ENSURING QUALITY OF FOOD PRODUCTS BY OHMIC TREATMENT OF MEAT PRODUCTS

— research paper —

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Abstract: In this paper, a Ohmic Treatment (OH) unit built in our laboratory is tested. Temperature profile inside sample set for three points (71, 76 and 81^{0}C), temperature distribution along the product at different times during preparation, pasteurisation value for different temperatures between 70-85^{0}C as a function of time of storage are analysed. The effect of OH on microbiological germs was determined. In all cases, the Total Number of Germs and Coliforms are totally inhibited. The action of OH on *Pseudomonas aeruginosa* germ is also very effective. After OH, all *Ps .aeruginosa* germs were destroyed.

Keywords: ohmic, heating, meat, microbiological, germs.

INTRODUCTION

Trends in food supply and simplicity are very important, and the "diet – health" is becoming increasingly aware. The OH (Ohmic Heating) is a process based on reactions that reduce the level of bacterial spores. The mechanisms of microbial inactivation highlights the benefits of ohmic processing: continue processing without heat transfer surfaces, fast processing without product degradation, susceptible to damage, increase retention of nutrients, low losses compared to conventional heating etc. During heat ohmic treatment heating power due to the mass of the product, so the result is a superior quality (Vicente et al., 2005).

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The currently project involves running experiments on a prototype model at the laboratory to monitor the effectiveness of Ohmic Treatment (OH) for meat products.

MATERIALS AND METHODS

Heating cell designed in our lab was built in a polycarbonate cylinder with two electrodes detachable stainless steel with titanium (high titanium) (Figure 1).

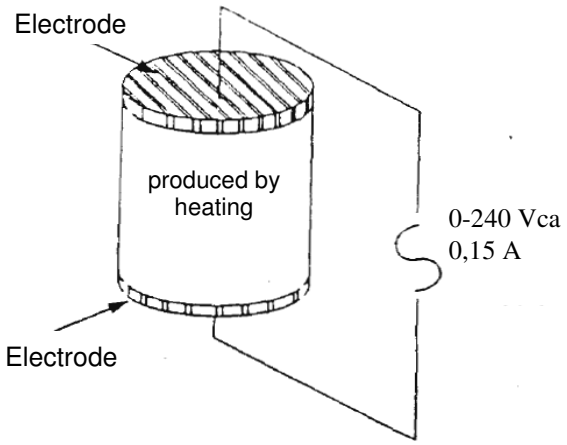

Figure 1. Laboratory OH unit

Upper electrode has a hole of 0,5mm for air movement. Temperature measurements were made using constantan – plated thermocouples copper with Teflon introduced by six holes completed in the copper half of the cylinder. Temperature, voltage and current at each minute were recorded. Voltage source could be adjusted to the end electrodes. It has values of 220V, 50 Hz and 18 Amps. Voltage was adjusted manually, used as a source autotransformer.
Device capacity is maximal 400grams/product.

OH treatment

Three variants were used:

1. Pasteurization – temperature 71^0C

Variant I: 10 minute increase voltage electrical in the products thermal centre and 5 minute parking at 71^0C.

2. Pasteurization – temperature 76^0C

Variant II: 10 minute increase voltage electrical in the products thermal centre and 5 minute parking at 76^0C.

3. Pasteurization – temperature 81^0C

Variant III: 10 minute increase voltage electrical in the products thermal centre and 5 minute parking at 81^0C

Meat inserted in the circuit in the heating device, should be at the working temperature within 10 minutes (or 5 or 15).

After, removing the meat from the device enters into a cooling.

Laboratory experiments were conducted on the following items – mince meat and small paste (10 kg of product).

Analysis

The Tryptose Lauryl Sulfate Broth**,** the Bouillon Bilie Au Vert Brilliant Brilliant Green Bile (2%) broth (BBLV) and the Mac Conkey G. broth (EUR. PHAR. MEDIUM G). were used to determine coliforms. In order to determine the Total Number of Germs, following culture media: Plate Count Agar and Nutrient Agar were used.

Pseudomonas aeruginosa was determined using following culture media: the Cetrimide Agar and the Pseudomonas Agar. The action of OH on *Pseudomonas aeruginosa* germ was analysed in samples of meat inoculated with *Ps. aeruginosa* in concentration 10,000 germs/g and 100,000 germs/g.

For all microbiological analyses, four determinations in parallel were made. Blind samples (without OH treatment) were used for comparison.

RESULTS AND DISCUSSION

In Figure 3, the temperature gradient inside samples is presented. The temperature gradient appears to be constant although the voltage is this may be due to higher electrical conductivity and current row increase as the temperature increases. During the storage period of 5 minutes, a slight decrease of care temperature (0.8^0C) is observed, due to heat diffusion into the environment.

Temperature distribution along the product at different times during preparation is presented in Figure 3. The cell was then cooled by immersion in an ice water (0^0C). All these measurements were determined in three expeated experiments. In held therefore , an initial series of 3 experiments with 3 repetitions for cooking temperature reached 71^0C for 5 minutes, 10 minutes and 15 minutes to examine visual taste and tactile qualities of the resulting product. This time of preparation were obtained by applying constant voltages of 103, 76 and 64 volts.

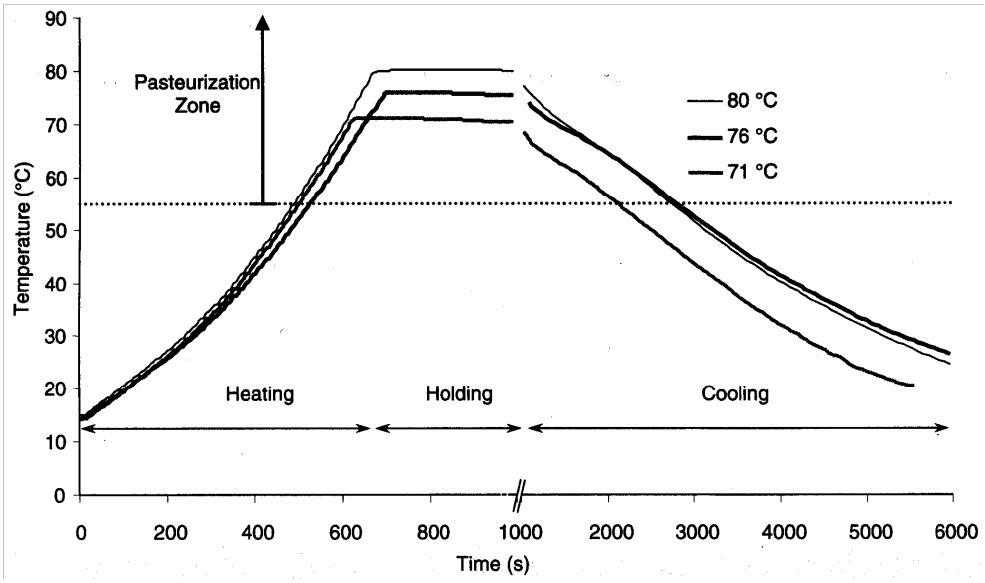

Figure 2. Temperature profile inside sample set for three points (71, 76 and 81^0C)

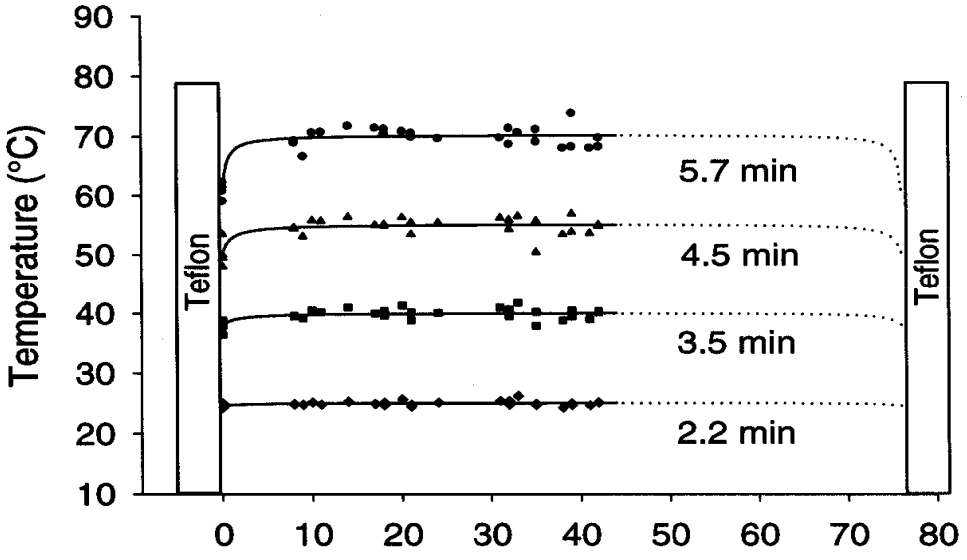

Figure 3. Profile of temperature along the section at different times during heating

To improve the preservation value (Figure 4) of the pasterurization once cooking time about 10 minutes the slow heating rate (5^0C / min) to achieve the final cooking temperature up to 16,5 in about 14 minutes to range from 0 up to 85^0C, while even the highest cooking temperature can be reached in less than 5 minutes at the highest heating rates.

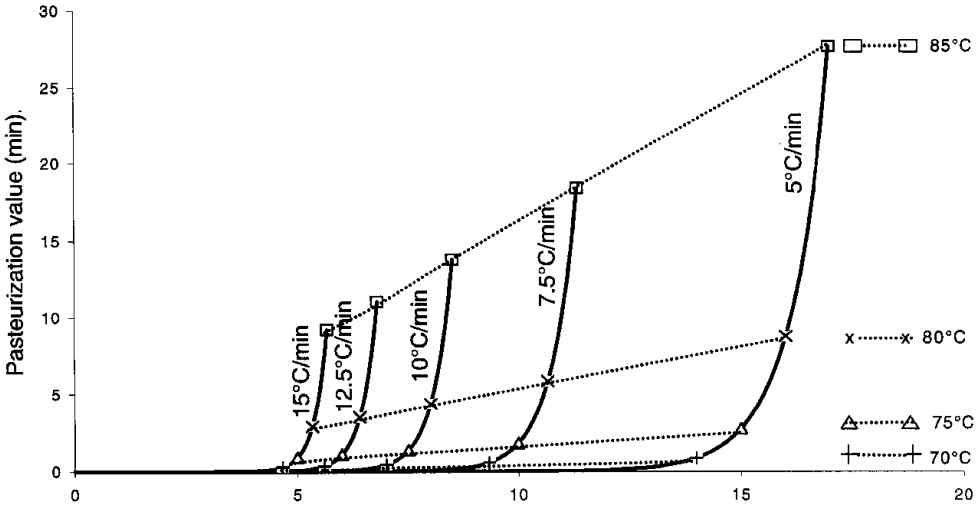

Figure 4. Pasteurization values during preparation as function of time cooking for five rates of growth temperature (15.0, 12.5, 10.0, 7.5 and 5.0^0C/min) and four finally temperature (70, 75, 80 and 85^0C). D_{70} = 2.95 min and Z=10^0C.

The curves presented in Figure 5 show the equivalent pasteurization at temperature between 70 and 85^0C. Curves are included in a range from 25 to 150 minutes for the storage time of less than 30 minutes. We conducted a second series of tests to cooking temperature of 76 and 81^0C.

The effect of OH on microbiological germs was determined. In all cases, the Total Number of Germs and Coliforms were totally inhibited.
The action of OH on *Pseudomonas aeruginosa* germ is also very effective. After OH, all *Ps .aeruginosa* germs were destroyed.

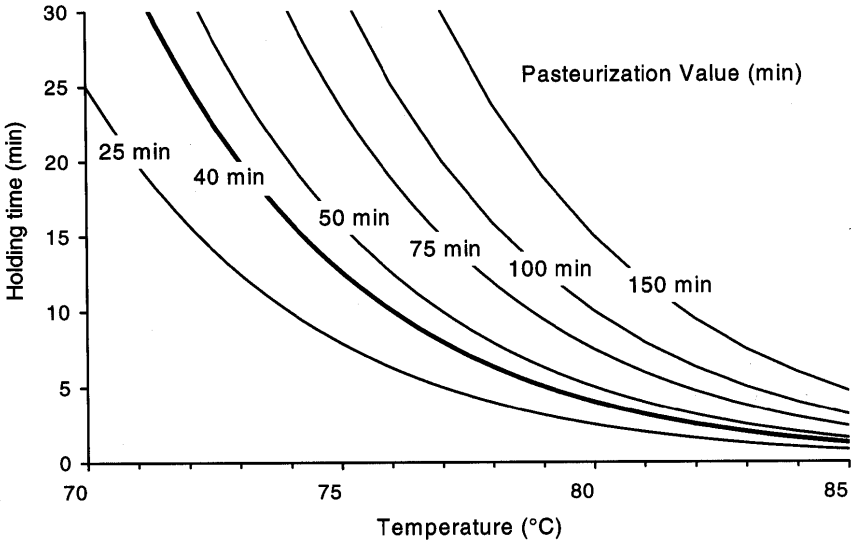

Figure 5. Curves of pasteurization for different temperatures between 70-85^{0}C as a function of time of storage

CONCLUSIONS

Experiments conducted with this prototype showed a very high efficiency. OH aims to destroy microbiological germs in the meat products. Applying industrial preparation OH would allow higher efficiency of 90%.
Compared with traditional preparation in perfumery, a reduction of energy consumption by 82 – 97% can be obtained, with fulfilment of pasteurization minimum specifications needed to produce commercial quality products.

References:

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