THE EMPLOYMENT OF RADIOFREQUENCY IN MEAT PROCESSING INDUSTRY

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Background

The present research is part of a project for technological innovation set up by Stazione Sperimentale per l'Industria delle Conserve in co-operation with the Animal Preserve Industry operators. The project purpose is to evaluate the possibility to insert radiofrequency systems in meat/cooked meat product lines and then to partially replace some specific operations such as freezing/de-freezing/cooking/tempering in the traditional technology. The interest in radiofrequency kept rising in these years and it is mainly referred to study the dielectric characteristics of the different kind of meats, the time involved and the comparison between the different operative frequencies.

The food processing technology tendency in years has been, along with a more accurate control on raw material, the pursuit of the wished effects, by minimising the technological damage on functional ingredients caused by industrial processing. The employment of radiofrequency, as well as microwaves, has been meant as "mild" technique able to supply consumers with products more and more similar to fresh ones.

Objectives

By applying to a substance an alternated electrical field with frequencies oscillating between 10 and 300 MHz (radio) and 300-3,000 MHz (microwaves), a heat generation takes place inside the product mass molecules because of a quick inversion in the electric charge orientation (radio) or in the bipoles (microwaves). Not all the molecules are sensitive to this kind of heating. Such a difference can be utilized for tempering operations (mortadella processing line) or for de-freezing (meat products in pieces). All the critical transformations of proteins occur between -5°C and -1°C about, that is the meat freezing point (3). If during freezing the mechanical damage on nutrients and on the functional components can be reduced by deep-freezing, during tawing the possibility to employ radiofrequences has been researched, by following its effects on the meat functional properties.

Material and Methods

In order to carry out the radiofrequency de-freezing, an experimental oven (Geaf Company) has been employed. It was running at 27.5 MHz, having 4 KW power and flat-parallel electrodes. The de-freezing operation concerned whole "lungissimus dorsi" muscles by employing 3.500 Volts voltage with 2.5 cm air gap, while the only conditioning from -20° to - 8°C was applied to mortadella meat blocks at 3,500 Volts voltage and 2.5 air gap.

Result and discussion

The samples employed has been checked as far as some chemical-physical characteristics are concerned, such as pH and WHC according to the press method, the total proteins with Kjeldhall and the proteins soluble in water (5) and in salt (6) according to Kjeldhall method and Bureto method. Apart from the advantage of the de-freezing time, remarkably reduced in comparison with traditional methods, the chemical-physical data have not revealed substantial differences between the two methods of de-freezing/tempering. The pH values remain comparable as well as WHC values. Sarcoplasmatic and miofibrillar protein extraction is comparable so it means that these proteins are not denatured by radiofrequency treatment and the functionality of raw material remains on high levels even with relatively long freezing period as for mortadella minced meat.

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	NATIONAL SHOULDER		ENGLISH SHOULDER		HAM TRIMMINGS		LONGISSIMUS DORSI	
	A	RF	A	RF	A	RF	A	RF
total protein content (mg/g meat)	202,3 ± 14,00	211,54 ± 2,21	181,25 ± 10,89	202,33 ± 0,17	180,30 ± 3,21	183,85 ± 9,09	—	—
protein 1 * (mg/g meat)	64,81 ± 6,35	70,91 ± 2,85	51,92 ± 1,01	55,22 ± 0,55	52,21 ± 8,86	56,88 ± 10,32	68,80 ± 6,40	68,00 ± 9,00
protein 2 ** (mg/g meat)	30,85 ± 4,54	32,93 ± 12,97	43,75 ± 5,86	41,61 ± 4,30	33,25 ± 7,76	43,17 ± 8,92	69,80 ± 14,80	67,40 ± 14,80
absorbance 1 * (/g meat)	0,122 ± 0,03	0,136 ± 0,03	0,098 ± 0,04	0,104 ± 0,02	0,118 ± 0,04	0,092 ± 0,02	—	—
absorbance 2 ** (/g meat)	0,067 ± 0,01	0,078 ± 0,03	0,100 ± 0,01	0,102 ± 0,01	0,090 ± 0,03	0,102 ± 0,02	—	—
pH	6,01 ± 0,07	6,04 ± 0,06	5,98 ± 0,05	6,01 ± 0,06	6,16 ± 0,01	6,03 ± 0,01	5,75 ± 0,12	5,83 ± 0,20
WHC	—	—	—	—	—	—	0,50 ± 0,05	0,47 ± 0,02

Chemico-physical parameters of meats used for mortadella formulations and longissimus dorsi muscle;
A : air thawing RF : radio frequency thawing

* 1: sarcoplasmic extract ** 2: miofibrillar extract