INFLUENCES OF PHOSPHATES AND THEIR BLENDS IN THE SENSORY PROPERTIES AND YIELD OF "COOK-IN" HAM

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Introduction

A very common practice in the meat industry is the addiction of phosphates in the pickle (VOLLMAR & MELTON, 1981). This phosphates, through its effects and chemical reactions with food components and other additives, have influence mainly in the water retention capability (CRA), color, texture, cure and rancidity (SOFOS, 1986).

The sodium tripoliphosphate (STP) is the more widely used in the red meat processing. Besides that, the STP, when mixtured with other phosphates, specially, the sodium hexametaphosphate (SHMP), the result is a more desirable product than using STP alone. The phosphate more frequently mixtured with STP for use in the cooked ham processing include SHMP, TSPP (pirophosphato tetrasodium) (VOLMAR & MELTON, 1981).

The objective of this work was to study the behavior of the different phosphates isolated or mixtured, mainly in relation to the efficiency and final quality of the cook-in ham.

Methods and Material

Formulation

The meat, swine that was furnished by the PRENDA S. A. in Santa Rosa, RS, has arrived at the Technology and Food Science Department refrigerated and in thermal boxes.

The experiment was done with five treatment groups and four repetitions. The type of phosphate has varied in each treatment. The cook in ham was elaborated according to the methodology used in the Brazilian cold storage plants.

pH determination

The pH measure was done with 1O g of meat, meat after tumbling and ham of each type of treatment, with 100 ml of distilled water according to TERRA & BRUM (1988).

Loss in the cooking process

It was verified through liquid weighing that was liberated after the cooking, looking losses were calculated in percentages starting from the initial weight.

Sensorial analysis

Sensorial analysis was done by six people, belonging to Technology and Food Science Department of the University Federal of Santa Maria. A hedonic scale ranging from 1.O to 9.O was used to evaluate the product as to the color, smell, cohesivity, slicing, flavor and texture. The value 9.O has represented a product of total acceptability, presenting an excellent softness, with juice, flavor and color desirable and 1.O has represented a very unacceptable product, extremely hard, dry with undesirable flavor and color. Sensorial analysis was done after each processing stage. The thickness of the sliced ham analysed was of 3.O mm.

Statistical analysis

The experimental design was randomized blocks, with five treatments and four repetitions. When it was necessary descriptive means were used: standard deviation mean and width. Duncan test was also utilized to find out the level of significance between the means.

Results and Discussion

pH effect

The pH has not presented a significative difference between the treatments (P<O.O5) either in relation to the meat or in relation to the processed meat and to the ham (Table 1). This is explained by the fact that the experiment was done with the pH of the pickle adjusted to 9.O and with the ionic force similar in all treatments (around O.6).

It is known that one of the most important effects of the phosphates in the meats is the pH increase, which produces a distance of the isoelectric point, increasing the water retention in the meats (SHULTZ, 1972). However, TROUT and SCHMIDT (1986) have observed that the ionic force action is different from the pH action. The latter does not increase the phosphates capability of increasing the cooking efficiency (RC) and the tension force (FT), because the pH effect seems to yield the same results in the treatments with or without phosphates. However, with a high ionic force, this general effect of the pH was not so apparent, because the speed with which the RC and the FT have increased has varied considerably with the pH increase (P<O.O5) between the treatments. Then, the variation in the speed of the increase seemed not to be due to the interaction between the pH and the phosphates, but to the result of the interaction between the ionic force and the phosphates. This behavior can be explained by the following: in a low ionic force (O.15) all the phosphates were equally effective and their increase speeds were the same; however in an ionic force bigger than O.5 the RC and FT phosphates values were more affected by the ionic force, that is, tetrasodium pirophosphate (TSPP) and sodium tripoliphosphates (STP) were higher in a 5.5 pH than the respective value for RC and FT of the other treatments with phosphates. Thus, the values of RC and FT for these phosphates were high in a low pH; values have increased in low velocity when the pH increased.

Effects of phosphate in the processing of "cook-in" ham

In the analysis of the results it was noticed mainly the losses occurred in the tumbling, cooking, total loss and efficiency (Table 2). By analyzing the means of the losses occurred in the tumbling it was noticed that there was no significative difference (P<O.O5) between the treatments, but in relation to the losses occurred in the cooking process, it was noticed that the hams treated with the Mixture 3 and STP - 1OO Control have presented a minor loss (P<O.O5). The loss verified in the hams treated with Mixture 2 was bigger; and the hams treated with SHMP - five were not significantly different of all the treatments. In relation to the total loss there was no significative difference between the treatments. This stresses the importance of the search for better phosphate combinations to increase the capability of water retention and with this to increase the efficiency in the cooking process. In Table 2 there still are the means attributed to the efficiency, where there was no significative difference between the treatments (P<O.O5) but the higher mean is related to the ham treated with the Mixture 3 and the low mean is related to the ham treated with SHMP - 5. Generally, it is accepted that the salts improve the functional properties of the meat products: a) they simplify the extraction of the structural miofibrillar proteins of the muscle cells during the mechanic treatment that is, mixturing, massaging, tumbling; b) they interact with the muscular proteins during the heating process, so the proteins form a strong matrix with free water and gives the desirable texture to the products.

The extraction of the miofibrillar proteins, however, seem to have only a small effect in the functional properties because: 1) under various conditions the extraction of the miofibrillar proteins and the functionality of the meat proteins are poorly related (KNIPE et al., 1985): 2) The miofibrillar proteins extracted have poor functional properties when heated without salts or phosphates (SIEGEL et al., 1978). Therefore, this discussion is concentrated on the changes thermicaly induced in the matrix of the meat protein. Most of the salts increase the functionality of the protein that are the result of changes in its format. Due to these format changes, the proteins form a structure of a tridimensional network when heated. This network structure is the molecular basis for the establishment through heating of the protein matrix described before. The salts produce these format changes by altering the hydrophobic and electrostatic interactions that stabilize the protein structure (TROUT and SCHMIDT, 1986). It was also observed that it has not occurred a significative influence of the pH

(P<0.05) in the phosphates effectivity. Therefore, if the phosphates were modifying the electrostatic interactions modifying the pH, an increase in the phosphate effectivity would have to occur. By modifying the pH, the electrical charge in the phosphate and in the protein of the meat should change, because the latter could increment the eletrostatic interactions between the two (the phosphate and the protein). This could change the protein format and its functional properties.Since the pH has no direct effect in the phosphate behavior, this proves that the hydrophobic effects of the phosphates had a predominant action in the functionality. Therefore, once that the phosphate eletrostatic effects are reduced, the hydrophobic effects of the phosphates become dominant. And, presumably those changes in the hydrophobic interactions are the ones that increment the functional properties (TROUT and SCHMIDT, 1986).

Phosphate effect in the sensorial properties

The phosphates besides favoring the extraction of miofibrillar protein and increasing the CRA, they have influence not only in the muscle texture but also in the sensorial caracteristics of the cooked ham (PEDRELLI et al., 1988).

Treatment means for the sensorial properties of the "cook-in" ham are presented in Table 3. By analyzing in isolation the sensorial attributes, it was observed that, in relation to the color it has not occurred significative difference between the treatments; in the smell, it was proved that the ham treated with the Mixture 2 have presented a higher punctuation (P<0.05), followed by the treatments with Control and Mixture 3; STP - 100 and SHMP - 5 presented the lower punctuation; in the cohesive the hams treated with STP - 100 have obtained higher punctuation (P<0.05) not occurring significative difference between this treatment and the treatment with Control and Mixture 3; the hams treated with the Mixture 2 and SHMP - 5 have presented a low punctuation, as far as slicing is concerned, the hams treated with STP - 100 have presented a better punctuation and the ones treated with Mixture 2 presented the lowest punctuation (P < 0.05), the other treatments did not differ significatively among them; as far as the flavor is concerned, the hams treated with SHMP - 5 had the lowest punctuation, the other treatments have not presented significative differences among them; considering the texture there was no significative difference among the treatments. In figure 1, it is demonstrated that the Mixture 3 presented a relatively lower punctuation, although significative difference was not observed among the treatments with the Control, STP - 100 and Mixture 2; a significative difference was found related to the treatment with SHMP - 5 (P < 0.05). To stress the effect of the phosphates, there is the relation between the punctuation of the sensorial attributes and the loss by cooking (figure 2) showing which is the best treatment for the "cook - in" ham processing. The hams treated with Mixture 3 presented the best punctuation and the minor loss in the cooking followed by Control and STP - 100; the hams treated with SHMP - 5 presented a relatively high loss in the cooking and a very low acceptability of the sensorial atributes; however, the hams treated with Mixture 2 presented a larger loss in the cooking and a reasonable acceptability of the sensorial attributes.

With the results obtained by VOLLMAR & MELTON (1981), it can be said that the use of high levels of SHMP does not have a good influence in the profit and general quality of the product. It can be clearly observed that the phosphate influences directly the general quality of the "cook - in" ham, specially because this type of product has better retained the quality of pickle added, with that, the organoleptic properties could be better kept, because noting was lost during the cooking.

Conclusions

It was concluded that:

- The "cook - in" ham processed with different types and mixtures of phosphate, presented in general, very good profits, not presenting significant difference between the treatments;
- The ham treated with Mixture 3 presented a superior quality, specially in relation to the acceptability of the sensorial attributes, and to the minor loss in the cooking, and presented a major profit;
- The phosphates contained in Mixture 2 presented a major loss in the cooking and a reasonable acceptability of the sensorial attributes. Thus, it can be stated that this treatment is considered as inferior to the processing and general quality of the cooked ham.

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