

Comparative Study on the Shelf Life of Treated Paneer

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Abstract—The present study was conducted to investigate the effect of different treatments on preservation of Cow milk paneer at refrigerated temperature. Three types of treatments were used i.e. salt, UV rays, microwave. Paneer was dipped in salt solution (4%, 5% and 6%). UV rays were used with exposure time of 15 seconds and 20 seconds respectively. Microwave treatment in 700 watt was used for 2 and 3 minutes respectively at 80% and 90% power level. All the treated samples were packed in sterilized polyethylene pouches. The sample was analysed for sensory, chemical as well as microbial quality. The shelf life of salt treated paneer (6%) showed 25 days with respect to control sample. 18 days of keeping quality was observed in case of paneer treated with UV rays (20 seconds). With 90% power level at 700 watt the treated paneer can be kept for 39 days.

1. INTRODUCTION

Preservation of food has always played a crucial role in the civilization of mankind. In the earlier days, the simplest way to enhance the keeping quality was to boil. Many thermal processes such as pasteurization, sterilization and UHT [1] have gained a lot of popularity. However, many drawbacks are also related to these processes of heat treatment viz. degradation of flavour, colour, nutrients etc. In Modern ages consumers want foods which are fresh, natural and free from chemical preservatives and harmful additives, minimally heat processed and at the same time have a reasonable shelf life with assured quality. India, being a tropical country, a higher average ambient temperature prevails throughout the year. Due to this, deterioration of the finished dairy products starts quickly during storage in terms of growth of microorganisms (lactic and non-lactic) present naturally or as contaminants. Thus, there is a crying need for methods of preservation which can be easily implemented and are cost effective. Some of these methods include brining or salting, microwave treatment, UV treatment etc. A major portion of the total milk produced in India is converted into indigenous milk products. It has been found that approximately 52 to 55 percent of the total milk produced in India is converted into traditional milk

products by the processes of coagulation, desiccation and fermentation [2]. Among the indigenous milk products paneer is one of the most popular food products especially for vegetarian people as a protein source.

2. DEFINITION OF PANEER

According to FSSR (2011), Paneer means the product obtained from the cow or buffalo milk or a combination thereof by precipitation with sour milk, lactic acid, or citric acid. It shall not contain more than 70% moisture and milk fat content shall not be less than 50% of the dry matter. Milk solids may also be used in the preparation of *paneer*. Low fat *paneer* shall contain not more than 70% moisture and not more than 15% milk fat on dry matter basis. Milk solids may also be used in the preparation of this product.

It shall conform to the following requirements: -

- (i)Moisture content: Not more than 70.0 percent.
- (ii)Milk fat: Not more than 15.0 percent of dry matter.

3. PLAN OF WORK

Paneer is prepared from fresh cow milk.

Paneer receives three types of treatment-

- i) Dipping in Brine solution of concentrations 4%, 5% and 6% for 1 hour and pH adjusted to 6.
- ii) Paneer cubes are kept under UV rays for 15 and 20 seconds respectively.
- iii) Dehydration of Paneer by microwave treatment in 700 Watt for 2 and 3 minutes respectively at 80% and 90% power level respectively.

All the samples are packed in sterile polyethylene pouches before their shelf life study is assessed as per control sample.

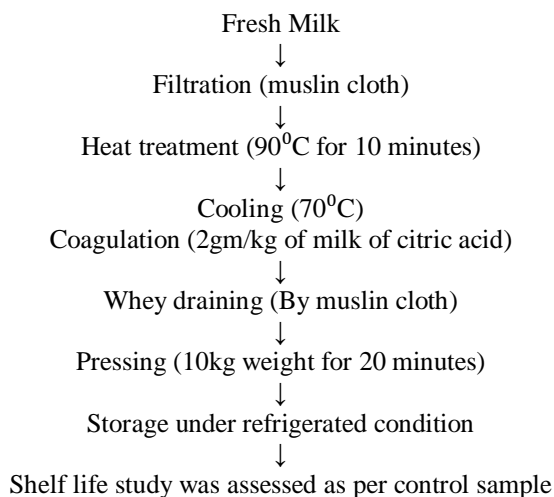
Chemical and microbiological tests are performed which include titratable acidity, Standard plate count, Coliform count and Yeast and mould count.

Methods relating to estimation, enumeration and bio-chemical characteristics of Paneer will be done as per the standard methods of the samples remained good in terms of SPC, coliform and yeast and mould count.

4. MATERIALS AND METHODS

A. Preparation of Paneer

Cow milk was collected from nearby the Haringhata dairy farm. Paneer was prepared by the method of Bhattacharya et al (1971) with slight modification. The fat % of the milk is adjusted with the addition of skimmed milk to 6% fat. Milk was heated up to 90°C followed by cooling to 70°C. The coagulant was added at the rate of 2gm/kg of milk is added with continuous agitation [3]. The pH at the time of coagulation ranges between 5 to 6. After complete coagulation, the stirring was stopped and the curd was allowed to settle down for five minutes. The whey was drained with muslin cloth; the temperature of the curd was about 60°C. The curd was filled in hoops lined with muslin to give desired shape [4]. It was carried on gradually by application of pressure so that the entrapped whey and air are expelled out properly. The pressed curd was cut with a knife and packed in polyethylene pouches which was previously sterilized by passing through a bath of hydrogen peroxide (20%) and under ultraviolet radiation (Hoffman 1972)



Flow Diagram for preparation of Paneer

B. Sampling

Proper sampling is very important step in microbiological analysis of milk and milk products. Since the reliability of the analysis of these products is dependent upon the reliability of the sample drawn and the sampling procedure.

C. Titratable acidity

2gm of Paneer was accurately weighed into a porcelain dish. 3ml of boiled distilled water was added and the sample was rendered into a fine paste using a pestle and mortar. The sample was diluted by another 17ml of boiled distilled washing off the adherent from the pestle. The solution was then cooled to room temperature. 10ml of 0.1N sodium hydroxide was added along with 1ml of 0.5% phenolphthalein as indicator and was titrated against 0.1N hydrochloric acid till the pink colour disappeared.

Titratable acidity (as lactic acid),

in terms of percentage by mass = $10v/m \times 0.9$

Where, v = volume of 0.1N hydrochloric acid required for titration.

m = mass in gram of sample of Paneer.

D. Coliform count

11gm of each sample was weighed accurately and was mixed with 99ml of dilution blank (0.9% NaCl) which has been previously sterilized. After that appropriate dilution was made. 1ml of these dilutions is transferred into the sterile petridishes using sterile 1ml pipettes. Then 15ml of melted violet red bile cooled to 40-45°C was poured into each plate and allowed to solidify. On solidification another layer of 3-4ml of media was poured on the first layer so as to create an anaerobic atmosphere for the growth of organisms. After solidification of the second layer the petridish was incubated in an inverted position at 37°C for 48 hours. The result was expressed as coliform count per ml of the sample.

E. Agar plate count

11 gm of Paneer was weighed and transferred to a sterile glass mortar 20ml of sterile buffer solution was added from 99ml blank a smooth paste was made using a pestle. A suspension of the sample was prepared after addition of another 20 ml of buffer and was transferred into a sterile 250 ml conical flask. Another 20 ml of buffer was added in the mortar to rinse it thoroughly and transfer into the flask. The rest of the buffer solution was poured into the dilution blank (99 ml) to the mortar rinse and was transferred into the flask. Mix the contents of the flask well. This gives a dilution of 1:10. Further dilutions were made as necessary. 1ml of each dilution was transferred into duplicate petridishes. Melted and cooled agar was poured and mixed well. The agar was allowed to solidify, after which the petridishes were inverted and incubated at 37°C for 48 hours. The plates were selected and the colonies were counted and the result was expressed as agar plate count per gm of the sample of Paneer after multiplying with the dilution factor.

F. Yeast and Mould Count of Paneer

99ml of the sterile dilution blank was mixed with 11gm of sample to get the first dilution. Subsequent dilutions were made and the required dilutions were pipetted into sterile petridishes. 15 ml of the melted potato dextrose agar was added into each plate, followed by few drops of 10% tartaric acid so as to bring the pH down to 3.5. After solidification of media the plates were incubated at 21-25^o C for 3-5 days. Then the count was taken. The packed paneer was then stored at the refrigerated temperatures.

G. Salting of Paneer by brine solution

The Paneer was dipped in Brine bath (4%, 5% and 6%) for 1 hour, pH was adjusted to 6 and at temperature 50^oC. If the brine bath was too acidic water containing the required amount of salt was added to it or it was neutralized by Calcium hydroxide. The brine bath was renewed from time to time. The dipped Paneer was packed in sterile polyethylene pouches and all the microbiological testing has been carried out similar to control sample and shelf life was checked.

H. Dehydration of Paneer by micro wave treatment

Paneer cubes of size 2 cm² were dehydrated in microwave oven in 700 Watt at 80%, 90% power level for 2 and 3 minutes respectively. The treated Paneer was then packed, stored and tested in a similar fashion [5].

I. Ultraviolet rays irradiated Paneer

Paneer cubes were kept under ultraviolet (UV) rays at a particular distance and for a particular period of time as such intensity and doses of radiation is checked and kept at a range so as to destroy maximum microorganisms. The treated Paneer was then packed, stored and tested in the same manner.

J. Method of statistical analysis

One-way analysis of variance technique was used considering different days of storage as a factor of variation separately for study of microbial count and acidity evaluation of each kind of preservative under study. Table of average microbial count and acidity for days of storage under each type of preservative was considered and compared to control sample as is shown subsequently along with mean square due to days of storage and standard error of mean.

5. RESULT AND DISCUSSION

A. Microbial count of control samples of Paneer stored at refrigerated temperature (7±1^oC)

The control samples of Paneer (without the addition of any preservative) were tested for SPC, Yeast and mould count and Coliform count during the storage period depicted in the Table. No. 5.1. The shelf life of the control samples of Paneer was found to be 10 days at refrigerated storage as after 10

days of storage the Paneer samples showed higher counts as compared to the prescribed standard.

Table No.5.1: Microbial count of Control Paneer samples stored at refrigerated temperature.

Sl. No.	Days of storage	SPC			Y & M		Coliform	
		(c.f.u. /gm, Av.±S.D.)						
1.	6	1800±537.80		112±57.34		13±0.73		
2.	10	9107±3466.78		145±88.78		35±5.05		
3.	14	564000±298707.9		296±143.76		85±134.54		
M.S.S.		324.7×10 ^{9**}		245.7×10 ^{2NS}		65×10 ^{2NS}		
S.E. (M)		55.7×10 ³		34.08		23		

Note: SPC=Standard Plate Count, M.S.S. =Mean sum of square due to days of storage, P. <0.01=**, P. (<0.005 and >0.01) = *, S.D. =Standard Deviation, S.E. (m) =Mean of standard error, N.S. =Not Significant

B. Microbial count of UV irradiated Paneer stored at refrigerated temperature

The quality of Paneer treated with UV irradiation with 15 sec and 20 sec exposure time are presented in Table No.5.2. The same tests performed as in case of control samples to ascertain the quality of the products. On the basis of SPC, the shelf life of Paneer was 15 days and 18 days respectively for 15 sec and 20 sec.

Table No.5.2: Microbial count of UV Irradiated Paneer stored at refrigerated temperature.

Sl. No.	Days of storage	SPC		Yeast and mould count		Coliform	
		15sec	20sec	15 sec	20 sec	15 sec	20 sec
		(c.f.u. /gm, Av. ±S.D.)					
1.	0	109 ± 65.4	98 ± 43.76	5 ± 3.98	3 ± 5.98	3 ± 0.56	2 ± 0.54
2.	15	235000 ± 3456.87	192000 ± 43561.56	175 ± 34.65	161 ± 32.87	67 ± 21.8	57 ± 21.9
3.	18	505000 ± 56852.43	460000 ± 65782.34	240 ± 43.89	225 ± 12.45	94 ± 12.2	91 ± 54.9
4.	21	725000 ± 76852.76	635000 ± 75679.78	360 ± 12.65	350 ± 87.47	172 ± 98.0	160 ± 21.7

M.S.S.	456.9×10 ^{9**}	389.7×10 ^{9**}	65×10 ^{3*}	54×10 ^{3*}	154.6 ^N	145.98 ^{NS}
S.E(M)	103×10 ³	98×10 ³	43.84	38.23	27.54	22.01

C. Microbial count of Brine treated Paneer stored at Refrigerated temperature

The impact of brine treated Paneer with different concentrations that is 4%, 5% and 6% are presented in Table No.5.3. The tests like SPC, Yeast and mould count [7] and Coliform count [6] were done to ascertain the shelf life of the products. On the basis of SPC [8], the shelf life of Paneer at 4%, 5% and 6% of brine concentration is 15days, 20days and 25days respectively.

Table No.5.3. Microbial count of Brine treated Paneer stored at refrigerated temperature.

Sl. No.	Days of storage	SPC			Yeast and mould count			Coliform		
		4%	5%	6%	4%	5%	6%	4%	5%	6%
		(c.f.u./gm, Av.±S.D.)								
1.	0	105 ± 75.5	102 ± 65.7	100 ± 53.32	12 ± 17.98	8 ± 12.87	7 ± 5.08	5 ± 23.98	3 ± 12.87	2 ± 21.43
2.	15	3900 ± 1892	1970 ± 1643	1930 ± 1546	180 ± 71	127 ± 65.43	125 ± 56.74	67 ± 32.12	39 ± 19.48	35 ± 17.35
3.	20	5180 ± 2476	3730 ± 6325	3640 ± 1893	370 ± .87	210 ± 134.76	205 ± 102.12	105 ± 51.43	67 ± 32.97	70 ± 35.98
4.	25	6210 ± 4343	5450 ± 3245	5000 ± 2143	970 ± .53	540 ± 250.65	510 ± 254.91	210 ± 123.43	11 ± 2.54	11 ± 0.52

M.S.S.	136 × 10 ^{9**}	123 × 10 ^{9*}	116 × 10 ^{9**}	34 × 10 ^{3*}	32 × 10 ^{3**}	29 × 10 ^{3*}	128.11 × 10 ^{2**}	125 × 10 ^{2**}	119.54 × 10 ^{2**}
S.E (M)	76 × 10 ³	64 × 10 ³	58 × 10 ³	28.65	25.03	21.64	18.54	17.95	16.04

D. Microbial count of Microwave treated Paneer stored at refrigerated temperature

The microbial quality of Paneer treated with Microwave at 700 Watt for 80% and 90% power level stored at refrigerated temperature is presented in Table No.5.4. The test like SPC, Yeast and mould count and Coliform count were done to predict the quality of the products. On the basis of SPC, the shelf life of Paneer exposed to 80% and 90% power level were 35 and 39 days respectively.

Table No.5.4: Microbial count of Microwave treated Paneer stored at refrigerated temperature

Sl. No.	Days of storage	SPC		Yeast and mould		Coliform	
		80%	90%	80%	90%	80%	90%
		(c.f.u./gm, Av.±S.D.)					
1.	0	249 ± 19.04	235 ± 12.98	4 ± 11.98	2 ± 6.43	6 ± 6.77	4 ± 4.32
2.	28	26500 ± 1.98	25430 ± 1.65	65 ± .23	50 ± .08	70 ± 65	32 ± 21
3.	35	171408 ± 654.89	161749 ± 6874.34	140 ± 6.43	122 ± 6.54	185 ± .21	166 ± 4.98
4.	39	511450 ± 5649.87	495000 ± 3423.78	185 ± 3.43	165 ± 9.86	290 ± 3.645	240 ± 20.32

E. Chemical changes in Acidity (% Lactic Acid i.e. L.A.) of Control Samples of Paneer stored at refrigeration temperature

On the basis of acidity test (in terms of % L.A.) of the control samples of Paneer at refrigerated temperature, the results are presented in Table No.5.5. The product is accepted up to 10 days of storage

Table No. 5. 5. Chemical changes in Acidity (%Lactic Acid) of Control samples of Paneer stored at refrigerated temperature

Sl. No.	Days of storage	Acidity
		(Av. ± S.D.)
1.	0	0.320 ± 0.02
2.	6	0.39 ± 0.03
3.	10	0.47 ± 0.01

M.S.S.	0.016**
S.E. (m)	0.04

F. Chemical changes in Acidity (% Lactic acid) of UV irradiated Paneer stored at refrigeration temperature

In the case of acidity test (in terms of %L.A.) of the UV irradiated Paneer with 15 and 20 sec exposure time at refrigerated temperature the results are presented in Table No.5.6. In case of 15 and 20 sec exposure time the product is accepted up to 15 and 18 days of storage respectively.

Table No.5.6: Chemical changes in Acidity (%Lactic Acid) of UV irradiated Paneer stored at refrigerated temperature.

Sl. No.	Days of storage	Acidity	
		15 sec	20 sec
		(Av. ± S.D.)	
1.	0	0.34 ± 0.03	0.33 ± 0.01
2.	6	0.39 ± 0.01	0.38 ± 0.05
3.	15	0.51 ± 0.01	0.49 ± 0.05
4.	18	0.55 ± 0.04	0.51 ± 0.03

M.S.S.	0.41**	0.33**
S.E.(M)	0.09	0.04

G. Chemical changes in Acidity (% Lactic Acid) of Brine treated Paneer stored at refrigerated temperature

The results of Paneer treated with brine solutions of 4%, 5% and 6% stored at refrigerated condition in the change of acidity are presented in Table No.5.7 [9]. With 4%, 5% and 6% concentration the product is accepted up to 15, 20, 25 days of storage respectively.

Table No.5.7: Chemical changes in Acidity (% Lactic Acid) of Brine treated Paneer stored at refrigerated temperature

Sl. No.	Days of storage	Acidity		
		4%	5%	6%
		(Av. ± S.D.)		
1.	0	0.35±0.03	0.33±0.03	0.30±0.09
2.	15	0.48±0.03	0.47±0.02	0.43±0.01
3.	20	0.49±0.02	0.48±0.01	0.44±0.07
4.	25	0.56±0.01	0.49±0.06	0.47±0.04

M.S.S.	0.049**	0.047**	0.044**
S.E.(M)	0.08	0.06	0.03

H. Chemical changes in Acidity (% Lactic Acid) of Microwave treated Paneer stored at refrigerated temperature

Change in acidity (in terms of % L.A.) of the Microwave treated Paneer with 80% and 90% power level at refrigerated temperature are presented in Table No.5.8. The product is accepted up to 35 days and 39 days for 80% and 90% power level respectively.

Table No.5.8: Chemical changes in Acidity (% Lactic Acid) of Microwave treated Paneer stored at refrigerated temperature.

Sl. No.	Days of storage	Acidity	
		80%	90%
		(Av. ± S.D.)	
1.	0	0.25±0.03	0.22±0.01
2.	16	0.34±0.03	0.32±0.01
3.	35	0.49±0.02	0.48±0.01
4.	39	0.55±0.02	0.50±0.01

M.S.S.	0.018**	0.016**
S.E.(M)	0.03	0.01

6. CONCLUSION

This study was carried out to assess the microbial count and shelf life of Paneer with different additives. Different microbial count such as standard plate count, yeast and mold count and coliform count were taken for individual types of Paneer and simultaneously acidity test was also done and results varied from sample to sample. There has been continuous increase in titratable acidity with the increase in storage period in every sample of treated Paneer. This also holds true for the microbial counts of the samples. The shelf life of salt treated Paneer (6%) showed 25days with respect to the control sample. 18 days of keeping quality was observed in case of Paneer treated with UV rays (20 seconds). With 90% power level at 700 Watt the treated paneer can be kept for 39 days. At a junction when it is important to develop technologies for the preservation of Paneer considerable scope exists for intensive R&D (Research and Development) work. Though methods have been developed for preservation further development is needed in order to save time and money.

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