maillard* reaction) and by high temperature denaturation (caramalization).

Particle size distribution: Wet screening method with certain modifications was employed in the particle size analysis[3]. The arithmatic average particle size in the case of conventional method sample was found to vary

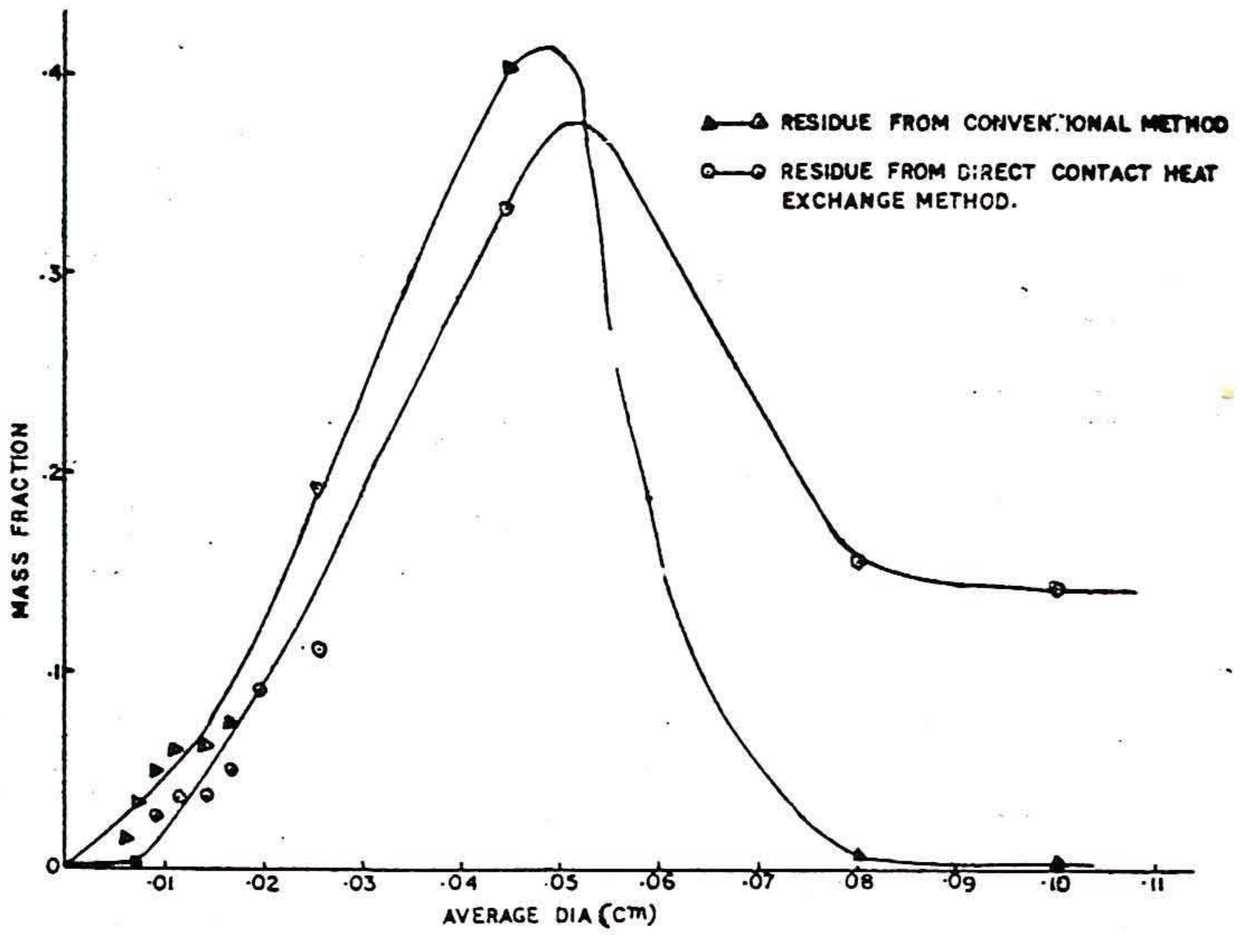

FIG.1 PARTICLE SIZE DISTRIBUTION FOR GHEE RESIDUE FROM CONVENTIONAL AND THE NEW METHOD

from 97.0 to 121.0 microns with the mean value as 106.8 microns. The range of the particle size obtained from direct contact heat exchange method was 131 to 145 microns with the average value as 138 microns. Hence there was not much difference in the average values of particle size. However a plot in mass fraction versus average diameter for both the type of samples as shown in Fig. 1 reveals that the sample obtained from direct contact heat exchange method contains lesser number of fines compared to the other sample. Reduction in the number of fines will result in their easy removal and will also reduce the fat losses because large number of fines trap more fat on the surface.

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References

1. Abichandani, H. and Sarma, S. C., *J. Fd Sci. Technol.*, 1978, **15**, 177.
2. *Indian Standard, Methods for Tests for Dairy Industry-Rapid Estimation of Milk*, Indian Standards Institution, New Delhi, IS-1479 (Pt.-1), 1960.
3. Zaidi, A. H., Abichandani, H. and Agrawala, S. P., *Indian J. Dairy Sci.*, (in press).

SIMPLIFIED EXTRACTION PROCEDURE IN THE RAPID SPECTROPHOTOMETRIC METHOD FOR LYCOPENE ESTIMATION IN TOMATO

Lycopene may be extracted from tomatoes completely by shaking with acetone for 15 min.

Tomato breeders all over India are actively engaged in breeding new tomato varieties with deep red colour to meet the requirements of the processing industry. The red colour of ripe tomato is due to the pigment lycopene ($C_{40}H_{56}$) although other carotenoid pigments besides lycopene are also present. Beer and Siddappa[1] standardised a rapid spectrophotometric method for the lycopene estimation. The method involves extraction of lycopene using acetone by grinding in a pestle and mortar or in an electric blender till the residue becomes colourless, transfer of pigment from acetone to petroleum ether phase and measurement of the optical density of the extract at 503 nm (since β-carotene has negligible absorbance at this wave length). Extraction procedure followed by them are laborious, time consuming and needs more solvent. Investigations carried out for rapid extraction of the pigments from tomato juice are presented in this paper.

In the preliminary investigations, various solvents were tried repeatedly for four times to verify reproducibility of results. The procedure consisted of shaking 1g of tomato juice (taken in duplicate in 100 ml stoppered conical flask) with 20ml of solvent for 30 min. on an electric shaker having a speed of 120 strokes per min. Optical density of colour was measured either directly in the extract or after transferring the pigments to petroleum ether phase and removal of moisture from the solvent using anhydrous sodium sulphate (Table 1).

Table 1 shows that extraction of lycopene was maximum in acetone. The pigments could then be transferred to 20 ml petroleum ether for measuring the colo intensity.

TABLE 1. OPTICAL DENSITY OF COLOUR EXTRACTED USING DIFFERENT SOLVENTS

Solvent system used	Optical density at 503 nm
Hexane (20 ml)	0.1938
Acetone + hexane (10 ml each)	0.1675
Petroleum ether (20 ml)	0.1549
Acetone + petroleum ether (10 ml each)	0.1549
Acetone (20 ml)[a]	0.4685
Acetone (20 ml)[b]	0.4089

[a]Pigments transferred to 20 ml petroleum ether and then the OD measured.

[b]Pigments transferred to 20 ml hexane and then the OD measured

TABLE 2. COMPARISON OF SIMPLIED METHOD WITH THE ORIGIN METHOD OF BEER AND SIDDAPPA[1]

Method used	Optical densit at 503 nm
1. *Beer and Siddappa's method*	
(*a*) Tomato juice (1g) ground with acetone using pestle and mortar till the residue was colourless, transferred to petroleum ether (20ml) and the colour measured at 503 nm using a spectophotometer.	0.4949
(*b*) Similar to 'a' but blending in an electric blender instead of grinding in pestle and mortar.	0.3979
2. *Proposed method* Tomato juice (1g) shaken with acetone (20 ml) for 15 min on an electric shaker Pigments transferred to petroleum ether (20 ml) and the optical density measured.	0.5086

The minimum time required for the complete extra ion of pigment was standardised by using aceto as solvent. Time of shaking varied from 0 to min. and the experiment was repeated thrice to che the reproducibility of the results. The results reveal that shaking for 15 min was sufficient to extract lycope completely.

The standardised method was compared with t method of Beer and Siddappa.[1] Table 2 shows th blending as compared to grinding resulted in loss pigments. perhaps during transferring of the sampl which is difficult to overcome. However, there w no difference between the values obtained by grindi (method 1*a*) and shaking on an electric shak (method 2). The latter method appeared to be equa efficient to the method of grinding and extracti followed by Beer and Siddappa[1]. The method simple, less laborious, equally precise, requires le solvent and enables handling of more number of sampl

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Beer, O. P. and Siddappa, G. S., *Food Technol. Chicag* 1959, **13**, 414.

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