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CHINESE SAUSAGE 2-THIOBARBITURIC ACID VALUES DURING PROCESSING AND STORAGE

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INTRODUCTION

Oxidation and rancidity of fat and moisture loss are postulated to have a major influence on Chinese sausage flavour. The conditions would appear to be appropriate for oxidation to develop both during the processing and storage of this sausage because of the unsaturated fatty acids in the meat tissue, salt incorporated into the product and the availability of adequate quantities of oxygen. Monitoring of lipid oxidation in Chinese sausage is important because of its potential influence on flavour, the increased demand for convenience meat items and the concern of consuming rancid products. The reaction of malonaldehyde (MDA) with 2-thiobarbutric acid (TBA) has been widely used for measuring the extent of oxidative deterioration in a lot of foods and in particular in muscle foods.

Review of literature

TBA analysis expresses lipid oxidation in milligrams of MDA per kilogram of meat. MDA is a secondary oxidation product of polyunsaturated fatty acids (Dahle *et al.*, 1962; Pryer *et al.*, 1976). The structure of TBA-MDA was investigated and reported by Nair and Turner (1984). The absorption spectrum generated by adding TBA to meat extract is identical to that of the complex formed between TBA and 1,1,3,3,-tetraethoxypropane thus the TBA reaction is normally considered to be a valid indicator of MDA and consequently oxidation in meat. The TBA test can be performed directly on an extract of food including meat (Gray, 1978; Salih *et al.*, 1987; Siu *et al.*, 1978; Witte *et al.*, 1970). The amount of MDA can be quantified by its reaction with TBA to form a coloured complex with a maximum absorbance at 530nm.

One objective of this research was to study changes in TBA value in Chinese sausage during processing and storage. The second objective was to evaluate the influence of phosphate and nitrite incorporated into Chinese sausage on its TBA values.

MATERIALS AND METHODS

Sausage preparation

The experimental design used in this Chinese sausage research consisted of three treatments. The first, or control sausage, was manufactured according to traditional Chinese sausage procedure. Raw material consisted of pork tissue (lean:fat ratio in separate pieces = 7:3). Fresh pork tissue and separate fat were purchased as needed from a local retail store. The additives utilized were Chinese sorghum white wine (2.25% of meat block), light soy sauce (2.5% of meat block), sodium nitrate (550ppm of meat block), salt (3.15% NaCl of meat block) and sugar (5% sucrose of meat block). The second treatment utilized in addition to the basic formula previously described added sodium pyrophosphate (0.5% of meat block). The third treatment also contained added phosphate (0.5% of meat block and sodium nitrite (150ppm of meat block). The lean meat and fat were individually ground through a plate with 1cm orifices, lean and fat was mixed and then mixed with additives. The total mixture was stuffed into collagen shirred casings (Brechteen Co., Germany), dried in a smokehouse (ALKAR) at 50°C (RH=80%) for four days and then stored at 20°C (RH=80%) for four months. The experiment was replicated four times.

TBA value analysis

All Chinese sausage samples were analyzed for TBA values at 0, 1, 2, 3, and 4 days of drying and at 1, 2, 3 and 4 months of storage. The TBA method was performed according to the scheme shown in Figure 1.

Immediately after weighing, the 5g sausage sample was introduced into a polyethylene sterile bag, 50ml of a cool (4±2°C) solution of trichloroacetic acid (TCA) in 1.6% of phosphoric acid was added to the bag containing the 5g sausage sample. The bag was placed into a stomacher 400 lab blender and homogenized for two minutes. Fifty ml of cool (4±2°C) distilled water was added to the slurry and blended for 30 additional seconds in the stomacher. The slurry was then filtered through Whatman No. 1 filter paper. The filtrate was collected in a cylinder and after the filtration was completed, distilled water was added to reach a final volume of 100ml. Five ml of this filtrate was pipetted into an assay tube and then 5ml of freshly prepared 0.02M TBA in distilled water solution was added. The tube was covered with Parafilm laboratory film. mixed by inversion three times and placed in the dark for 15 hours to develop the colour reaction. The amount of developed colour was measured at 530nm in a UV-VIS Hitachi Perkin Elmer Spectrophotometer Model 139-0251.

Calculation of TBA number

The TBA number is defined as the mg of MDA per 1000g of sausage sample and was calculated using the following formula (Ockerman, 1985):

$$K = \frac{\text{conc. of MDA in moles in 5ml extract}}{\text{O.D.}} \times \text{MW of MDA} \times 10^{7} / \text{sample wt} \times 100/\text{recovery}$$

The value of the first item from the standard curve [slope of curve: change in X (or TEP) for one unit change in Y (or O.D.)] is $6.718916921 \times 10^{-8}$ using 20% TCA in 1.6% H_3PO_4 and a wavelength of 530nm.

The molecular weight (M.W.) of MDA is 72.03.
The sample weight = 5g.
% recovery = 91% in 20% TCA in 1.6% H_3PO_4.

$$K = 6.718916921 \times 10^{-8} \times 72.03 \times 10^{7} / 5 \times 100 / 91$$
$$= 10.64$$

Once the K value was obtained, the TBA number could be calculated using the following formula:

The TBA number = K x O.D. of the sample.

RESULTS AND DISCUSSION

Chinese sausage belongs to the semi-dry sausage classification but it is not a fermented sausage. It is produced by drying the raw materials for four days. This causes the moisture of the sausage to decrease from 65 to 70% to 15 to 20%. Usually the diameter of the sausage is 18 to 20mm and the length is 24 to 26cm and this small size encourages drying.

It was found that during drying there is little oxidative changes in the lipid faction (Figure 2). TBA value during the first two days increased as the moisture decreased,then the TBA value decreased. The maximum TBA value was less than 0.35mg/kg. It is postulated by producers that this slight oxidation and loss of moisture during drying was responsible for the special flavour of Chinese sausage. Least squares means of treatments were ranked in the order of TBA values during drying and were from high to low -- the control, phosphate and phosphate plus nitrite -- but the differences were not large enough to be statistically significant. The differences between TBA values of dried and stored product were significantly different with the TBA values increasing after drying and during storage as would be expected.

The maximum TBA value at two to three months (Figure 2) reached 0.84mg/kg (control sample), 0.71mg/kg (phosphate) and 0.68mg/kg (phosphate plus nitrite) respectively for these products.

The treatment with phosphate plus nitrite reached its maximum TBA value at three months of storage compared to two months for the control and the phosphate sample. Again, the order of least squares means for TBA values, from high to low, during storage was control, phosphate and phosphate plus nitrite but these differences were not large enough to be significant.

It would appear from this research that the addition of phosphate and phosphate plus nitrite is of minimum value in lowering the TBA value in dried Chinese sausages.

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