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Cumulative effect of temperature on paneer yield and their constituents

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ABSTRACTS : Paneer, a popular indigenous dairy product of India, is similar to an unripened variety of soft cheese which is used in the preparation of a variety of culinary dishes and snacks. It is obtained by heat and acid coagulation of milk, entrapping almost all the fat, casein complexed with denatured whey proteins and a portion of salts and lactose. Paneer is marble white in appearance, having firm, cohesive and spongy body with a close-knit texture and a sweetish-acidic-nutty flavour. Paneer have to composed by fat, protein, lactose, ash and found herein chemical property acidity vitamins etc. which is that amount depend on the coagulation temperature. We have examined yield of paneer on different temperature like 70°C, 80°C, 90°C and 100°C in which 70°C is beneficial temperature for paneer coagulation.

Key Words : Precipitated milk solids (Paneer) yield, coagulation temperature

Paneer is the precipitated milk solids. It is commonly prepared after skimming the milk. Fresh paneer is used in most households as an addition in vegetarian and non-vegetarian dishes. It is consumed abundantly by eating houses for preparation of various recipies, as dished containing paneer are the most sought after. Paneer is highly nutritive and a rich source of protein. Good quality paneer can be obtained from cow milk using certain modifications in the manufacturing process or through use of additives (Jadhavar *et al*., 2009a). Vishweshwaraiah and Anantakrishnan (1985) reported that paneer obtained from cow milk standardized to 4.5% fat conformed to the PFA standards. Pruthi and Koul (1989) also found that paneer made from cross-bred cows (HF x Sahiwal) milk having 3.7% fat and 8.25–8.42% SNF conformed to the PFA standards. However, cow milk yields inferior quality paneer especially in sensory characteristics compared to buffalo milk. Such effect could be ascribed to different make-up of casein micelles and lower protein and calcium contents in cow milk compared to buffalo milk (Sindhu, 1996). The temperature and pH of coagulation have a significant effect on the body and texture, TS recovery and yield of paneer. The optimum temperature of coagulation differs for different types of milk and their composition, including fat. Coagulation temperature influences moisture retention in paneer. An increase in temperature of coagulation from 60 to 90 °C decreased the moisture content of paneer from 59.0 to 49.0%. Paneer obtained by coagulating milk at 70 °C had the best organoleptic quality and had desired frying quality namely integrity/shape retention and softness (Sachdeva and Singh, 1988; Chandan, 2007).

A coagulation temperature of 70°C has been recommended for paneer making from buffalo milk (Bhattacharya *et al*., 1971; Sachdeva and Singh, 1988). Temperatures higher than this resulted in dry and hard paneer while lower temperature yielded product having very moist surface (Sachdeva and Singh 1988). Masud (2002) and Bajwa *et al*. (2005) recommended use of higher (85°C) and lower (72 °C) coagulation temperature for buffalo milk paneer. Chawla *et al.* (1985) recommended coagulation temperature of 85°C for low-fat buffalo milk.

Heat treatment of milk has a profound effect on physico-chemical, sensory and microbiological properties of paneer. It also affects TS recovery and thus yield of paneer. Heat treatment of milk is essential to destroy the pathogenic as well as spoilage micro-organisms. It also denaturates whey proteins, reduces solubility of colloidal calcium phosphate, thus co-precipitating them along with the casein upon acidification of milk. These constituents increase the yield of curd, which are otherwise lost in whey (Rose and Tessier, 1959; Fox and Morrissey, 1977; Brule *et al*., 1978; Walstra and Jenness, 1983). Heat treatment at 90°C for 10–15 min was necessary to achieve desired yield (Muller *et al*., 1967).

To obtain good quality paneer, most workers recommended higher coagulation temperature for cow milk. The suggested coagulation temperature for obtaining good quality paneer from cow milk was 80–85°C (Vishweshwaraiah and Anantakrishnan, 1985; Mistry *et*

al., 1992; Arya and Bhaik, 1992; Sharma *et al*., 2002). Coagulation temperature of 90°C and 70°C has been recommended when preparing paneer from ewe's milk and mixed milk (cow: buffalo; 1:1) respectively (Pal and Yadav, 1991, Pal *et al*., 2008). Singh and Kanawjia (1991) suggested 90°C of coagulation temperature for making paneer from recombined cow milk. Low coagulation temperature of 60°C has been used by Sanyal and Yadav (2000) for preparing reduced-fat paneer.

Variation in the pH of coagulation has a significant effect on the body and texture, flavour, quality and yield of paneer. According to De (1980) and Sachdeva and Singh (1988), with the fall in pH (5.5-5.0), the moisture retention and yield of paneer decreased. Paneer made from cows' milk coagulated at pH 5.0 was sensorily superior to the one coagulated at pH 5.5 (Vishweshwaraiah and Anantakrishnan, 1985). However, at coagulation pH of 5.0 the moisture, TS recovery and yield were lower. The moisture content and yield of paneer increased from 50 to 58.6% and from 20.8 to 24.8%, respectively, when coagulation pH increased from 5.1 to 5.4. Sensory quality was best at pH 5.3–5.35 which is recommended for paneer making from buffalo milk (Sachdeva and Singh, 1988). Sachdeva *et al.* (1991) recommended the pH range of 5.20–5.25 for cow milk paneer.

Materials and Methods

Cow milk was procured from the local market of Jaunpur and other raw material including lactic acid, muslin cloth, and glass bottles were also procured from the Tilak Dhari Post Graduate College, Jaunpur.

Preparation of paneer

Cow milk is boiled in a suitable iron vessel and a small portion of this is then transferred to a smaller vessel (Fig.-1). The coagulant (usually sour whey) is added to the hot milk and stirred with a ladle till coagulation is completed. The contents of the vessel are emptied over a piece of coarse cloth to drain off whey. The whole process is repeated till all the milk is converted into paneer. The curd is collected after draining the whey and pressed to remove more whey. Finally, product is then washed with cold tap water.

Physico-chemical analysis

The paneer was analyzed for Moisture, Fat, Protein, Lactose, Acidity, Ash, moisture was determined by AOAC (1980). Fat was estimated by Gerber Method. Protein content was determined by macro-kjeldahl method (AOAC, 1980). Lactose content was determined by Lane- Eynon method. Acidity was determined by titrating against 0.1N NaOH according to AOAC (1995) method. Ash content is determined by AOAC

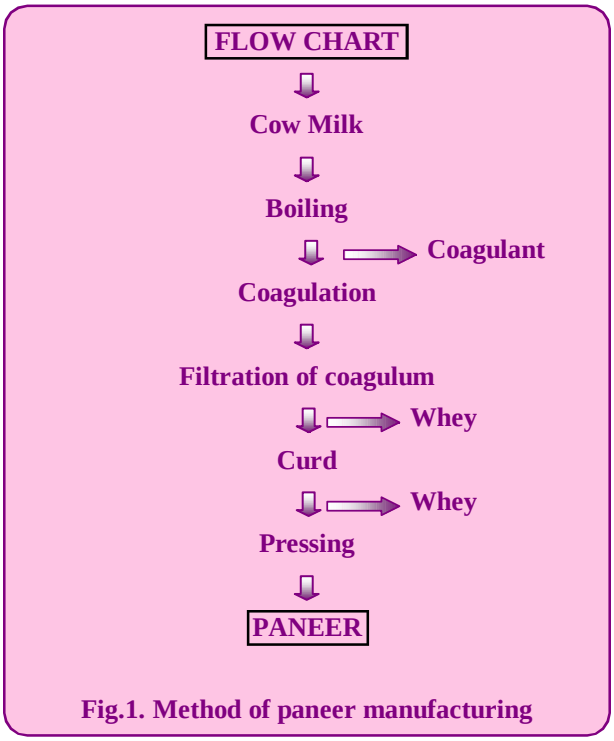

Fig.1. Method of paneer manufacturing

Methods

Results and Discussion

Paneer Yield

According to Fig.-1 decreasing paneer yield with increasing temperature therefore, the temperature has effect on protein coagulation, so highest yield of paneer 15.45gm/100g at 70°C and lowest paneer yield has 14.45gm/100gm at 100°C and total yield difference 1gm. (Table-1). 'But good quality of paneer obtained at 80-90°C (Vishweshwaraiah and Anantakrishnan, 1985; Mistry *et al*., 1992; Arya and Bhaik 1992; Sharma *et al*., 2002).

Moisture

Moisture content increasing with temperature (Fig.-2) therefore minimum moisture content 49gm/100gm at 70°C and highest moisture content 54.6gm/100gm at 90°C (Table-1). According to Fig.-2 when the coagulation temperature more than 90°C moisture content decreasing from paneer. It means temperature variation affected paneer moisture from temperature variation. An increase in temperature of coagulation from 60 to 90°C decreased the moisture content of paneer from 59.0 to 49.0%. Paneer obtained by coagulating milk at 70 °C had the best organoleptic quality and had desired frying quality namely integrity/shape retention and softness (Sachdeva and Singh, 1988; Chandan, 2007).

Table-1 : Effect of temperature on paneer yield and constituents during coagulation.

Temperature	Paneer yield	Moisture	Fat	Protein	Lactose	Acidity	Ash
70°C	15.45	49.13	16.57	19.39	3.24	0.20	2.34
80°C	15.42	50.88	16.61	20.71	2.7	0.22	2.52
90°C	15.31	54.6	14.26	21.97	2.29	0.21	2.43
100°C	14.45	54.06	15.41	21.07	3.85	0.23	1.94

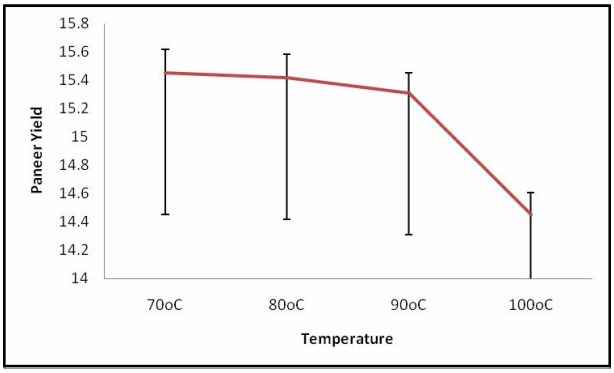

Fig.-1 : Temperature effect on paneer yield

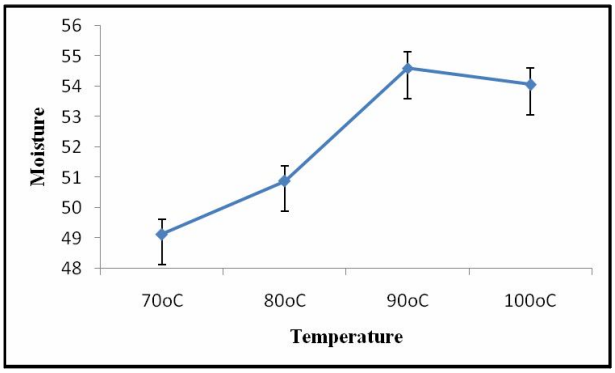

Fig.-2 : Temperature effect on moisture

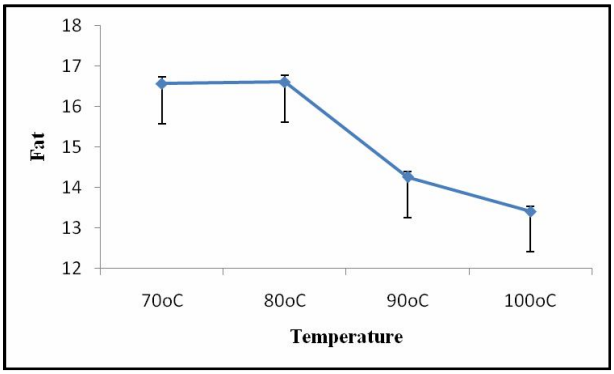

Fig.-3 : Temperature effect on fat.

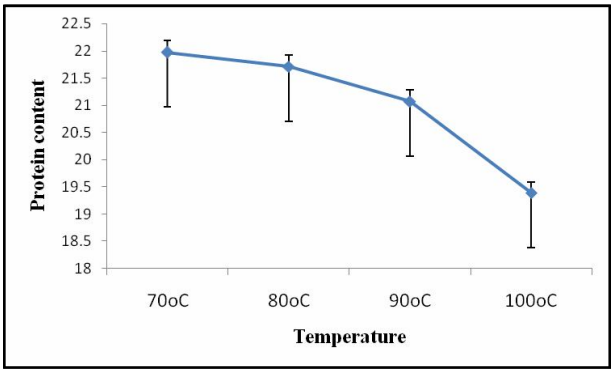

Fig.-4 : Temperature effect on protein content.

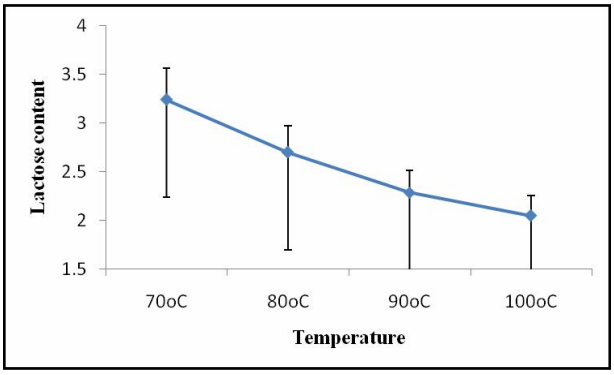

Fig.-5 : Temperature effect on lactose content.

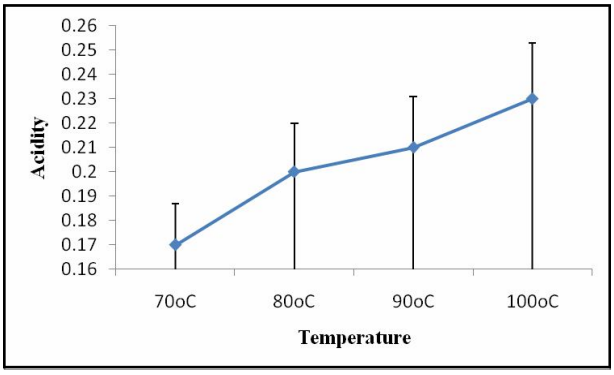

Fig.-6 : Temperature effect on acidity.

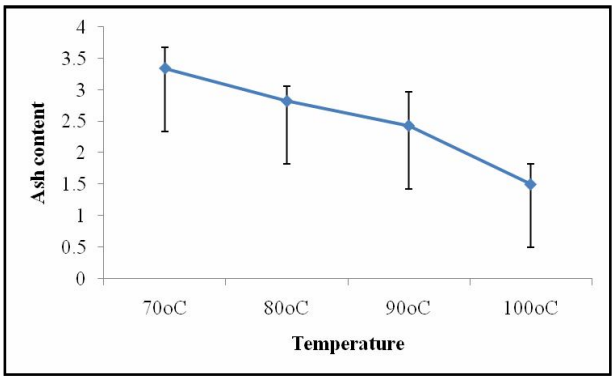

Fig.-7 : Temperature effect on ash content

Fat

According to Fig.-3 Fat are decreasing with temperature but highest fat content is at 80°C because of fat globules solubility are increased with temperature. The highest fat content is observed 16.57gm/ml at 70°C in experimental sample and lowest content is 15.41gm/ml (Table-1). Its similar results have found Masud (2002)

Protein content

The yield of protein is varied by temperature. We have to see in following Fig.-4. Reciprocal relationships between protein and temperature. It means Protein yield is decreasing with temperature. Protein yield is 19.39gm/100m at 70°C its lowest and 21.97 gm/100m at 90°C its highest yield (Table-1). But Fat is decreased at 80°C so optimum temperature for protein yield (21.71 gm/100ml) is at that temperature. Similar result was fond Sanyal and Yadav (2000).

Lactose content

According to Fig.-5 decreasing lactose with increasing temperature therefore, the temperature effect on lactose so highest yield of highest lactose 3.24gm/100ml at 70°C and lowest lactose 2.29gm/100ml at 90°C Table-1. According to above description optimum temperature for lactose separation with paneer at 70°C it is similar results was also found by Bajwa *et al*. (2005).

Acidity

According to Fig.-6 increasing acidity with increasing temperature therefore, the temperature effect on acidity so highest acidity0.23% at 90°C and lowest acidity (0.20%) at 70°C and total yield difference 0.03%. (Table-1). There are similar results have found Sanyal and Yadav (2000).

Ash Content

According to Fig.-7 ash content is decreasing with increasing temperature. The highest content of ash 2.34gm/100ml at 70°C and lowest ash content in paneer 1.94gm/100ml at 100°C (Table-1). There are reciprocal relationship between ash content and temperature in paneer coagulation according to above mention.

Paneer is profitable and commercial products. It's a coagulated product which that enormously effects on coagulation temperature. We have taken four temperature level 70°C, 80°C, 90°C and 100°C in which optimum temperature 70°C for coagulation of paneer. I have got utmost yield at that optimum temperature for commercial level paneer production.

References

AOAC, 1980. Official Methods of Analysis

AOAC, 1995. Official methods of analysis 16th Ed. Association of official analytical chemists. Washington DC, USA

Arya, S.P. and Bhaik, N.L., 1992. Suitability of crossbred cow's milk for paneer making. *J. Dairying Foods Home Sci*., **11**(2) : 71–76.

Bajwa, U.; Kaur, J. and Sandhu, K.S., 2005 Effect of processing parameters and vegetables on the quality characteristics of vegetable fortified paneer. *J. Food Sci. Technol*., **42**(2) : 145–150.

Bhattacharya, D.C.; Mathur, O.N.; Srinivasan, M.R. and Samlik, O., 1971. Studies on the method of production and shelf life of paneer. *J. Food Sci. Technol*., **8**(5):117–120.

Brule, G.; Real-Del-Sol, E.; Fauquant, J. and Fiaud, C., 1978. Mineral salts stability in aqueous phase of milk: Influence of heat treatments. *J. Dairy Sci*., **61**(9) : 1225–1232. doi: 10.3168/jds.S0022-0302(78)83710-2.

Chandan, R.C., 2007 Cheese varieties made by direct acidification of hot milk. In Hui YH eds)Handbook of food products manufacturing vol-I. Wiley-Inter Science, John Eiley and Sons Inc., Pub, : 645–650.

Chawla, A.K.; Singh, S. and Kanawjia, S.K., 1985. Development of low fat paneer. *Indian J. Dairy Sci*., **38**(4) : 280–283.

De, S., 1980. Outlines of dairy technology. 2. New Delhi: Oxford University Press; 1980 : 156.

Fox, P.F. and Morrissey, P.A., 1977. Reviews of the progress of dairy science: The heat stability of milk. *J. Dairy Res*., **44**(4) : 627–646. doi:10.1017/S0022029900020616.

Jadhavar, V.V.; Patil, B.D.; Pawar, B.K. and Jagtap, D.Z., 2009. Studies on quality of paneer prepared from cow and soy mix milk. *J. Mah. Agric. Univ*., **34**(1) : 45–48.

Masud, T., 2002. Effect of coagulation temperatures and strength of coagulant used on the composition of paneer. *Indian J. Nutr. Diet*., **39**(12) : 548–550.

Mistry, C.D.; Singh, S. and Sharma, R.S., 1992. Physico-chemical characteristics of paneer prepared form cow milk by altering its salt balance. *Aust. J. Dairy*

Technol., **47**(1) : 23–27.

Muller, L.L.; Hayes, J.F. and Snow, N., 1967. Studies on co-precipitates of milk proteins. I. Manufacture with calcium contents. *Aust. J. Dairy Technol*., **22**(1) : 12–16.

Pal, M.A. and Yadav, P.L., 1991. Effect of blending buffalo and cow milk on the physico-chemical and sensory quality of paneer. *Indian J. Dairy Sci.* **44**(5) : 327–332.

Pal, M.A.; Malik, A.H.; Wani, S.A.; Salahuddin, M. and Bhat, A.S., 2008. Quality and yield of ewe milk paneer under the influence of various processing variables. *Bev. Food World,* **35**(8) : 44–48.

Pruthi, T.D. and Koul, J.L., 1989. Paneer from crossbred cows' milk. *Indian J Dairy Sci*., **42**(2) : 403–404.

Rose, D. and Tessier, H., 1959. Composition of ultrafiltrates from milk heated at 80 to 230°F in relation to heat stability. *J. Dairy Sci*., **42**(6) : 969–980. doi: 10.3168/jds.S0022-0302(59)90680-0.

Sachdeva, S. and Singh, S., 1988. Optimization of processing parameters in the manufacture of paneer. *J. Food Sci/ Technol*., **24 :** 142–145.

Sachdeva, S.; Prokopek, D. and Reuter, H., 1991. Technology of paneer from cow milk. *Jpn J. Dairy Food Sci*., **40**(2) : A85–A90.

Sanyal, M.K. and Yadav, P.L., 2000. Improvement in the quality of reduced-fat paneer from buffalo milk through sodium chloride incorporation. *Buffalo J*., **16**(2) : 153–162.

Sharma, R.B.; Kumar, M.; Pathak, V. and Kumar, M., 2002. Effect of different seasons on crossbred cow milk composition and paneer yield in sub-Himalayan region. *Asian Australas J. Anim. Sci*., **15**(4) : 528–530.

Sindhu, J.S., 1996. Suitability of buffalo milk for products manufacturing. *Indian Dairyman,* **48 :** 41–47.

Singh, S. and Kanawjia, S.K., 1991. Manufacturing technique for paneer from recombined milk using cow skim milk powder and butter oil. *Indian J. Dairy Sci.*, **44**(1):76–79.

Vishweshwaraiah, L. and Anantakrishnan, C.P., 1985. A study on technological aspects of preparing paneer from cow's milk. *Asian J. Dairy Res.*, **4:** 171–176.

Walstra, P. and Jenness, R., 1993. Dairy chemistry and physics. New York: Wiley.