



COURSE TITLE: MICROBIOLOGY OF MILK PRODUCT

COURSE NO. - DTM-222: CREDIT HRS - 2 (1+1)



## MICROBIOLOGY OF THE INDIGENOUS MILK PRODUCTS - PART II

### Heat and acid coagulated products

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Acidified heat coagulated milk products are one of the oldest and most popular foodstuffs and are produced throughout the world.

Traditional Indian dairy products can be classified into six categories based on the principle of manufacture

- Heat desiccated products
- Heat and acid coagulated products
- Fermented products
- Products made with addition of cereals
- Clarified butter fat (ghee)
- Frozen products



Chhanna are curds or cheese curds, originating from the Indian subcontinent, made from buffalo or regular cow milk by adding food acids such as lemon juice instead of rennet and straining. It is very similar or analogous to cottage cheese.



Paneer is a fresh cheese common in the Indian subcontinent. It is an unaged, non-melting soft cheese made by curdling milk with a fruit- or vegetable-derived acid, such as lemon juice. Its acid-set form, before pressing, is called chhana.



Kalakand is an Indian sweet made out of solidified, sweetened milk and paneer. It is also popular in Pakistan



Rasogulla is an Indian syrupy dessert popular in the Indian subcontinent and regions with South Asian diaspora. It is made from ball-shaped dumplings of chhanna and semolina dough, cooked in light syrup made of sugar. This is done until the syrup permeates the dumplings.



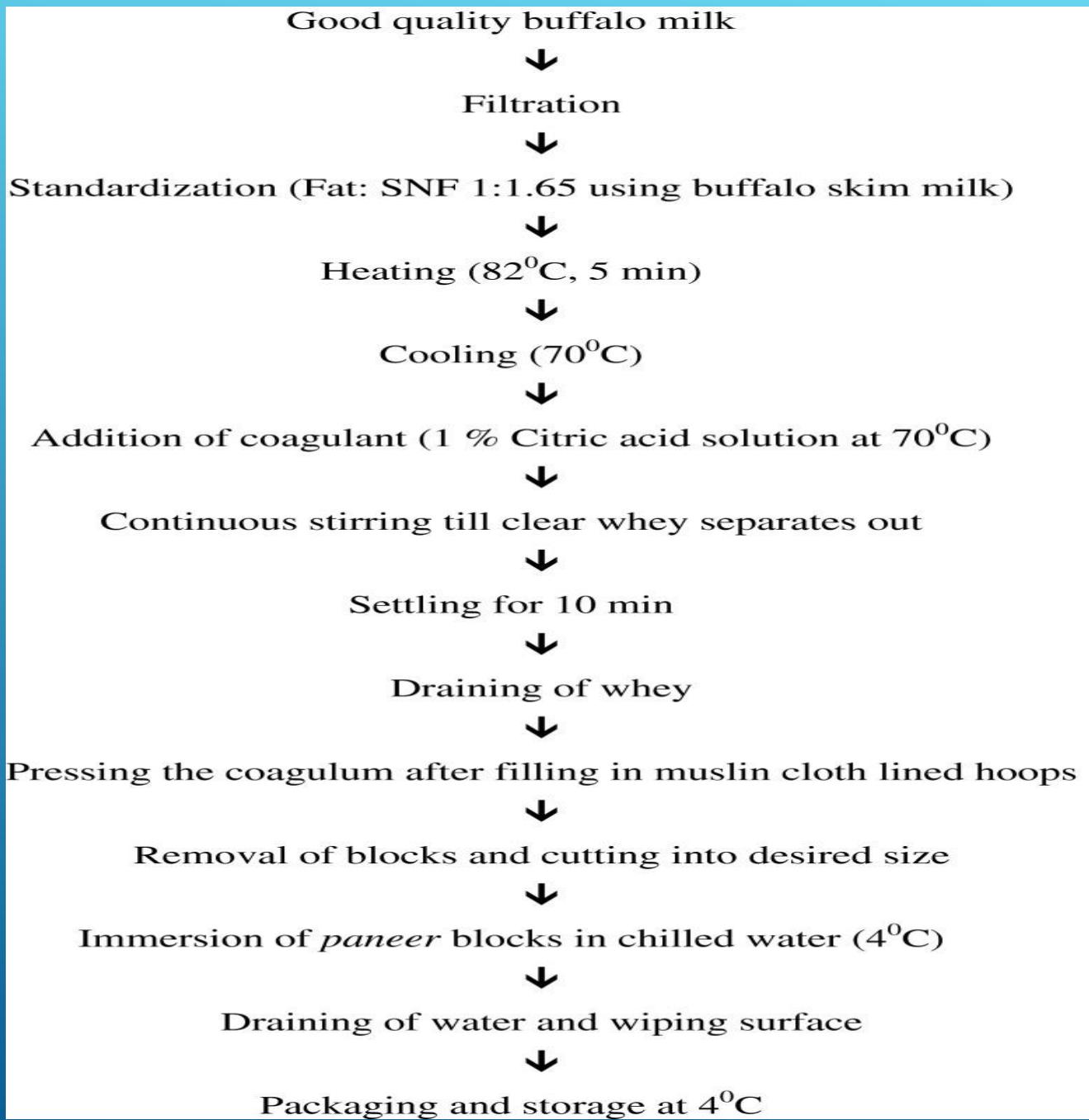
<i>Product</i>	<i>Type of Milk</i>	<i>Moisture</i>	<i>Fat</i>	<i>Protein</i>	<i>Lac- tose</i>	<i>Ash</i>
<i>Paneer</i>	Buffalo	52.3	28.8	18.3	3.5	2.0
	Cow	56.0	22.0	18.5	2.1	1.4
<i>Channa</i>	Buffalo	51.7	29.7	14.4	2.3	1.9
	Cow	53.1	24.8	17.8	2.2	2.1
<i>Rasogolla</i>	Buffalo	52.8	4.2	6.4	36.1	0.5
	Cow	50.1	7.3	8.7	—	1.1
<i>Sandesh</i>	Buffalo	27.1	18.5	19.8	—	1.9
	Cow	25.5	19.9	18.5	—	1.7

## Paneer

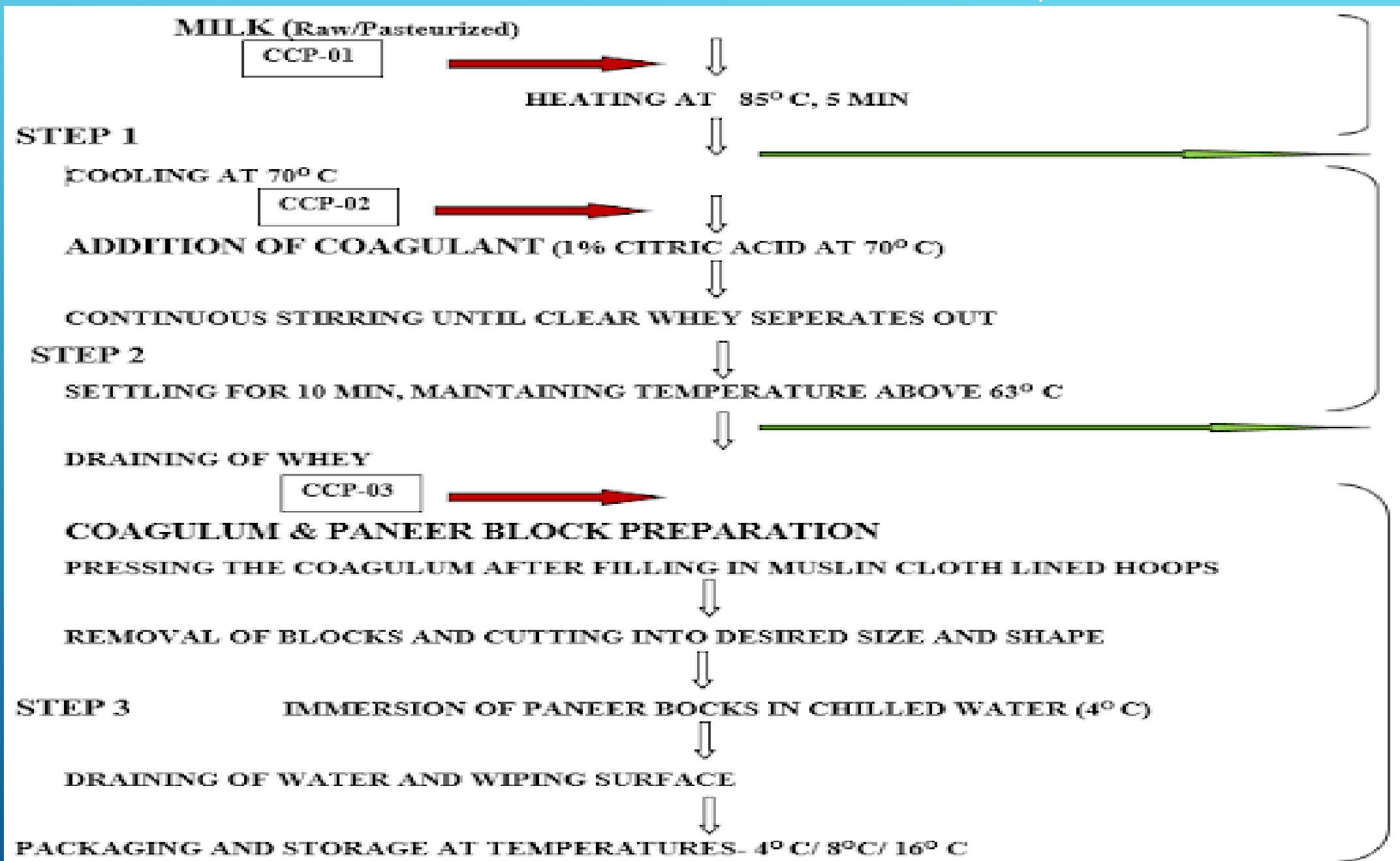
Paneer is obtained by acid and heat coagulation of milk. Good quality paneer is characterised by a white colour, sweetish mildly acidic and nutty flavour, spongy body and a close knit structure. Paneer is highly nutritious since it retains about 90% fat and protein, 50% minerals and 10% lactose of the original milk. It provides one of the methods of conserving, preserving and prolonging shelf life of milk solids in highly concentrated form.

Paneer is a South Asian variety of soft cheese obtained by acid and heat coagulation of milk. It is a non-fermentative, non-renneted, non-melting and unripened type of cheese. Paneer is popular throughout South Asia, used in raw form or in preparation of several varieties of culinary dishes and snacks. The production of paneer is now spreading throughout the world.

Paneer is a rich source of animal protein available at a comparatively lower cost and forms an important source of animal protein for vegetarians. Over and above its high protein content and digestibility, the biological value of protein in paneer is in the range of 80 to 86 (Shrivastava and Goyal 2007). In addition, paneer is a valuable source of fat, vitamins and minerals like calcium and phosphorus. It has a reasonably long shelf life under refrigeration.



# Quantitative Microbial Risk Assessment for Consumption of Paneer



## Microbiological quality of paneer

The microbiological quality of *paneer*, like other indigenous milk products, chiefly depends on the conditions of manufacture, subsequent handling, storage and sale of the product. The possible sources of contamination might be air, water, utensils, cutting knife, muslin cloth as well as persons handling the product. Hence, the number and types of microorganisms and their distribution in the product may vary depending on the location of the *halwai* shop, extent of exposure of the product to the atmosphere, temperature and period of storage etc. According to a survey conducted on the market quality of *paneer* obtained from Karnal and Delhi samples were found to contain heavy load of total bacterial population, coliforms and yeasts and moulds. Another study on market paneer from Ludhiana city indicated heavy contamination of the product with *Staphylococci*, 25% of which were found to be positive for coagulase and TDNase.

## Microbiological quality of chhana

Chhana samples showed an average bacterial count of  $1.6 \times 10^4$  per gram. However, during storage at  $37^\circ\text{C}$ , the count increased to  $31 \times 10^6$  and  $110 \times 10^6$  at the end of 24 and 48h, respectively. The spoilage of the product was chiefly due to thermoduric bacteria. Among the bacterial types isolated from chhana, micrococci predominated and constituted 45 % of the total microflora, followed by sporeformers (34%). The remaining portion (about 27%) constituted non-sporeforming rod shaped bacteria. Incidence of yeasts and moulds was studied and the initial count of 260 per gram increased to  $385 \times 10^3$  per gram on storage for 48 hours. The most commonly occurring moulds in chhana belonged to the genera *Penicillium*, *Aspergillus*, *Mucor*, *Rhizopus*, *Fusarium* etc.

## Microbial Defects in Paneer / Chhana

Due to high fat and moisture content, these products are prone to microbiological spoilage leading to rancidity (due to fat breakdown) and mouldy surface (due to mould growth). Storage of packaged *chhana* or *paneer* at low temperature (5°C - 10°C) can check the rancid defect. The mold growth can be avoided by keeping moisture at an optimum level and by avoiding delays in the marketing and disposal of these products.

FSSAI has specified following criteria for process control at plant level. These are not applicable at retailer level. However, these parameters should be maintained up to retailer's end as consumers buy the paneer directly from the retailer.

Given here are acceptable limits of total plate count (TPC), coliform, yeast and mould, *E. coli* and *S. Aureus* for paneer.

TPC – m: 150, 000/gm, M: 350,000/gm ii) Coliform (cfu/gm) – m: 10/gm, M: 100/gm  
iii) Yeast and mould (cfu/gm) – m: 50/g, M: 150/gmiv) *E. coli* – m <10/gm:v) *S. aureus* – m: 10/gm, M: 100/gm Here ‘m’ represents an acceptable level; values that are only marginally above it are acceptable. The ‘M’ shows a microbiological criterion that separates ‘marginally acceptable quality’ from ‘unsatisfactory/ potentially hazardous quality’.

# Rasogulla

Rasogulla is an Indian syrupy dessert popular in the Indian subcontinent and regions with South Asian diaspora. It is made from ball-shaped dumplings of chhana (an Indian cottage cheese) and semolina dough, cooked in light syrup made of sugar. This is done until the syrup permeates the dumplings. The spongy white rasgulla is believed to have been introduced in present-day West Bengal in 1868 by a Kolkata-based confectioner named Nobin Chandra Das. Das started making rasogulla by processing the mixture of chhana and semolina in boiling sugar syrup in contrast to the mixture sans semolina in the original rasgulla in his sweet shop located at Sutanuti (present-day Baghbazar). His descendants claim that his recipe was an original, but according to another theory, he modified the traditional Odisha rasgulla recipe to produce this less perishable variant.

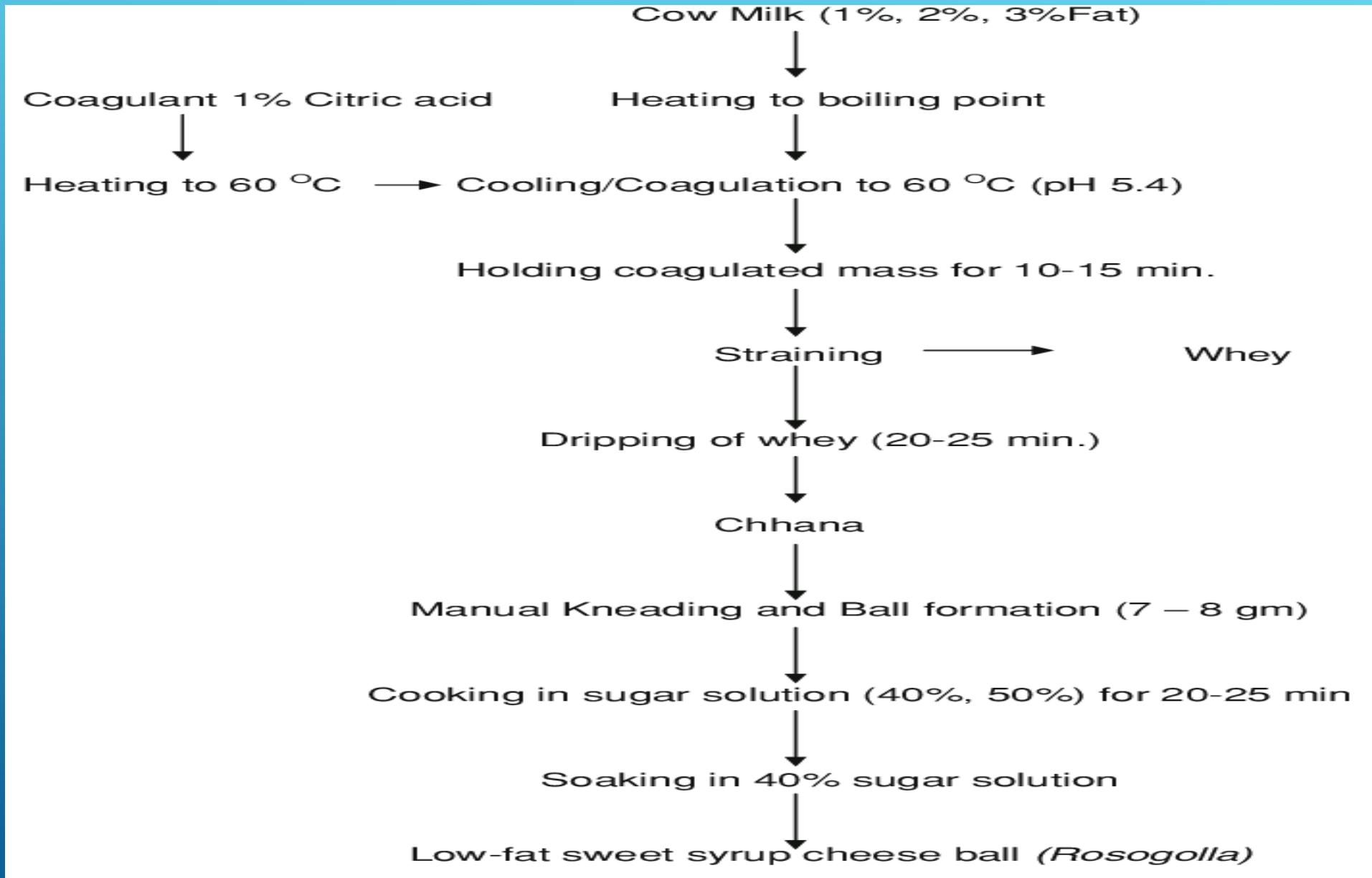


# Composition of Rasogulla

Characteristics	Specifications
Moisture	45-55%
Milk fat	5%
Sucrose	45%
Protein	5%
Acidity of syrup (pH)	6
Concentration of syrup, max	55 °C Brix

Milk Type	Moisture (%)	Fat (%)	Protein (%)	Carbohydrates/ Sucrose (%)	References
Cow milk	47.52-52.06	7.1-7.5			Bhattacharya & Des Raj [8]
Buffalo milk	37	4.2	6.8	51.9	Soni et al. [20]
Goat milk	48-52.3	6.42-7.58			Bhargava et al. [12]
Cow + Soy milk (70.30)	44.59	5.92	6.12	41.34	Thakur et al. (2013)
Cow milk	54.86	4.9	5.05	34.35	Haque et al. (2003)
Buffalo milk	41.8	7.9	5.58	43.83	

# Manufacturing of Rasogulla



Milk → Boiling the milk → cooling the milk (70-72 °C) → Coagulant addition to milk



Draining and dipping the whey ← holding the coagulated mass for some time



Cooking in sugar syrup ← Kneading and ball formation ← Chhana



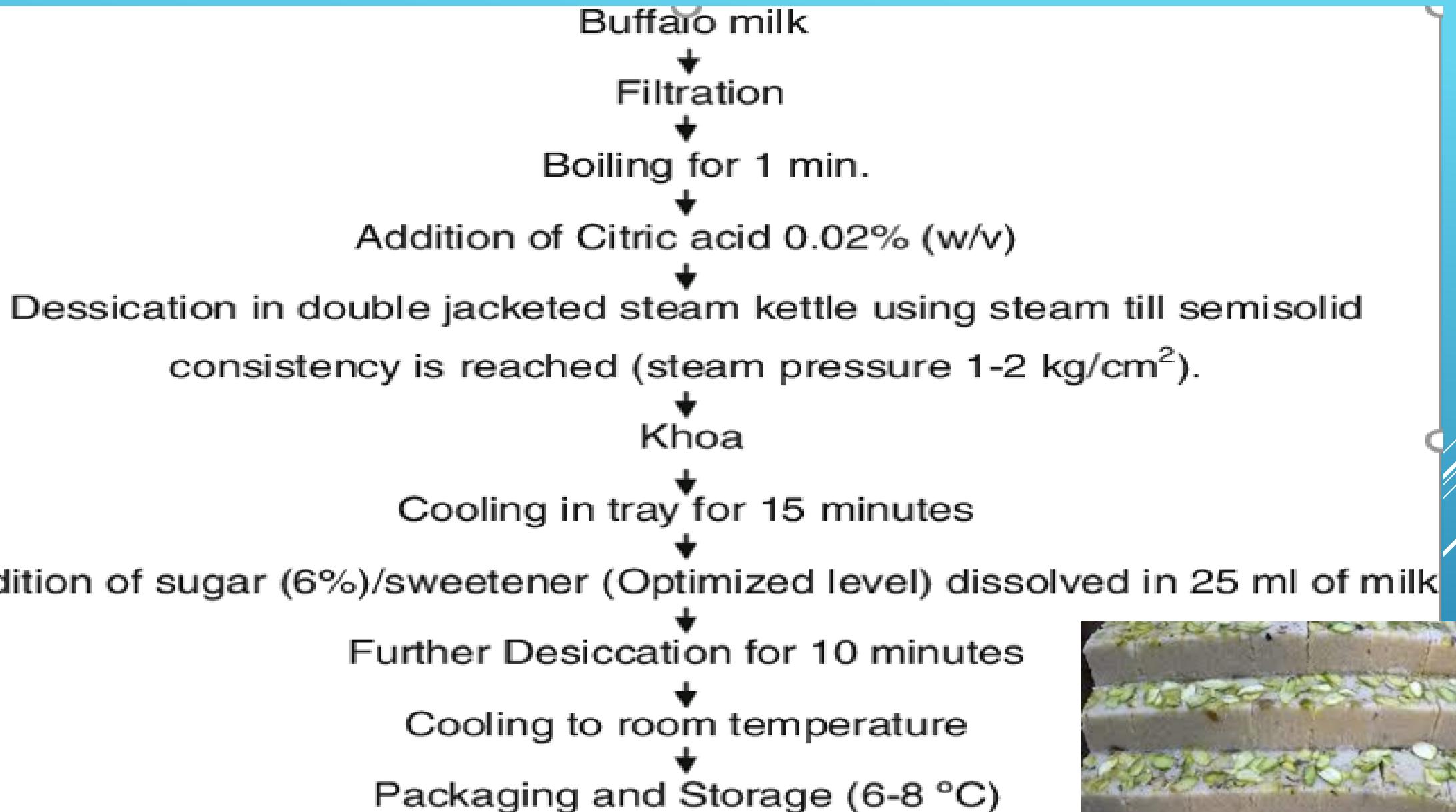
Soaking in sugar syrup | → Cooled and stored in cans/PET jars

## kalakand

*Kalakand* is a milk sweet basically prepared from *Danedar* variety of *khoa*. *Kalakand* is characterized by large sized hard grains with less cohesive body. The chemical composition of *Kalakand* is more or less similar to *burfi*, but there are large differences in the sensory and rheological properties of the two sweets. Contrary to *burfi*, *kalakand* has more distinct cooked flavour and brown colour. The body of *kalakand* is greasier with grainy texture. The grains are hard and of large size. Good quality *kalakand* is normally prepared in one step from buffalo milk. However, it can also be prepared from *khoa*. The firmly set product is cut to required shape and size. When making *kalakand* from *khoa*, *danedar* variety is used.

## Preparation of kalakand from milk

Buffalo milk is preferred for *kalakand* manufacture. Slightly sour milk (upto 0.18% lactic acid) can be used for its preparation. Buffalo milk standardized to 6% fat and 9% SNF is taken in a pan and boiled. At the appearance of first boiling, 0.05% citric acid (on weight of milk) dissolved in small quantity of water is added to milk. There is no need to add citric acid in case of slightly acidic milk. The milk is boiled with continuous stirring and scraping. At pat formation stage, sugar @ 30% on expected yield of *khoa* or alternatively 7.5% on the basis of milk is added and stirring is continued. When desirable textural and body characteristics are achieved, mixture is removed from fire and poured in a tray, smeared with a thin layer of ghee for setting. The *kalakand* is cut into desirable shapes or alternatively served as such without any definite shape.



Constituents %	Milk cake		Kalakand	
	Patil (2002)	Wagh (2001)	Arora et al., (1991)	Suresh & Jha (1994a)
Total solids	81.17	88.41	63.59 - 84.75	70.0 - 80.1
Fat	21.32	24.10	4.75 - 26.46	19.1 - 22.2
Protein	11.38	11.45	9.40 - 17.91	13.2 - 15.7
Sugar	-	08.00	15.38 - 42.14	34.5 - 39.9
Lactose	07.67	-	11.96 - 21.90	(Total carbohydrates)
Ash	02.29	-	1.78 - 3.48	2.1 - 2.3
Acidity	-	0.31	0.26 - 0.70	0.5 - 0.7

Microbial counts (cfu/g)	Market samples			Lab samples	
	Magdum (1990)	Arora et al (1991)	Suresh & Jha (1994a)	Rao (1992)	Suresh & Jha (1994b)
Total counts	1836-41160	1000-12300	29500-92000	4033	1000
Coliforms	0-228	0-4000	660-1500	0	40
Yeasts & moulds	2-154	0-9250	440-1200	1033	10

In order to improve the quality of traditional milk products the following suggestions may be considered:-

- Training for hygienic milk production should be given to farmers at farm gate level
- Dairy Technical Support Services should be provided
- Marketing of traditional milk products should be channelized through identified institutions.
- Improved breeds of animal should be introduced or given to farmers

- As many farmers live in scattered areas and under poor conditions, a cooperative society or small farmers' association should be formed to organize milk transport to markets
- The quality of products should be improved
- A package of policies is needed to harmonize the prices of various inputs
- A locally-relevant research and development plan with special attention to appropriate technology is needed

THANK YOU