EFFECTS OF DISTILLED SOYBEAN OIL (DSO), AN ANTIOXIDANT COMBINATION AND PASTEURIZATION ON MECHANICALLY DEBONED CHICKEN MEAT OXIDATION, DURING FROZEN STORAGE AT - 16°C FOR 6 MONTHS.

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SUMMARY

Samples of mechanically deboned chicken meat from backs and necks containing 22.6% of fat were frozen stored at -16°C for 6 months in PVC film and an aluminium extra-film, and analysed regarding oxidation development by TBA values every 15 days. The treatments were: distilled soybean oil (DSO, a natural tocopherol source, added 0.4286% on fat weight), a mixture of DSO and antioxidants (MIN) and pasteurization (PAS, 6 min. at 60°C). The initial TBA number was 0.331 mg malonaldehyde/kg. At 26th week the results related to TBA were: Control: 5.947, DSO: 5.579, MIN: 1.298 and PAS: 2.036. The addition of MIN retarded the oxidation reaction more effectively than PAS, and PAS was better than DSO. These results show the important role of antioxidants (natural and synthetics, combined or not) and pasteurization on conservation of mechanically deboned chicken meat frozen stored.

Keywords: mechanically deboned chicken meat, antioxidants, oxidation, poultry meat

Introduction

Deteriorating lipid oxidation of mechanically deboned chicken meat (MDCM) is influenced by factors like type and processing conditions (mechanical stress, time, temperature, handling), the nature of the composition, degree of bone marrow extraction (affects pigment levels and bone particles), exposing to air oxygen, light (mainly ultraviolet), kind of packing, use of vacuum, controlled atmosphere or irradiation, presence of sodium chloride and other salts, catalyst metals, phospholipids and antioxidant substances (Dawson and Gartner, 1983; Newmann, 1981; Pikul and Kummerow, 1990). Negative effects of MDCM oxidation also occur in products where MDCM is used as an ingredient (Dawson and Gartner, 1983; Weck et al., 1987; Allen and Foegeding, 1981). For this reason, many studies have been developed to minimize these problems. Some of the antioxidants already tested in MDCM are: butylated-hidroxyanisole (BHA), butylated-hidroxytoluene (BHT), alpha-tocopherol, ethylenediaminetetraacetic acid (EDTA), citric acid, ascorbic acid, polyphosphates and rosemary extracts (Dawson and Gartner, 1983; Newmann, 1981).

Distilled soybean oil (DSO) is a subproduct of vegetable oil industry, obtained from soybean oil deodorization. DSO is a dark-brown liquid residue. It contains 6 to 9% of total tocopherols (from which 13.4% in alpha form, 2.5% as beta, 53.3% as gamma and 30.8% as delta tocopherols) (Augusto, 1988). The vitamin E activity is associated to alpha form, and the antioxidant action with fractions gamma and delta-tocopherol (Shahidi and Wanasundara, 1992). DSO contains about 60% of total fatty acids (with 36.46% in free form), 17.05% of sterols and 4.4% of total hydrocarbons (Augusto, 1988). The potential antioxidant action of DSO was proved by Costa et al. (1994). In that experiment, was developed an antioxidant mixture that includes citric acid, propyl gallate and BHA.

The objective of this work is to study the effects of: (1) a natural antioxidant, the distilled soybean oil (DSO), (2) a combination (MIN) of distilled soybean oil with the antioxidant mixture developed before (Costa et al., 1994), and (3) pasteurization (PAS) on oxidation development of MDCM samples from backs and necks, frozen stored at -16°C during 6 months. Pasteurization was studied by Dawson and Gartner (1983) and showed excellent results at 60°C, for 6 minutes, on oxidation control of MDCM, frozen storage at -18°C for 6 months. At these conditions, the initial and final TBA values of MDCM practically did not change: 1.5 and 1.6

mg malonaldehyde/kg, respectively. The maximal limit to addition of alpha-tocopherol used like antioxidant permitted by brazilian and north-american legislations is 0.030% on fat weight (Brasil, 1971; FSIS/AAFH, 1993). Therefore, the quantity of DSO added (0.4286% on MDCM fat) considered a medium of 7% of total tocopherols contained to the limit of 0.030%. The MIN antioxidant also has DSO (which observed using conditions written above), include citric acid, BHA and propyl gallate (as complementary antioxidants) and propyleneglycol, ethanol and water (as vehicles). To utilization at 0.6002% on fat weight, were respected the limits of 0.030% to tocopherol and 0.010% to the sum of citric acid + BHA + propyl gallate. According to legislation (Brasil, 1971), the individual limit to each one of these three antioxidants is 0.010% on fat.

Materials and Methods

Samples of MDCM from necks and backs were collected immediately after their production in industry. DSO and MIN antioxidants were added to samples at 0.4286% and 0.6002% on fat weight, respectively. The addition was realized in 50kg of MDCM in an industrial mixer double Sigma. After addition, samples were packed in a plastic film and in an aluminium sheet (to reduce light exposing) and stored at -16°C during 6 months. MDCM pasteurization was done in a thermostatic bath at 60°C, during 6 minutes, followed by cooling and freezing at same conditions. Centesimal composition and complementary analysis of MDCM are presented at tables 1 and 2. The techniques utilized in water, fat, protein, ashes, pH, total acidity, calcium, total pigments and peroxide index determinations were described by Terra and Brum (1988). The techniques used to iron and TBA index determinations were described by Department of Foods and Experimental Nutrition (1978) and by Salih et al. (1987), respectively.

Results and Discussion

Table 3 (whose data can be visualized at figure 1), presents the results of checking of lipid oxidation from MDCM by TBA values, during the 6 months of storage at -16°C. Table 4 shows the results of statistical analysis applied to the experiment. According to tables 3 and 4, using of MIN antioxidant in MDCM showed better results than pasteurization (PAS), and was the best treatment. MIN also presented synergistic interaction between its components, and the result of last analysis (at 26th week), of 1.298 mg MDA/kg, was similar to best results of Dawson and Gartner's experiment (1983) with mechanically deboned turkey meat. Values obtained with pasteurized MDCM are also acceptable, considering storage time used and the absence of chemical substances to MDCM conservation. These results agree with values reported by Dawson and Gartner (1983), but are slightly bigger than, probably due to the absence of vacuum conditions and nitrogen atmosphere in this work. Pasteurization needs care and rigorous control of temperatures, but it has the advantage of reducing microbiological contamination. In this experiment it was observed liquid liberation and partial protein denaturation during pasteurization process (Newmann, 1981). Distilled soybean oil (DSO) alone did not show expected performance probably due to its high viscosity.

Conclusions

Combined use of distilled soybean oil with citric acid, BHA and propyl gallate (MIN antioxidant) at 0.6002% on fat weight possibilited excellent control of MDCM oxidation during the six months at -16°C.

Pasteurization at 60°C during 6 minutes was effective in control of MDCM oxidation.

The weak individual performance of distilled soybean oil at test conditions may be caused by insufficient dispersion in MDCM.

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