VARIATION OF SEVERAL MEAT INDICATORS CHARACTERISTICS FOR THE MEAT PRESERVED BY REFRIGERATION AFTER UV IRRADIATION

C. Danilevici
*Valahia University of Targoviste, Faculty of Enviromental Engineering and Biotechnologies, Unirii Street

Abstract
This work is aiming to follow the correlation between the main indicators of microbiological, sensorial and physical-chemical analyze, which are referring to beef freshness, preserved by a combined procedure (refrigeration and UV irradiation). This correlation allows determining the freshness of the meat with a bigger grade of certitude. The combined procedure of meat preservation by UV irradiation and refrigeration is already studied and applied in several developed countries.

Key words: meat, UV irradiation, refrigeration, mixed preservation

INTRODUCTION

After the slaughtering of the animals, meat is subject to a gradual damage process and to microorganisms assault, especially those of degradation. We appreciate that an aliment stops being fresh and not remain fit for human consumption when its main components (protides, lipids, glucides) are implicated in process of the microbial decomposition which are visible through the organoleptical modifications which can be observed with the help of senses, and from chemical point of view by creation of non-utilizable products for human body or even toxically.

OBJECT OF THE RESEARCH

Taking into consideration the fact that the main form of meat's corruption is putrefaction, which is constituted by the decomposition of the proteic substances, it represents the effect of the biochemical process of proteic simplification determined by the protheolitical enzymes made by the microbial putrefaction flora together with the catapsines of the muscle tissue. All these transformations are visible through some microbial load and by evolution of certain sensorial and physico-chemical indicators that can be determined. By interpretation they indicate the freshness of the beef preserved to a certain analyzed moment.

MATERIAL AND ANALYZE METHODS

We have prelevated samples of meat from the beef muscle psoas, UV irradiated (λ=254 nm) for 10 minutes at 10 cm distance to the irradiation source (lamp UV type 100S), then refrigerated at $+4^0$C. There have been made in parallel several determinations, using in analyses not irradiated beef, as well as irradiated, on three categories of indicators:

1. Study of the action of UV irradiation on the microbiosys from the beef surface (bacteria, dregs, moulds) on the selective mediums;
2. Sensorial analyse of beef (aspect, colour, consistence, smell and bullion aspect after boiling and sedimentation) features;
3. Physic-chemical analyse of the beef (pH and hydrolysable nitrogen variation)

There was made a study regarding the evolution of beef freshness and the correlation existent between the levels of these indicators in certain phase of the combined preservation (UV irradiation and beef refrigeration).

RESULTS AND DISCUSSIONS

The results of the first set of experiments are presented in table 1 and table 2:

Table 1. Determination of the contamination grade of UV irradiated beef

Analyzed sample	Sample 1		Sample 2	
	Bacterias/ cm^2	Dregs and moulds /cm^2	Bacterias/ cm^2	Dregs and moulds /cm^2
Non-irradiated beef	3750	31	1875	6
UV irradiated beef for 10 minutes at 10 cm to UV source	31	0	6	0

Table 2 Evolution of non-irradiated and UV irradiated beef, preserved in refrigeration conditions

Analysed sample	Microbiosys of analysed meat						
	Coliforms bacteria /g	Escherichia coli/g	Coagulase-Positives staphylococcus/ g	Salmonella/ 25g	Sulfito-reduction clostridia / g	Ntg/ g	Listeria/ g
Non-irradiated fresh beef	1000	10	Absent	Absent	Absent	5000	Absent
Fresh beef UV irradiated for 10 min. at 10 cm to source	0	0	Absent	Absent	Absent	10	Absent
Beef UV irradiated for 10 min. after 7 days of preservation	10	0	Absent	Absent	Absent	50	Absent

It was observed that under the UV radiation action the microbial load from beef surface was considerably decreased (from 3750 bacterias/cm^2 to 31 to sample 1 and from 1875 to 6 bacterias/cm^2 at samples 2, including the dregs and the moulds less representatives for meat).

The experiments from the second set, which are referring to the sensorial analyses, led to the next results, in table 3:

Table 3

Sensorial properties of the irradiated and non-irradiated beef

Analysed product	**Sensorial properties**				
	Exterior aspect and on section of the meat	**Meat colour**	**Meat consistence**	**Meat smell**	**Aspect of the bullion after boiling and sedimentation**
Fresh non-irradiated beef	At surface, meat presents a dry layer; low moisture on section	At surface, meat has red colour; in section is shiny and red coloured characteristic to the species	Meat is firm and elastic, in section is compact	Nice and characteri stic to species	Clear, spiced, nice smell and taste
Non-irradiated fresh beef after 8 days	Meat is partial covered with a sticky mucus, in small quantity, in section is wet, without being sticky.	Red-brown colour surface, in section red colour	On the surface and in section the consistence is decreased	At surface is a heavy smell of non-aired meat	Low dirty, bad taste
Beef UV irradiated 10 minutes at 10 cm to source after 8 days	At surface, meat presents a dry layer; low moisture on section	At surface, meat has red colour; in section is characteristic to the specie	At surface is firm and elastic, in section is compact	Nice, characteri stic to specie	Clear, spiced, nice smell and taste
Beef UV irradiated 10 minutes at 10 cm to source after 14 days	Meat is wet, not with a mucus, in small quantity, in section is wet, without being sticky.	Dark red colour surface, in section is characteristic to the specie	Low elasticity, section surface is more line	Characteri stic to specie	Low dirty, less spice
Beef UV irradiated 10 minutes at 10 cm to source after 16 days	Meat is partial covered with a sticky mucus, in small quantity, in section is wet, without being sticky.	Red-brown colour surface, in section red colour	On the surface and in section the consistence is decreased	At surface old, heavy smell	Low dirty, bad taste

It is different at non-irradiated beef in comparison with the irradiated one being shorter to non-irradiated beef, which confirm the faster alteration at non-irradiated beef.

The third set of experiences present us the evolution of two main quantitative indicators psyhico-chemical, which characterise the freshness of beef: pH variation (image 1) and hydrolysable nitrogen variation (image 2).

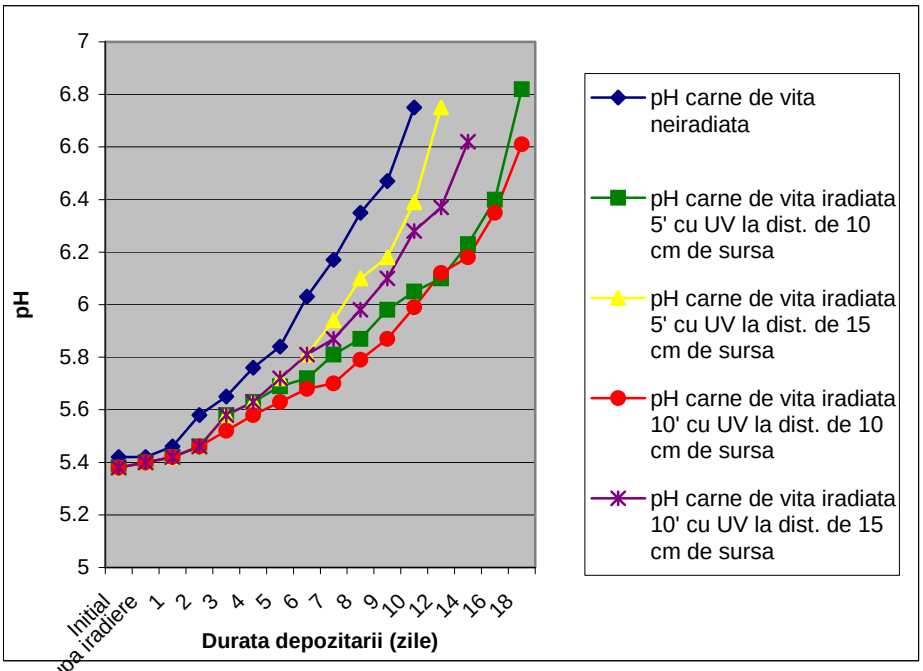

Figure 1. Variation of pH of UV irradiated beef and preserved to 4^0C

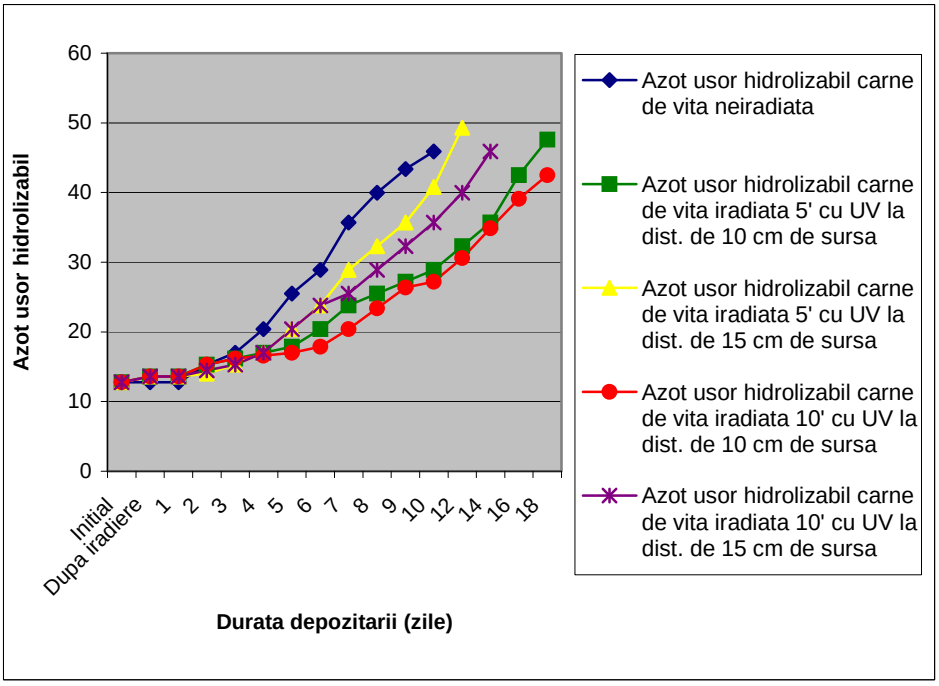

Image 2. Variation of hydrolysable nitrogen ($mgNH_3$ /100g beef) for beef irradiated with UV and preserved to de 4^0C

From image 1 it was observed that the value of pH of 6 (considered like meat freshness limit) is reached by non-irradiated meat faster than the UV irradiated meat.

The interpretation of the correlation of the three sets of experiments:

As it was presented above the meat alteration mechanism has like base the decomposition of proteic substances under the proteolitical enzymes action specific to the muscular tissue and to those secreted by the microorganisms from meat surface.

The proteic decomposition assures a nutritive sub-layer simplified ideal for the fast multiplication of the anaerobe flora.

In the same time the proteic simplification products have an alkaline function, leading to the increase of the pH to the neutral zone.

The same simplifications products (NH_3, H_2S, indol, scatol) provoke the sensorial modifications easy to observe (smell, shape, color etc.) and the increase of the hydrolysable nitrogen.

All these aspects are confirm by the experimental results presented in tables 1, 2, 3 and the images 1 and 2 at non-irradiated beef where it was observed the micro-organism (table 2), unpleasant modifications of the sensorial properties after 7 days of preservation (table 3) and increases of physico-chemical indicators (pH and hydrolysable nitrogen - graphics 1 and 2).

At beef UV irradiated for 10 minutes at 10 cm to the source we could observe the same evolution of the registered indicators in the three sets of experiments but with a more slowly speed, which led to the prolongation of freshness preservation of irradiated meat in comparison with the non-irradiated meat (tables 1, 2, 3 and graphics 1 and 2).

The explanation of this phenomenon is given by the fact that UV irradiation destroys the biggest part of beef surface micro-organisms and thus they cannot secrete proteolitical enzymes, only the enzymes specific to the muscular tissue remaining to action and so the alteration proteolitical processes will be slowly.

CONCLUSIONS

- The analyze of the several indicators for meat non-irradiated and UV irradiated beef, both preserved in refrigeration conditions shows that by mixed preservation by UV irradiation and refrigeration at $+4^0$C we succeed to prolong the freshness of meat with cca 100%.
- It is a correlation between the indicators evolution, which indicates the microbial load, the sensorial and physic-chemical properties (pH and hydrolysable nitrogen) for non-irradiated and UV irradiated beef. Their levels indicate the meat freshness in a certain phase of meat preservation in refrigeration conditions.

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