



Effect of Microwave Radiation on Shelf Life of *Paneer* for Rural Market

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ABSTRACT

An attempt was made to enhance the shelf life of paneer by microwave irradiation. Standard plate count; coliform count; yeast and mold count; proteolytic count; acid producers count; staphylococcus count and sensory evaluation on a nine point Hedonic scale of each product i.e. treated and untreated products stored at ambient condition (30°C) and at refrigerated condition (5 - 7°C) was done at 0 , 2nd , 5th , 7th day and onward till they were acceptable based on organoleptic test and consumer acceptance. The shelf life of paneer was extended by 8d at room temperature and 15d at refrigeration temperature. Use of microwave radiation of indigenous milk products is suggested to enhance the shelf life of the product.

Key Words : Microwave, shelf-life, *Paneer*.

INTRODUCTION

Indian dairy industry has witnessed rapid progress in the last four decades. About 40-50 per cent of the total milk produced is converted into different varieties of traditional milk products using processes such as heat and acid coagulation, heat desiccation and fermentation. Out of this an estimated 5 per cent of milk produced in India is converted to paneer (Chandan, 2007). Paneer is mainly used for various culinary preparations. In the last few decades, the popularity of paneer has spread from the north to all over the country. The simplest way to enhance the keeping quality of milk and milk products is boiling. Many thermal processes i.e. pasteurization, sterilization and UHT have gained a lot of popularity. However, many drawbacks are also related to these processes of heat treatment viz. degradation of flavour and colour, nutrients, etc.

Microwave treatment is an intense thermal treatment, which is now widely used to extend the shelf life of food products. It is well established that the microflora of liquid milk could be reduced

by microwave treatment. It has also been observed that in pasteurized milk with microwave, microbial population was lower than untreated milk and has longer shelf life. Villamiel *et al* (1996) concluded that continuous microwave processing might be an efficient and mild method for the pasteurization of milk. They also concluded that shelf life of microwave treated milk was longer than that of milk heated on hot electric plate. Kindle *et al* (1996) also reported that colony counts of all microorganisms were significantly decreased by microwave heating. Hence, study was conducted to increase shelf life of *paneer* through microwave irradiation.

MATERIALS AND METHOD

Samples of *Paneer* were procured under aseptic conditions from the local market. All the samples were separately packed in polypropylene pouches (75µ thickness and dimension 4 " X 3") aseptically, as suggested by Mathur *et al* (1992). Two container of each sample were microwave treated and other two were kept as control. *Paneer* samples were treated at power level 60 (i.e. 600w) for 32s. Power

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level and time combination was chosen based on their effect on taste, body and texture. The treated samples were kept under refrigerated condition (5°C) and under ambient temperature (30°C).

Standard Plate Count, Coliform Count, Yeast and Mold Count according to the methods of BIS (1960); Proteolytic Count (Harrigan and McCance, 1976), Acid Producers Count (AOAC), *Staphylococcus* Count (Chapman, 1960) and Sensory evaluation on a nine point Hedonic Scale was done for each product i.e. treated and untreated products stored at ambient condition and at refrigerated condition at 0, 2nd, 5th, 7th day and onward till they were acceptable based on organoleptic test and consumer acceptance.

RESULTS AND DISCUSSION

Effect of microwave treatment on the microbiological quality of *paneer*

Standard Plate Count

In general the total plate count decreased due to microwave treatment and increased both in treated and untreated sample during storage (Table 1). The total plate count in fresh *paneer* sample was 12.4×10^4 cfu/gm. Maximum bacterial growth took place in untreated sample. Untreated fresh *paneer* (12.4×10^4 cfu/gm) was unacceptable organoleptically after 5d and 10d of storage respectively, under ambient and refrigerated condition. However, the shelf life of treated *paneer* was extended up to 8d and 15d under ambient and refrigerated conditions, respectively. It was observed that after microwave treatment the reduction in total plate count was 59 per cent. Similar results were observed by Kindle *et al* (1996). Bacteria destruction up to 5000 fold was reported by Kindle *et al* (1996) in infant milk food.

Effect on coliform count

The coliform count of fresh sample of *paneer* was nil (Table 1). Reduction in coliform count by microwave treatment was not examined as *paneer* from market had no coliform count, effect on coliform by microwave irradiation could not

be determined. Hammad (1998) observed that no viable coliform were detected in raw milk after microwave heating at 600W for 4 min.

Table I. Effect of Microwave Treatment on *Paneer*.

Sr. No.	Parameter	Before (cfu/g)	After (cfu/g)	Reduction (%)
1.	Standard Plate Count	124,000	51,000	59
2.	Coliform count	NIL	NIL	NIL
3.	Yeast and Mold Count	150	100	34
4.	Proteolytic Count	500	150	70
5.	Acid producers count	130	50	62
6.	<i>Staphylococcus</i> count	NIL	NIL	NIL

Effect on yeast and mold count

There was no significant change in yeast and mold count as compared to other microbial count due to microwave treatment of different indigenous dairy products. Yeast and mold count of *paneer* before treatment were 15×10^4 cfu/gm and it was observed that after irradiation, the percent reduction was 34 per cent in *paneer*. Similar results were observed by Culkin and Fung (1975) who reported that microwave heating at 2450 MHz caused little or no destruction of *Aspergillus*, *Penicillium*, *Rhizopus* etc. in foods.

There was a little effect of microwave heating on yeast and mold count in controlling their growth during storage. Yeast and mold count increased in both treated and untreated sample during storage. Fresh *paneer* having 15×10^4 cfu/gm yeast and mold count was spoiled by 5d stored at room temperature (count increased to 4.7×10^2 cfu/gm) and spoiled by 8d of storage under refrigerated condition (count increased to 38×10^4 cfu/gm). It was also observed that treated sample initially having 10×10^4 cfu/gm became unacceptable after 10d of storage under ambient condition (Yeast & Mold count increased to 47×10^4 cfu/gm) and 15d of storage under refrigerated condition (Yeast & Mold count increased to 42×10^4 cfu/gm).

Shelf Life of *Paneer*

Table 2. Effect of microwave treatment on *paneer* during storage.

Parameter	Sample	Paneer	
		Count at 0 day	Count at the day of spoilage
SPC	Untreated (at room temp.)	12.4 X 10 ⁴	51X10 ⁴ @5day
	Untreated (at refrigeration temp.)	12.4 X 10 ⁴	51 X 10 ⁴ @10 day
	Treated (at room temp.)	5.1 X 10 ⁴	59 X 10 ⁴ @8 day
	Treated (at refrigeration temp.)	5.1 X 10 ⁴	57 X 10 ⁴ @15day
Coliform	Untreated (at room temp.)	0	0@5day
	Untreated (at refrigeration temp.)	0	0@10 day
	Treated (at room temp.)	0	0@8 day
	Treated (at refrigeration temp.)	0	0@15day
Yeast & mold count	Untreated (at room temp.)	150	360@5day
	Untreated (at refrigeration temp.)	150	470@10 day
	Treated (at room temp.)	100	380@8 day
	Treated (at refrigeration temp.)	100	420@15day
Proteolytic count	Untreated (at room temp.)	500	31X 10 ² @5day
	Untreated (at refrigeration temp.)	500	52 X10 ² @10 day
	Treated (at room temp.)	150	24 X10 ² @8 day
	Treated (at refrigeration temp.)	150	52 X10 ² @15day
Acid Producers count	Untreated (at room temp.)	130	420@5day
	Untreated (at refrigeration temp.)	130	440@10 day
	Treated (at room temp.)	50	350@8 day
	Treated (at refrigeration temp.)	50	450@15day
Staphylococcus count	Untreated (at room temp.)	0	0@5day
	Untreated (at refrigeration temp.)	0	0@10 day
	Treated (at room temp.)	0	0@8 day
	Treated (at refrigeration temp.)	0	0@15day

Effect on Proteolytic count

The proteolytic count was lower in microwave treated sample than in untreated sample. It was observed that proteolytic count was inhibited by microwave treatment as fresh paneer, having proteolytic count of 5 X 10² cfu/gm and treated paneer, having proteolytic count of 1.5 X 10² cfu/gm was spoiled by 5d at room temperature (count increased to 31 X 10² cfu/gm) and by 10d at refrigerated condition (count increased to 52 X

10² cfu/gm); and untreated sample spoiled by 8d at room temperature (count increased to 24 X 10² cfu/gm) and by 15d at refrigerated condition (count increased to 52 X 10² cfu/gm). It was observed that reduction rate of proteolytic bacteria due to microwave treatment was 70 per cent in *paneer*.

Effect on Acid Producers Count

Acid producers count also reduced due to microwave treatment. The acid producers count of

fresh *paneer* was 130 cfu /gm and after microwave treatment it was reduced to 50 cfu /gm (62%). During storage, it was observed that the number of acid producers colonies in fresh *paneer* (13 X 10² cfu/gm) increased to 42 X 10² cfu/gm after 5d when stored at room temperature and to 44 X 10² cfu/gm after 10d under refrigerated condition. The count at microwave treated (600W for 30sec.) was 5 X 10² cfu/gm and increased to 35 X 10² cfu/gm after 8d when it stored at room temperature and to 45 X 10² cfu/gm after 15d under refrigerated condition (Table 2)

Effect on *Staphylococcus* count

Microwave treatment had a significant effect on survival of *Staphylococcus* spp.

No *staphylococcus* was detected in fresh *paneer*.

Sensory evaluation

The sensory score for flavour, colour, consistency and appearance of microwave treated *paneer* samples were observed to be same as compared to untreated products.

On the basis of organoleptic evaluation it was observed that the quality of *paneer* before and after treatment were almost same. During storage the overall acceptability of control sample was decreased to a greater extent than those of microwave treated sample.

CONCLUSION

Control sample of *paneer* was evaluated for 10d whereas treated *paneer* was evaluated for 15d. Control sample of treated *paneer* was evaluated for 28d. During storage, colour and appearance, smell of both the product was more affected than body and texture. Colour and appearance more quickly deteriorated due to mold growth and taste and flavour deteriorated due to acid producers bacterial growth.

It has been reported that microwave treatment of *paneer* up to 115°C for 5m did affect the body and texture and flavour attributes of the product and increase the shelf life and can be effectively utilized for fulfilling the local rural market demand.

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Received on 12/10/2016

Accepted on 15/12/2016