COLOR PARAMETRES EVOLUTION DURING WASHING PROCESS OF MECHANICALLY DEBONED POULTRY MEAT

Navarro-Rodríguez de Vera, C.[1]; Fernández-López, J.[1]; Perlo, F[2].; Pérez-Alvarez, J. A.[1]; Sayas-Barberá, E.[1].
[1]Departamento de Tecnología Agroalimentaria, Escuela Politécnica Superior de Orihuela, Universidad Miguel Hernández, Ctra. Beniel Km 3,2.Orihuela 03312, Alicante, Spain. [2]Facultad de Ciencias de la Alimentación. Universidad Nacional de Entre Ríos, Concordia. Argentina.

Background.

Mechanically deboned poultry meat is an inexpensive source of proteins, which has been given special attention by most segments of the the food industry. This kind of meat is rich in myofibrillar proteins and haemocompounds. These red pigments must be removed from raw materials to increase its conservation, for further utilization in different meat products. Aqueous washing of mechanically recovered meat has been quite succesful for the fish industry where very low–value fish are used to create a high-value product widely used for further processing.

Objective.

The general aim of this study was to determine the effect of washing upon chemical (fat content) and physical (CIELAB color parameters) characteristics of mechanically deboned poultry meat.

Methods.

Sample preparation: Commercial mechanically deboned poultry meat was obtained from a certificate EU industry and transport to the Food Technology Department labs. under freezing conditions (-18°C). 30 samples (250 g each) of mechanically deboned poultry meat were prepared and thawed at 3°C overnight. The meat and extraction media (5:95 respectively; concentration that during all work was the same) were tempered to 5±1°C prior to washing and maintained at this temperature throughout all process. The "extraction media" was prepared with distilled water (additive 1) and 0.5%, 1% and 1.5% of salt (called additive 2, 3 and 4, respectively), 0,005%, 0,01% and 0.015% of tripolyphosphates (additives 5, 6 and 7,in this case) and a combination of 0.5% of salt with 0.005%, 0.01% and 0.015% of tripolyphosphates (additives 8, 9 and 10).Nine replicates were run for each washing treatment. Washing was performed during 10 minutes, during 6 consecutive times. The temperature of the slurry remained between 5±1°C. The slurry was continuously mix in a 5L beaker in an ice bath using a three blade propeller (4.5 cm diameter) (AV-5 SBS Instruments, SA). After mixing, (the mechanically deboned poultry meat with the extraction media) was rested for a short period and the fat layer on top of the solution was striped off. Washed meat was collected by filtration. After skimming, proteins from the remained solution were determined by the Bradford assay. After every washing steps, CIELAB color coordinates (Lightness (L*), redness (a*) and yellowness (b*)) of the extract were determined, using a Minolta CR-10, (Minolta Camera. CO Osaka, Japan). D_{65} as illuminant and 10° as standard observer (Cassens et al., 1995) were used American Meat Science Association Guidelines for color evaluation were applied (*H*unt et al., 1991). pH was determined by a pHmeter Crison GLP21 (Crison Instrument SA, Barcelona,España) and fat was analyzed using AOAC methodology (AOAC, 1990).
Statistical Analysis: Each parameter was tested in triplicate. Statistical analysis (ANOVA) and Tukey´s test were applied (*Affifi & Azen, 1979*). The statistical data analysis was undertaken using the statistical package BMDP ver. 9.0.

Results and Discussion.

In tables 1 and 2 Tukey´s test for each parameter under study can be seen.
Lightness (L):* ANOVA results showed differences ($P<0.01$) for washing step and additives. In general the washing process increased L*. Similar behavior was observed in dry-cured model systems (*Fernández-López, 1998*) when water is added in its formulation. The water dilutes myoglobin concentration which is one of the main factors responsible of these color coordinate (*Onyango et. al., 1998*). When additive factor is analyzed (table 1) is notorious that the use of phosphates did not affect L*, and when salt was added L* increased. Salt enhanced washing effect upon this coordinate (table 2).
Redness (a).* ANOVA results showed differences ($P<0.01$) for washing step and additives. *Johansson et al., (1991)* suggested that this coordinate is related with the myoglobin (Mb) content, and this was confirmed by *Fernández-López* (1998). The redness decreased due to the washing process (Table 2). This behavior could be explained because myoglobin and hemoglobin are water-soluble proteins, which can be removed by the wash solution. As the same time all additives under study produced a decreased in a*.
Yellowness (b):* ANOVA results showed significant differences for washing step and additives ($P<0.01$). This color coordinate is related to different properties (myoglobin state, meat structure, etc). In this study phosphates were the additives with major (table 1) effect on this color coordinate. In the other hand the washing reduces its values (table 2) , this effect could be due to lack of myoglobin mainly.
pH: ANOVA results showed significant differences for washing step and additives ($P<0.05$). All additives under study increased pH. The use of phosphates (additive 6 and 7) were the additives which increased more notoriously this parameter. In table 1 can be observed that an antagonistic effect occurred when combination of salt and phosphates were incorporated.
Fat content (%): ANOVA results showed significant differences for washing step and additives ($P<0.05$). All extraction treatments resulted in significantly lower fat in the recovered meat (table 1).
Soluble proteins (g/L): ANOVA results showed significant differences for washing step ($P<0.01$). Tukey´s test for this parameter showed that no differences ($P>0.05$) were found between 4, 5 and 6 washing steep. The protein content of the extraction media after every washing step is shown in figure 1. The protein extraction decreased during washing treatment (sarcoplasmic proteins were removed). The extraction is more efficient than in the last three ones.

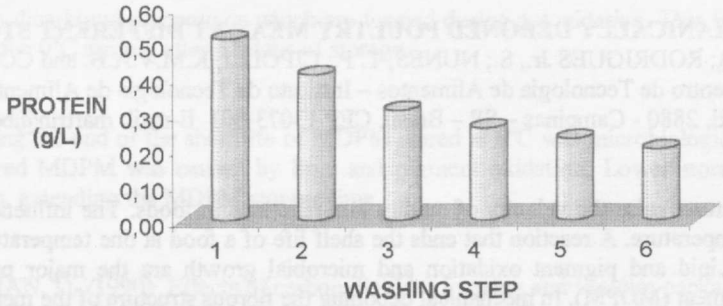

Figure 1.- Protein content of the extraction media after every washing step.

Conclusions.

Lightness is the only color coordinate that was increased by washing (37,2%): Redness and yellowness decreased due to washing (65,9% and 33,1% respectively). Fat is easily eliminated during washing treatment.

Pertinent literature.

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Table 1.- Effect of additives on CIELAB color coordinates, pH and fat of mechanically deboned poultry meat[1]

		L*	a*	b*	pH	FAT
ADDITIVE	1	51.03 a	12.02 e	10.82 d	6.66 a	12.60 d
	2	53.83 bc	8.54 bcd	9.93 bcd	6.88 c	8.41 bcd
	3	58.98 e	6.32 a	10.19 bcd	6.95 cd	8.03 abcd
	4	54.42 bc	7.32 abc	9.38 b	6.90 c	4.62 ab
	5	52.59 ab	9.97 d	10.26 bcd	6.77 b	10.54 cd
	6	51.37 a	18.97 f	4.95 a	7.01 de	8.09 abcd
	7	51.38 a	24.10 g	4.48 a	7.08 e	11.77 cd
	8	56.71 d	7.12 ab	10.30 bcd	6.77 b	8.33 bcd
	9	55.77 cd	6.21 a	10.53 cd	6.79 b	6.81 abc
	10	57.22 de	8.98 cd	9.56 bc	6.72 ab	3.21 a

[1] Means within each measurement represented by the same letter are not significantly different, $P<0,05$. Each value is a mean of three replications; each replicate consists of three observations.

Table 2.- Effect of washings process on CIELAB color coordinates, pH and fat of mechanically deboned poultry meat[1].

		L*	a*	b*	pH
WASHING STEP	0	42.99 a	21.38 e	12.13 d	6.93 a
	1	52.08 b	13.50 d	10.22 c	6.71 a
	2	55.70 c	9.19 c	8.80 b	6.85 b
	3	56.60 cd	8.84 bc	8.02 a	6.91 c
	4	56.23 cd	8.90 bc	7.70 a	6.94 c
	5	57.72 de	7.58 ab	8.29 ab	6.92 c
	6	58.97 e	7.29 a	8.12 ab	6.94 c

[1] Means within each measurement represented by the same letter are not significantly different, $P<0,05$. Each value is a mean of three replications; each replicate consists of three observations.