

PASTEURIZATION EFFECT TO QUALITY OF SALAD WITH MEAT IN MAYONNAISE

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Abstract

Experiments have been carried out at the Latvia University of Agriculture Department of Food Technology. The aim of the present study was to investigate effect of pasteurization regime for salad with meat and mayonnaise to maintain its quality. Salad samples were packed in vacuum using conventional packaging films as well as environmentally friendly plasticized poly- β -hydroxybutyrate (PHB) and polyactic acid (PLA) films foreseen for food packaging, applying pasteurization (*Sous vide*). Vacuum packed salad samples were placed in pouches size of 200x300 mm, PHB (thickness 75 μ m), and PLA (thickness 40 μ m). Mass of sample 200 \pm 1 g in each pouch from which substantially all air was removed prior to final sealing on *MULTIVAC A 300/16*. Following-up by thermal treatment in water bath *Clifton Food Range (Sous vide)* in different temperature +60 \pm 0.5 °C, +65 \pm 0.5 °C, and +70 \pm 0.5 °C, including warming up 15 or 10 min, different holding time, and following different cooling time. The cooling occurred in two steps: by water artesian well at +10 \pm 1 °C temperature following by ice water cooling at +1–+2 °C. The quality of meat salad in mayonnaise was defined by measuring of total plate count (CFU/g) of micro-organisms; from it were determined optimal pasteurization temperature and all treatment process in time. A control sample without any preservatives was packed in conventionally used polypropylene (PP) trays covered with non hermetical. Mild *Sous vide* treatment of meat salad in mayonnaise at ambient temperature in water bath +65 \pm 0.5 °C in total thermal treatment time within 50 min, including warming up 15 min, holding time 20 min and core temperature of sample +63 \pm 0.5 °C and following total cooling time 15 min does not have influence on the consistency of salads and cut down the total microbial colony count. Environmentally friendly packaging films plasticized PHB and PLA could be successfully used for *Sous vide* thermal food treatment at the temperature not higher than +63 \pm 0.5 °C

Key words: salad with meat and mayonnaise, *Sous vide*, packaging, shelf life.

Introduction

The market for ready-to-eat products has become global. Consumers expect and demand safe, high quality fresh produce every day. An innovative approach to packaging that can increase shelf life of ready-to-eat products is necessary. The produce industries for ready-to-eat products are looking for increasingly to sophisticated plastic films packaging to ensure consistent high quality, protection from injuring, ensuring cleanliness, and reducing disease with ever increasing shelf life (Church, Parsons, 2000).

The market for different kinds of salads with mayonnaise has become popular in the recent years in the Baltic States. Last century in the 80's that kind of salads were popular only in the coffee-bars, in the 90's it was possible to find just several kind of no packed salads on the market, but in 1996 the first salads in the packaging boxes came at sight at the market showcases. Packaging boxes were plastic PE or PP trays with non hermetical lids. The main idea of salad packaging in the plastic trays comes from Europe. In 2000's Europe's idea was adapted in the Baltic States. Now, in 2008 it is possible to find in the commercial network salads in different forms packaged in plastic containers with non hermetical lids, as well as salads packaged in vacuum or modified atmosphere. Salad business in Baltic States at the time being is constantly growing and it is a very successful one. Assortment of salads in mayonnaise will continue to grow in the future. An innovative approach to packaging that can increase shelf life of salads is necessary. Ready-to-eat products need a preservatives or mild pasteurization to give them a commercially acceptable shelf life (Ghazale, 1998).

The term "*Sous vide*" means "under vacuum" and describes a processing technique whereby freshly prepared foods are vacuum sealed in individual packages and then pasteurized a time temperature combinations sufficient to destroy vegetative pathogens but mild enough to maximize the sensory characteristics of the product¹ (Galimpin-Johan, 2007; Jang,

¹ Hyytiä-Trees, E., Skyttä, E., Morkkila, M., Kinnunen, A., Lindström, M., Lähteenmäki, L., Ahvenainen, R. and Korkeala, H. // Safety Evaluation of *Sous Vide*-Processed Products with Respect to Nonproteolytic *Clostridium*

Lee, 2005). General processing steps involved in *Sous vide* are preparation of raw materials, vacuum packaging, pasteurization, chilling/cooling, chilled storage¹. *Sous vide* has long been used as a method for cooked catering products and enhancing quality compared with conventional methods. The *Sous vide* technologies for ready-to-eat meals developed over the last 20 years as food service industry's need to become more efficient while simultaneously satisfying the consumer's growing demand for higher quality in food and food services (Nissen *et al.*, 2002). Products treated with *Sous vide* are being increasingly used in the retail market. Using *Sous vide* the products offers greater microbiological safety, longer shelf life and flexible storage logistics. The *Sous vide* economic benefits include better use of labour and equipment through centralized production and extended shelf life due to vacuum packaging, which by excluding oxygen inhibits oxidative processes and growth of spoilage organisms (Paik *et al.*, 1999; Rhodehamel, 1992). The shelf life of a *Sous vide* product can be as long as 42 days (Schaffner, Labuza, 1997).

Literature studies concluded that the safety of *Sous vide* products needs to be carefully evaluated product by product. Time-temperature combinations used in thermal treatments should be re-evaluated to increase the efficiency of processing, and the use of additional antibotulinar hurdles, such as bio preservatives, should be assessed (Wang *et al.*, 2004). The effects of *Sous vide* packaging upon the sensory characteristics of chicken breast and of sliced potatoes in cream both immediately after cooking (70–80 °C) and following subsequent chilling, chilled storage and reheating – higher hedonic scores were associated with higher flavors and juiciness scores for chicken and with higher flavor and moisture scores for potato (Church, Parsons, 2000). Salads in mayonnaise belong to group of ready-to-eat foods with high risk and relatively few data have been published on the survival and growth of spore-forming bacteria in those products packed by several packaging technologies. Several guidelines give interpretation of microbiological analysis of some ready-to-eat foods² (Ohosone, 1997), but there is not mentioned, that those products are salads in mayonnaise. A novel process for preparing a pasteurized meat and vegetable containing salad in mayonnaise having a long shelf-life under refrigerated storage was proprietary³. This process includes essential steps of acid treatment to pH 4.5 and +65 to +75 °C temperature-short time bulk heat treatment before packaging. US Patent 5114733 (1992)⁴ relates to a process for preparation of salad mixture with oil emulsion not requiring any preservatives. Prepared salad is placed in container and air tight closed, pasteurized under increased pressure, refrigerated and storage time achieved several weeks. Another finding is US Patent 5320856 (1994)⁵ which informs about separate independent ingredients specific thermal stabilization treatments, cooling and after combination into the desired complex food article which is finally sealed in a package. The aim of the present study is to investigate the effect of pasteurization for each of 21 variants of salads with meat and mayonnaise to find out the best treatment regime to prolong the shelf life without hazardous influence on the quality.

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<http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=91810&tools=bot>; resource used on 20.05.2007.

¹ USFDA // Food Code Annex 6 Food Processing Criteria. 2005. Source: <http://www.cfsan.fda.gov/~arcobat.fc05-a6.pdf>; resource used on 29.01.2008.

² Food Safety Authority of Ireland. // Guidelines for the Interpretation of results of Microbiological Analysis of some Ready-to-eat Foods sample at Point of Sale/ Guidance Note No.3, 2001. Source http://www.fsai.ie/publications/guidance_notes/gn3.pdf; resource used on 30.01.2008.

³ United States Patent 4191787 1980. // Process for Preparing a Pasteurized Meat-Containing Salad. 1980. Source: Available at: <http://www.freepatentsonline.com/4191787.html>; resource used on 29.04.2006.

⁴ United States Patent 5114733 1992. // Process for Preparing a Salad Product and an Emulsion Therefore. 1992. Source: <http://www.freepatentsonline.com/5114733.html>; resource used on 29.04.2006.

⁵ United States Patent 5320856 1994. // Method of Making Complex Food Articles Having Prolonged Shelf-life. 1994. Source: <http://www.freepatentsonline.com/5320856.html>; resource used on 29.04.2006.

Materials and Methods

Experiments have been carried out at the Latvia University of Agriculture Department of Food Technology. The object of research is salad with meat in mayonnaise. Meat salads in mayonnaise produced for a local market were used for experiments. The ingredients in the salads were potatoes, cooked beef, boiled eggs, pickled cucumbers, salt, and mayonnaise Provansa purchased on the local market. Twenty-one different types of *Sous vide* treated and control samples were evaluated. The details of experiment are described in the Table1.

Table 1

Performed experiments of salads with meat in mayonnaise

Sam- ple No.	Packaging material	Packaging technology	Pasteuri- zation tempera- ture, °C	Heating time, min	Hold- ing time, min	Cooling time, min	
						By artesian water (+10±1), °C	By ice water (+1–2), °C
1.	PA/PE	<i>Sous vide</i>	65	15	20	15	0
2.	PA/PE	<i>Sous vide</i>	65	15	20	5	10
3.	PA/PE	<i>Sous vide</i>	65	15	25	5	10
4.	PA/PE	<i>Sous vide</i>	65	15	15	5	10
5.	PA/PE	<i>Sous vide</i>	65	15	20	5	5
6.	PA/PE	<i>Sous vide</i>	70	15	20	15	0
7.	PA/PE	<i>Sous vide</i>	70	15	20	5	10
8.	PA/PE	<i>Sous vide</i>	70	10	15	5	10
9.	PA/PE	<i>Sous vide</i>	70	10	10	5	10
10.	PA/PE	<i>Sous vide</i>	70	15	20	5	5
11.	PA/PE	<i>Sous vide</i>	60	15	20	15	0
12.	PA/PE	<i>Sous vide</i>	60	15	20	5	10
13.	PA/PE	<i>Sous vide</i>	60	15	25	5	10
14.	PA/PE	<i>Sous vide</i>	60	15	30	5	10
15.	PA/PE	<i>Sous vide</i>	60	15	20	5	5
16.	PA/PE (control)	Vacuum	–	–	–	–	–
17.	PE containers	Air ambiance	–	–	–	–	–
18.	plasticized PHB	<i>Sous vide</i>	65	15	20	5	10
19.	PLA	<i>Sous vide</i>	65	15	20	5	10
20.	PLA	Vacuum	–	–	–	–	–
21.	plasticized PHB	Vacuum	–	–	–	–	–

Salad samples were *Sous vide* packed in vacuum using conventional PA/PE film and environmentally friendly in Brazil commercially produced plasticized poly-β-hydroxybutyrate (PHB) film pouches, thickness of films were 75±2 μm. Polylactic acid (PLA) film foreseen for food packaging thickness of 40±1 μm, was used as well. Salad with meat in mayonnaise was placed in PA/PE (thickness 20/45 μm) pouches with barrier properties size of 200x300 mm and sealed by chamber type machine MULTIVAC A 300/16. As a control the meat salad in mayonnaise without preservatives was packed in traditionally in retail used PE containers covered with non hermetical lids. Mass of each sample was 200±1 g following-up by thermal treatment (*Sous vide*) in water bath Clifton Food Range in different temperature +60±0.5 °C; +65±0.5 °C and +70±0.5 °C, including warming up 15 or 10 min, different holding time (10; 15; 20; 25; 30 min), and following by different cooling time (10; 15 min). The cooling occurred in two steps: by water from artesian well at +10±1 °C temperature following by ice water cooling at +1 to +2 °C. After processing, samples of each salads were

stored at $+6\pm 0.5$ °C. Microbial population in salads with meat in mayonnaise was assessed in the next day after packaging and pasteurization. Microbiological quality of selected samples was evaluated by the methods of the Guidance Note No. 3 of Ireland (2002)¹. They conform the prepared mixed vegetable salads as well as cooked meat belonging to category D, accordingly acceptable till $CFU10^6 < 10^7$. The principal spoilage mechanisms that limit the shelf life of cooked and processed meat products as ingredient of salad in mayonnaise is microbial growth. The results were processed by mathematical and statistical methods. Data were subjected using The Friedman's test using the statistical analysis software SPSS 16.0 for Windows, significance was defined at $p < 0.05$.

Results and discussion

The remaining CFU, g^{-1} of micro organisms in pasteurised samples of meat salad in mayonnaise (cooked beef, potatoes, boiled eggs, pickled cucumbers, and mayonnaise) accordingly Table 1. is showed in the Figure 1.

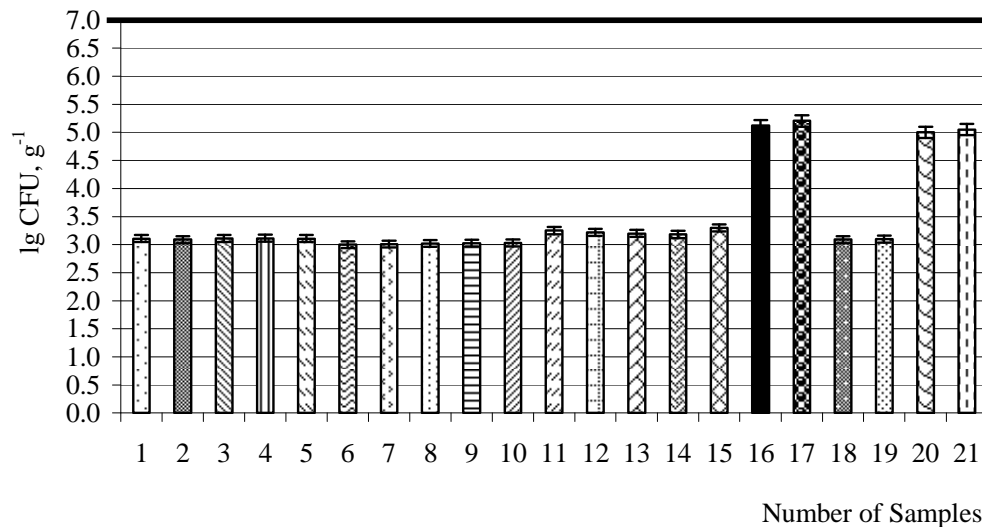


Figure 1. The total plate count values of salads

The horizontal line in the Figure 1, according to the guidelines from the Note No. 3 of Ireland (2002)⁷ represents the acceptable maximum number of bacteria ($\lg CFU, g^{-1} \leq 7$).

The results of Friedman's test showed that there are not a significant difference between the samples 1 to 15; 18 and 19 ($P > 0.05$), while the difference exists between previously mentioned and samples 16; 17; 20 and 21 ($P < 0.05$). The lowest CFU could be reached applying the *Sous vide* treatment at the temperature in the water bath $+70\pm 0.5$ °C (samples 6 to 10, Table 1), nevertheless consistence and colour of product has been changed, and it is not attractive point for consumers. Applying pasteurisation temperature $+60\pm 0.5$ °C in the water bath the remaining CFU is higher (samples 11 to 15). The best *Sous vide* thermal treatment regime could be suggested using ambience temperature in the water bath $+65\pm 0.5$ °C (samples 1 to 5, Table 1). In this case the consistence of salads has remained similar to fresh prepared product before pasteurisation. This process includes the essential steps of meat-containing salad with mayonnaise packaging in individual pouches, from which substantially all air has been removed prior to final sealing of containers, following-up by thermal treatment of hermetically sealed pouches in water bath at ambient temperature $+65\pm 0.5$ °C in total treatment time within 50 min, including warming up 15 min, holding time 20 min at pasteurization temperature in the core of sample $+63\pm 0.5$ °C and following cooling within 15

¹ Food Safety Authority of Ireland. // Guidelines for the Interpretation of results of Microbiological Analysis of some Ready-to-eat Foods sample at Point of Sale/ Guidance Note No.3, 2001. Source http://www.fsai.ie/publications/guidance_notes/gn3.pdf; resource used on 30.01.2008.

min. The cooling occurs in two steps: by water from artesian well at $+10\pm 1$ °C following by ice water cooling at $+(1-2)$ °C. Experimental data proved, that environmentally friendly packaging films plasticized PHB and PLA (samples 18 and 19) could be successfully used for *Sous vide* thermal food treatment at the temperature not higher than $+65\pm 0.5$ °C and the pasteurization effect is similar than using conventional packaging films. The total count of micro organisms in salads packed in not hermetically closed PE containers at air ambience as well as in vacuum packed pouches was $\lg \text{CFU, g}^{-1} > 5$ (samples 16 and 17).

Conclusions

Mild *Sous vide* treatment of meat salad in mayonnaise at ambient temperature in water bath $+65\pm 0.5$ °C in total thermal treatment time within 50 min, including warming up 15 min, holding time 20 min and core temperature of sample $+63\pm 0.5$ °C and following total cooling time 15 min does not have influence on the consistency of salads and cut down the total microbial colony count. Environmentally friendly packaging films plasticized PHB and PLA could be successfully used for *Sous vide* thermal food treatment at the temperature not higher than $+65\pm 0.5$ °C.

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