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# Development of visual scale for optimization of in-package thermization (microwave) treatment parameters of *burfi*

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**Abstract**
*Burfi*, a popular milk-based confection of Indian sub-continent, during storage undergo several physical, biochemical and microbiological changes making it unfit for human consumption. Because of its intermediate moisture range and non-acidic nature, spoilage in *burfi* is mostly caused by growth of surface yeast and moulds. Various research works have shown the importance of thermization treatment to reduce post-process contamination. In-package microwave thermization treatment is one such approach, wherein the initial microbiological load is decreased without adversely affecting the sensory attributes of the packaged product. Thus, in this study, *burfi* prepared using double jacketed steam kettle and packaged in nylon pouches (KPA$^{TM}$) was subjected to different microwave power (10-100%) and exposure time (10-90s) and a visual scale was designed to ease the optimization process.

**Keywords:** *burfi*, microwave, in-package thermization treatment, nylon pouches

## Introduction
*Burfi*, a *khoa*-based confection is available in the market in a variety of forms, such as plain *burfi*, fruit and nut *burfi*, cashew *burfi*, chocolate *burfi*, saffron *burfi*, doda *burfi*, rava *burfi*, etc. [1]. Despite severe heat treatments given during its manufacture, post production microbial growth is one of the main reasons for spoilage of *burfi*. Various studies have been carried out using several preservation techniques, to enhance storage life of *burfi*, but scanty work has been reported on the use of in-package thermization (microwave) treatment of *burfi*. Thermization is the generic term used for a range of subpasteurization heat treatments which effectively reduces the number of spoilage organisms with minimum heat damage to food components. Use of thermization as a post-manufacture heat treatment has been successfully carried out in several dairy products such as *dahi*, *misti dahi*, yoghurt, *lassi* and buttermilk [2, 3, 4, 5]. Microwave processing is one such thermization technique which is an emerging technology involving use of electromagnetic radiation for quick processing of foods resulting in high nutritional, sensory and keeping quality. The advantage of using microwaves is that these electromagnetic radiations generate heat within the food, by interacting with water molecules and mineral component of the food, rapidly raising the temperature to the desired extent [6]. Some studies have been done considering the effectiveness of microwave treatment as a preservation technique for some Indian dairy delicacies such as *khoa*, *paneer* and *rosogolla* [7, 8, 9].

Nowadays, various visualization tools and designs are being used for clarity and ease of work, thus saving time in the long run. Various elements such as line, shape, negative/white space, values, colour, texture, etc can be used to design a visual scale [10].

Hence in view of the above, the present study was conducted to design a visual scale to aid in optimization of microwave / thermization treatment parameters, which could be later used as technique to enhance the quality and shelf life of *burfi*.

## Materials and Methods
### Ingredients and Chemicals
Fresh pooled buffalo milk was received from the Experimental Dairy of the ICAR-National Dairy Research Institute, Karnal, India. Commercially available superfine, sulphurless cane sugar (Trust$^{TM}$ C*lassic*) was manufactured by M/s Simbhaoli Sugars Ltd., Hapur (UP) was purchased from the local (Karnal) market. Nylon based barrier pouches (KPA$^{TM}$, 90 micron) having high sealing strength were procured from M/s Sealed Air (India) Pvt. Ltd., Cryovac Food Packaging Division, New Delhi.

### Preparation and Treatment of *burfi*
*Burfi* was prepared using the standard batch method of manufacture [11] using double jacketed stainless steel kettle and packaged in nylon pouches (KPA$^{TM}$) (200g) under atmospheric condition. It was subjected to in-package thermization (microwave) treatment. The treatment involved subjecting the packaged product to different microwave power level ranging from 10-100% (100% represents 900W power) and treatment time ranging from 10-90s using a domestic microwave oven (Samsung, CE118KF). *Burfi* sample not treated with in-package thermization treatment was treated as control.

**Development of visual scale and screening of microwave power level and exposure time**

A visual scale was developed to screen single treatment time for each microwave power level on the basis of minimum visual change in the product as shown in Fig. 1. Based on this scale, ten combinations of microwave power-treatment time were selected.

## Results

**Screening of in-package thermization (microwave) treatment parameters using visual scale**

The effect of different microwave power treatments subjected to varying duration on the visual appearance of packaged *burfi* is presented in Fig. 2. It can be seen that the samples subjected to 60%-100% power levels beyond 10s; 40%-60% levels beyond 20s; 30% level beyond 40s; 20% level beyond 60s and 10% level beyond 70s of exposure, resulted in softening coupled with fusion and vapour/moisture exudation. No changes were observed in the samples subjected to either 10% or 20% power levels and 30s of exposure time. Hence, a single time period for each microwave power level exposure (Table 1) was selected on the basis of minimum effect on visual appearance using visual scale shown in Fig. 1.

**Table 1:** Selection of microwave power level and treatment time for in-package thermization treatment of *burfi*

| Sample code | Microwave power level (%) | Power (W) | Treatment time (s) |
|---|---|---|---|
| A | 100 | 900 | 10 |
| B | 90 | 810 | 10 |
| C | 80 | 720 | 10 |
| D | 70 | 630 | 10 |
| E | 60 | 540 | 10 |
| F | 50 | 450 | 10 |
| G | 40 | 360 | 10 |
| H | 30 | 270 | 30 |
| I | 20 | 180 | 50 |
| J | 10 | 90 | 60 |

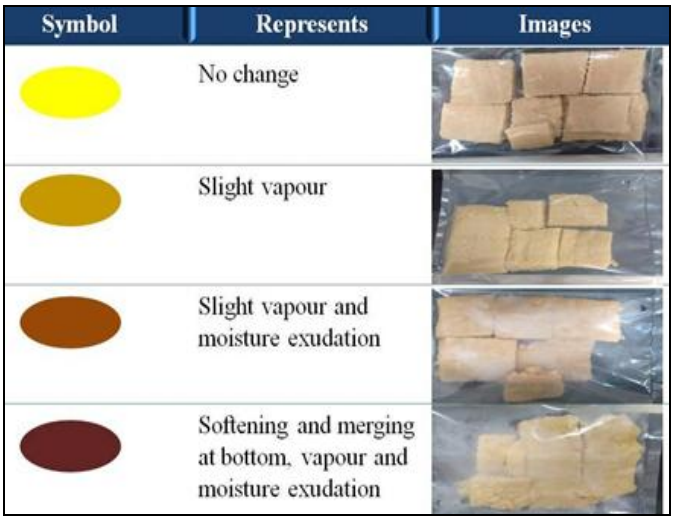


**Fig 1:** Visual scale for screening of in-package thermization treatment

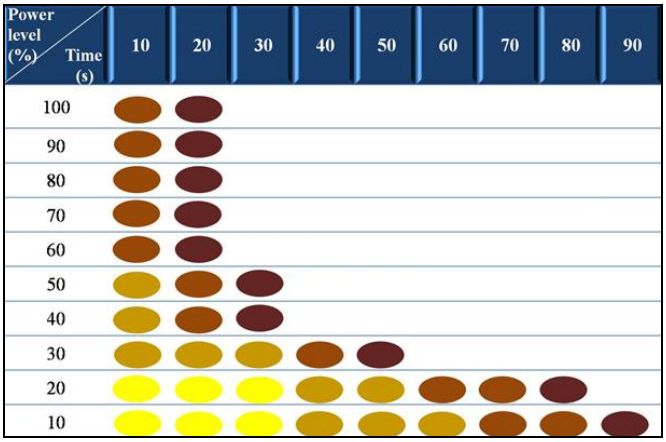


**Fig 2:** Pictorial representation of the effect of in-package thermization (microwave treatment) on visual appearance of *burfi*

## Conclusion

A visual design or tool is a very user friendly and effortless technique for optimization and screening processes, thus saving time and money. It has a vide scope of use and development in food industry. In this study, *burfi* packaged in nylon (KPA™) pouches and subjected to thermization using microwave treatment at different power levels in the range of 0-100% exposed for different durations (10-90s) was analyzed and screened using visual scale, thus indicating huge potential of use of visual scale in food industry.

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