RESEARCH PAPER | International Journal of Agricultural Engineering | Volume 5 | Issue 2 | October, 2012 | 142 –146

Effect of edible coating and different packaging treatments on quality of paneer

ARCHANA LAMDANDE, SHYAM R. GARUD AND ANIL KUMAR

Received : 17.04.2012; Revised : 01.07.2012; Accepted : 17.08.2012

See end of the Paper for authors' affiliations

Correspondence to:

ARCHANA G. LAMDANDE
Department of Food Science and Technology, College of Agriculture, G.B. Pant University of Agriculture and Technology, Pantnagar, U.S. NAGAR (UTTARAKHAND) INDIA
Email : archanalambande@gmail.com

ABSTRACT : Paneer, popular with people in Indian subcontinent and with Indian diasporas scattered in several countries, has a shelf life of less than a day at ambient temperature. This investigation was carried out to study the effect of edible coating and different packaging treatments on shelf life improvement of paneer. Freshly prepared paneer was coated with composite edible coating, packed in packaging materials and stored under different storage conditions 5^0C (T_1), 30^0C (T_2) and ambient conditions (T_3). Uncoated (F_1) and Coated (F_2) samples were packed with vacuum in LDPE packaging material. When paneer samples were packed with vacuum, temperature had significant (P=0.05) effect on overall acceptability of the paneer while titratable acidity was significantly (P=0.05) affected by coating and temperature. Whereas, coating and temperature had significant effect (P=0.01) on TVC and Y&M counts. The effect of edible coating was found significant (P=0.01) on pH of the product when packed under vacuum. The coated samples packed in LDPE with vacuum had maximum shelf life of 56 days at 5 ± 1^0 C. It is concluded from the present study that the edible coating and different packaging treatments had significant effect on shelf life of paneer.

KEY WORDS : Edible coating, Paneer, Quality, Vacuum packaging, Shelf-life

HOW TO CITE THIS PAPER : Lamdande, Archana, Garud, Shyam R. and Kumar, Anil (2012). Effect of edible coating and different packaging treatments on quality of paneer. *Internat. J. Agric. Engg.*, **5**(2) : 142-146.

Milk has played an important role in the socio-economic status of human beings since time immemorial. India has witnessed a remarkable growth in milk production during the last few decades due to the success of the Operation Flood programme, which is one of the world's largest and successful integrated dairy development programs initiated in 1970s. It has led India to emerge as the largest milk producer in the world, transcending a record level of 104.8 million metric tonnes (MMT) in 2008 accounting for 15 per cent of the world's total milk production (NDDB, 2009; Bhasin, 2009). 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. According to the PFA (2010), paneer means "product obtained from cow or buffalo milk or combination there of, by precipitation with sour milk, lactic acid, or citric acid. It shall contain not more than 70 per cent moisture and the fat content should not be less than 50 per cent expressed on dry matter". Milk solids may also be used in preparation of paneer. Bureau of Indian Standards (BIS, 1983) imposed maximum of 60 per cent moisture and minimum of 50 per cent fat in dry matter for paneer. The production of paneer has been largely confined to the unorganised dairy sector which employs traditional, inefficient methods of manufacture. Due to the ever growing demand for paneer, researchers were encouraged to develop new techniques for the manufacture of paneer.

Paneer is a highly perishable product. It was reported that the freshness of paneer remains intact only for 3 days at refrigeration temperature (Bhattacharya *et al.*, 1971). At room temperature paneer does not keep good for more than one day. In order to increase the shelf life of paneer, additives, modification in paneer manufacturing process, surface treatments and packaging materials have been recommended by various workers. Quality of paneer deteriorates due to the growth of organisms on the surface of paneer during storage (Sachdeva, 1983). The total counts as well as yeast and mould counts increased during storage of paneer up to 10 days at 5^0C. Gupta *et al.* (1985) conducted sensory evaluation of paneer and revealed guidelines for good quality paneer, is

packaged in polyethylene pouches, has uniform greenish-white and yellowish-white colour when made from buffaloes' and cows' milk, respectively, has a mildly acidic, sweet, nutty flavour, firm body and smooth texture. Use of packaging significantly increased the shelf-life of paneer. The type of packaging material also plays an important role in enhancement of shelf life. Normally, paneer blocks of required size/weight are packaged in polyethylene pouches, heat sealed and stored under refrigeration conditions. Use of saran coated packaging films (saran is a polyvinylidene chloride which is a synthetic polymer having low permeability to a wide range of gases and vapours thus making it most valuable for use in food packaging) helped in enhancing the shelf life of paneer to a great extent (Sachdeva and Singh 1990).

Edible film and coating enhances the quality of food products, protecting them from physical, chemical and microbiological deterioration (Kester and Fennema, 1986). Most commonly edible films and coatings function as a barrier against gases or vapour and as carriers of active substances, such as antioxidants, antimicrobials, colour and flavours (Gennadios and Weller, 1990; Guilbert and Gontard, 1995). The purpose of edible films is to provide mechanical integrity or handling characteristics of the food, and a selective barrier to oxygen, carbon dioxide, moisture, aroma and lipids. Besides their barrier properties, edible films and coatings may control adhesion, cohesion and durability, and improve the appearance of coated foods. So applying appropriately prepared composite edible coating to the paneer coupled with suitable packaging may prevent the undesirable changes and increase the shelf life of the product. The present study was planned to study the effect of edible coating and different packaging treatments on shelf life improvement of paneer with vacuum packaging.

METHODOLOGY

The present study was done to see the impact of edible coating, packaging materials and storage temperatures on quality of paneer. The experiments were conducted in Laboratories of Dept. of Food Science and Technology, G.B. Pant University of Agriculture and Technology, Pantnagar, Uttarakhand, India.

Milk source:

Fresh buffalo milk was procured from Livestock Research Center (LRC), G.B. Pant University of Agriculture and Technology, Pantnagar, Distt. Udham Singh Nagar (Uttarakhand). The entire reagents used in the investigation were of analytical reagent (AR) grade.

Paneer preparation:

Paneer was prepared as per the procedure outlined by Sachdeva (1983). Composite edible coating material prepared by using whey protein concentrate and other ingredients. This coating material and vacuum treatment was used to increase the shelf life of paneer. Then edible coated paneer cubes were packed with vacuum into LDPE and stored at temperatures 5 ± 1^0C, 30 ± 1^0C and ambient conditions. The stored paneer samples were tested periodically.

Analytical procedures:

Determination of titratable acidity:

It was determined by using standard method of AOAC (1984). Two grams of paneer sample was macerated with 20 ml of distilled water and then titrated with 0.1 N NaOH using phenolphthalein indicator. Titratable acidity expressed as lactic acid was calculated by the following formula:

$$\text{Titratable acidity} = \frac{\text{ml of N/10 NaOH used for titration x 0.9}}{\text{Weight of sample (g)}}$$

Determination of pH:

pH of paneer was determined by using a digital pH meter (Systronics µpH System 361, Electronic Corporation of India Ltd.). Ten grams of sample was blended with 10 ml of distilled water and the pH of the suspension was determined by dipping the electrode in the suspension.

Statistical analysis:

The results were analysed statistically by using 2 Factorial Completely Randomized Design (CRD). The statistical analysis showed that significant results by using two variables coating/uncoating and temperature. The experimental data were analysed using the statistical methods of Snedecor and Cochran (1994).

Sensory evaluation:

The paneer samples with edible coating were subjected to sensory analysis during storage studies. For sensory evaluation paneer samples were served to a panel of ten semi-trained panellists. Panel members were directed to judge each samples on the basis of appearance, flavour, body and texture and overall acceptability, and to indicate their degree of liking on a 9-point Hedonic Scale (Lawless and Haymann, 1998).

Microbiological assays:

The samples were analysed for total plate count and yeast and mould counts. Microbiological analysis was carried out by the procedures given in APHA. Eleven grams of paneer was removed aseptically and macerated using sterilized pestle and mortar. Then it was suspended uniformly in 99 ml of dilution blank. Serial dilution was also prepared. Appropriate dilutions of sample (1 ml) were plated in triplicate using potato dextrose agar (PDA), (pH 3.5 ± 0.1) procured from Hi-media Laboratories Pvt. Ltd., Bombay. The Petriplates were incubated at 22 ± 1^0C for 3 to 5 days.

RESULTS AND DISCUSSION

The results of the present study as well as relevant discussion have been summarized under following heads:

Effect of coating and storage temperatures on quality of paneer:

Effect of edible coating and storage temperatures with vacuum on pH, titratable acidity, overall acceptability, total viable count and yeast and mould counts of paneer during storage at different temperatures is presented in Table 1.

Effect of coating and packaging materials on sensory characteristics of paneer during storage with vacuum:

The temperature had significant (P=0.05) effect and their interactive effect of coating and temperature were found significant (P=0.01) on overall acceptability of the product during storage (Table 2). The quality of paneer depends upon the quality of milk from which it was made. Milk fat exerts significant effect on the organoleptic quality of paneer. The sensory score increased with increasing fat (4 to 6 %) levels (Arora and Gupta, 1980). Sensory quality was best at pH 5.3–5.35 which is recommended for paneer making from buffalo milk (Sachdeva and Singh, 1988).

Effect of coating and packaging materials (with vacuum) on chemical characteristics of paneer during storage:

Paneer samples stored at refrigeration and room temperature were analyzed for pH and titratable acidity.

Titratable acidity:

Titratable acidity of paneer samples was determined in order to evaluate the extent of degradation occurring in carbohydrates and its relationship with the keeping quality of paneer The coating and temperature had significant effect (P=0.05) on titratable acidity of the product whereas their interactive effect were found significant (P=0.01) on titratable acidity of the product during storage as evident from the Table 3. The increase in titratable acidity of paneer was slow in the beginning and then there was a sharp increase towards the end of the storage. The same trend was also observed by Sachdeva and Singh (1990) who noted that the increase in acidity was significantly higher (P = 0.05) at room temperature as compared to refrigerated storage of paneer samples due to rapid growth of microbes.

pH:

Coating and interactive effect of coating and temperature were found significant (P=0.01) on pH of the product during

Table 1 : Effect of coating and packaging materials with vacuum on quality of paneer during storage at different temperatures

Combinations	pH	Acidity	Overall acceptability	TVC	Y&M
$F_1P_2VT_1$	5.74± 0.02	0.190±0.01	7.80±0.10	2.77±0.03	2.54±0.06
$F_1P_2VT_2$	5.7±0.02	0.178±0.009	7.19±0.17	2.69±0.04	2.94±0.01
$F_1P_2VT_3$	5.82±0.02	0.184±0.002	7.41±0.14	2.44±0.03	2.54±0.06
$F_2P_2VT_1$	5.88±0.07	0.192±0.01	7.17±0.16	2.29±0.11	2.39±0.08
$F_2P_2VT_2$	5.83±0.02	0.247±0.03	7.66±0.15	2.68±0.03	2.29±0.11
$F_2P_2VT_3$	5.8±0.02	0.184±0.002	7.96±0.15	2.29±0.11	2.39±0.08

F_1= Uncoated, F_2= Coated, P_2= Packed in LDPE, T_1= 5°C, T_2= 30°C, T_3= Room Temperature V= Vacuum packaging

Table 2 : Effect of treatments (with vacuum) on overall acceptability of paneer during storage

	a	b	a*b
F value	3.47 NS	4.98 *	28.72 **
SEM±	0.50E-01	0.61E-01	0.27
C.D. (P=0.01)	0.22	0.26	0.37
C.D. (P=0.05)	0.15	0.19	0.27

* and ** indicate significance of values at P=0.50 and 0.01, respectively
NS = Non-significant, a- Coating/uncoating, b- temperature

Table 3 : Effect of treatments (with vacuum) on titratable acidity of paneer during storage

	a	b	a*b
F value	8.69 *	4.44 *	7.86 **
SEM±	0.57E-02	0.70E-02	0.99E-02
C.D. (P=0.01)	0.25E-01	0.30E-01	0.43E-01
C.D. (P=0.05)	0.17E-01	0.22E-01	0.31E-01

* and ** indicate significance of values at P=0.05 and 0.01, respectively
NS= Non-significant a- Coating of paneer, b- temperature

storage (Table 4). pH of coagulation 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).

Effect of coating and packaging materials (with vacuum) on microbiological characteristics of paneer during storage:

The microbial changes in coated and uncoated paneer samples during storage packed under vacuum were enumerated in terms of total viable counts and yeast and mould counts. Bureau of Indian Standards (BIS 1983) set limits for microbial count *viz.*, total plate count $<5\times10^5$/g, yeast and mould count <250/g, and coliform count of <90/g. Rajorhia *et al.* (1984) observed that paneer made at pilot scale level at National Dairy Research Institute, Karnal had lower yeast and mould, and coliform count than paneer obtained from market (Delhi, Karnal).

Total viable count (TVC):

Coating/uncoating and temperature and their interactions were found to have significant effect (P=0.01) on total viable count of the product during storage (Table 5). The microbiological quality of paneer depends on the microbiological quality of milk, and the hygiene exercised during manufacture of paneer and its subsequent handling, packaging and storage. Microorganisms such as coliforms, yeasts and moulds that might be present in raw milk get destroyed completely, when milk is heated at 82^0C for 5 min. But these microbes may contaminate the product through a number of sources like air, water, equipment, knife, muslin cloth and persons handling the products (Aggarwal and Srinivasan 1980). These microbes can cause proteolytic and lipolytic changes, discolouration and other defects in the product (Thakral *et al.*, 1986).

Yeast and moulds counts:

Coating and temperature and their interactive effects were found significant (P=0.01) on total plate count of the product during storage as shown in the Table 6. Ghodekar (1989) observed that the market paneer was contaminated with yeast and mould which led to deterioration in sensory quality of paneer during storage due to proteolytic and lipolytic changes. Such products become unacceptable and potentially injurious to the health of consumers.

Table 4 : Effect of treatments (with vacuum) on pH of paneer during storage

	a	b	a*b
F value	26.18**	3.43ns	10.15 **
SEM±	0.12E-01	0.14E-01	0.20E-01
C.D. (P=0.01)	0.51E-01	0.62E-01	0.88E-01
C.D. (P=0.05)	0.36E-01	0.44E-01	0.63E-01

* and ** indicate significance of values at P=0.05 and 0.01, respectively
NS = Non-significant, a- Coating/ uncoating, b- temperatures

Table 5 : Effect of treatments (with vacuum) on total viable count of paneer during storage

	a	b	a*b
F value	59.542**	50.801**	32.818**
SEM±	14.866	18.206	25.748
C.D. (P=0.01)	64.179	78.603	111.161
C.D. (P=0.05)	45.798	56.090	79.324

*and ** indicate significance of values at P=0.05 and 0.01, respectively
NS = Non-significant, a- Coating/uncoating, b-temperature

Table 6 : Effect of treatments (with vacuum) on total plate count of paneer during storage

	a	b	a*b
F value	174.22**	51.17**	75.08**
SEM±	15.59	19.10	27.01
C.D. (P=0.01)	67.33	82.46	116.62
C.D. (P=0.05)	48.04	58.84	83.22

* and ** indicate significance of values at P=0.05 and 0.01, respectively
NS = Non-significant a- Coating/uncoating, b- temperature

Conclusion :

Paneer made by heat and acid coagulation of milk. It has very limited shelf life; hence there is a need to adopt standard procedure to extend shelf life of paneer. This study described that the edible coating and storage temperatures significantly affected physiochemical, sensory and microbiological quality of the paneer. By selecting appropriate combinations of these two hurdles. It is concluded that spoilage of paneer may be arrested and shelf life of the product may be controlled by using various treatments.

Authors' affiliations:

SHYAM R. GARUD AND ANIL KUMAR, Department of Food Science and Technology, College of Agriculture, G.B. Pant University of Agriculture and Technology, Pantnagar, U.S. NAGAR (UTTARAKHAND) INDIA

REFERENCES

AOAC (1984). *Official methods of analysis*. 14th Association Official Analytical chemists, Washington DC (U.S.A.).

Arora, V. K. and Gupta, S.K. (1980). Effect of low temperature storage on paneer. *Indian J. Dairy Sci.,* **33** : 374–380.

Aggarwal, P.K. and Srinivasan, R.A. (1980). Mould contamination from dairy and farm environment. *Indian J. Dairy Sci.,* **33** : 117–119.

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

Bhasin, N.R. (2009). From the President's desk. *Indian Dairyman,* **61** : 4–5.

BIS (1983). Specification for paneer. IS 10484 Bureau of Indian Standards, New Delhi, p 3–8.

De, S. (1980). *Outlines of dairy technology*, 2nd Ed. Oxford University Press, New Delhi, p 156.

Gennadios, A. and Weller, C.L. (1990). Edible films and coating from wheat and corn protein. *Food Technol.,* **44** : 63-69.

Ghodekar, D.R. (1989). Factors affecting quality of paneer- A review. *Indian Dairyman,* **41** : 161–168.

Guilbert, S. and Gontard, N. (1995). Edible and biodegradable food packaging. In: *Food and packaging materials-chemical interactions* (P. Ackermann, M. Jagerstud and T. Ohlsson, eds.). The Royal Society of Chemistry, Cambridge, U.K. pp.159-174.

Kester, J.J. and Fennema, O.R. (1986). Edible film and coating: A Review. *Indian J. Dairy Sci.,* **40** : 42-49.

PFA (2010). *Prevention of food adulteration rules*, 1954 (amended up to 2009). Universal Law Publishing Company Pvt. Ltd., New Delhi, pp. 165–166.

Rajorhia, G. S., Pal, D. and Arora, K.L. (1984). Quality of paneer marketed in Karnal and Delhi. *Indian J. Dairy Sci.,* **37** : 274–276

Sachdeva, S. (1983). Production, packaging and preservation of paneer: Ph.D. Thesis, Kurukheshtra University, Kurukhshetra, HARYANA (INDIA).

Sachdeva, S. and Singh, S. (1988). Optimisation of processing parameters in the manufacture of paneer. *J. Food Sc. Technol.,* **25** : 142–145.

Sachdeva, S. and Singh, S. (1990). Shelf-life of paneer as affected by antimicrobial agents. Part I. Effect on sensory characteristics. *Indian J. Dairy Sci.,* **43** : 60–63.

Snedecor, G.W. and Cochran, W.G. (1994). *Statistical method*s. Oxford and IBH Publishing Company. New Delhi (INDIA).

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.

WEBLIOGRAPHY

NDDB (2009). Statistical database. National Dairy Development Board, Anand. (*http://www.nddb.org/statistics.html*. Accessed in Nov. 2009)

***