APPLICATION OF GELATINE COATINGS TO CONVENIENCE-STYLE PEPPERONI PIECES TO EXTEND SHELF-LIFE STABILITY WHEN HELD UNDER COMMERCIAL PACKAGING SYSTEMS

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Background

Modern trends in convenience foods sector have resulted in the increased consumption of chilled and frozen processed, pre-prepared and consumer-friendly food products. Meat toppings (ham pieces, bacon bits, salami and pepperoni meat slices) are examples of such products. These products are highly processed and either industrially packaged in bulk bagging systems for further use and processing within the convenience food sector (i.e. manufacture of pizzas, ready meals) or sold in aerobic, modified atmosphere or vacuum packaged consumer retail packs. Meat toppings used in convenience food products can be susceptible to oxidative and colour deterioration during storage and this limits the shelf-life of these food product components. Lipid oxidation results in the development of off-flavours and odours, loss of polyunsaturated fatty acids, fat-soluble vitamins and pigments and reduced consumer acceptability (Gray et al., 1996).

Interest in edible coatings manufactured from proteins, polysaccharides and lipids has intensified in recent years. These coatings can help maintain and improve the quality of fresh, frozen and processed muscle foods by reducing moisture loss, lipid oxidation and colour deterioration, sealing in volatile flavours, acting as carriers for antimicrobial and antioxidant food additives and reducing oil uptake during frying of breaded and battered products (Gennadios et al., 1997).

Gelatin, a protein resulting from the partial hydrolysis of collagen using acid or alkali treatment followed by or accompanied with heating in the presence of water, has been proposed as a preservative coating for meat and other foods.

Objective

The objective of this study was to determine the effectiveness of using gelatin as a natural and edible coating for pepperoni slices in enhancing packaged shelf-life quality.

Materials and Methods

Pepperoni was manufactured from pork bellies which had been vacuum packaged and held at –20°C for 2 months. Bellies from unsupplemented or basal pigs and those supplemented with 1000 mg α-tocopheryl acetate/kg diet were used. Bellies were cut into 5cm pieces, weighed and held at -5°C for 1 hour (hr). Spices (pepper, cardamon, caraway seed), glucono-delta-lactone, salt and sodium nitrite (50mg/kg sample) were added to the meat pieces. These meat pieces were minced to ensure good distribution of the added ingredients and this meat was then stuffed into RS2 50mm fibre casings. The pepperoni was held at room temperature until the pH had decreased to 4.9 and then cooked to an internal temperature of 72°C in a fan assisted oven and stored at 3°C overnight, after which they were sliced. The meat slices were dipped into water (control) or 2, 4, 6% gelatine solutions at room temperature before being packaged in either oxygen permeable or vacuum packages.

Vacuum packaging was carried out using a Webomatic Type D463 vacuum packer (Webomatic Vacuum Packaging Systems, Bochum, Germany). The vacuum packaging material consisted of Cryovac polyamide/polyethylene 20/70 low oxygen permeable (45ml/m^2/24 hr at standard temperature and pressure (STP)) multiflex films (Cryovac Europe, Lausanne, Switzerland). Aerobically packaged samples were wrapped with oxygen permeable (6000-8000ml/m^2/24 hr at STP) polyvinyl chloride film (Wrap film systems Ltd., Telford, England). Samples were then stored at 3°C or -20°C under light and in darkness for various periods of time.

Lipid oxidation in meat was assessed by measuring thiobarbituric acid reactive substances (TBARS) using the method of Ke et al. (1977) and expressed as mg malondialdehyde/kg sample. Measurements were carried out on a sample size of 4 pieces of meat at each point. Colour (Hunter 'a' values) of meat pieces was determined using a CR-300 Minolta Chromameter (Minolta Camera Co., Osaka, Japan). Colour measurements were determined in triplicate on a sample size of 6 pieces of meat at each analysis point.

Results and Discussion

The use of gelatin as a coating material for meat toppings was successful in reducing lipid oxidation (Table 1) and extending colour stability (Table 2) of meat pieces. Gelatin was most beneficial when applied to pepperoni pieces held in aerobic packs. Greater lipid oxidation ($p<0.05$) and colour deterioration ($p<0.01$) occurred in aerobic packs compared to vacuum packs. Greater lipid oxidation (higher TBARS values, $p<0.05$) and increased colour deterioration (lower Hunter 'a' values, $p<0.05$) occurred in pepperoni meat pieces derived from basal pigmeat compared to that which had been previously supplemented with dietary α-tocopheryl acetate. In addition, it was interesting to note the initially lower TBARS values and higher Hunter 'a' values observed in pepperoni meat that had been manufactured from the α-tocopheryl acetate supplemented pigmeat. In general, as the concentration of gelatin increased in the coating solutions, so did its protective effects on product quality. Solutions containing 4% and 6% gelatin maintained TBARS and Hunter 'a' values in pepperoni toppings at initial levels when held over a 7-week period at 3ºC. Similar results were obtained for pepperoni toppings held for a period of 5 months at -20ºC. The results presented here clearly demonstrate the potential that edible/biodegradable coatings have in extending the shelf-life and improving the quality of processed muscle food products. In addition, this technological approach also suggests a definite approach which might be considered in attempting to reduce the amount of packaging material that is currently required to effectively package food, and in particular, muscle food products.

Conclusions

Results showed that the use of gelatin as a natural meat product coating could extend the shelf-life of processed meat toppings and improve overall product quality. In addition, when a combination of control measures are used effectively (i.e. packaging, dietary α-tocopheryl acetate supplementation and coating systems), maximum keeping quality can be anticipated such that products can be expected to be saleable items for quite some time after manufacture.

References

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NDP
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Table 1. Effect of gelatin on the oxidative stability (TBARS) of pepperoni slices manufactured from pigmeat which was both unsupplemented and supplemented with dietary α-tocopheryl acetate stored at 3°C in aerobic and vacuum packaging conditions

Treatment/Weeks	**0**	**1**	**3**	**5**	**7**
AEROBIC PACKAGING					
Basal	0.24±0.01	0.24±0.01	0.32±0.02	0.49±0.01	0.77±0.01
2% gelatin	0.24±0.01	0.24±0.01	0.30±0.02	0.32±0.01	0.40±0.01
4% gelatin	0.24±0.01	0.24±0.01	0.24±0.02	0.28±0.02	0.30±0.01
6% gelatin	0.24±0.01	0.20±0.01	0.23±0.02	0.24±0.02	0.20±0.02
Supplemented	0.20±0.01	0.20±0.02	0.26±0.01	0.30±0.02	0.44±0.02
2% gelatin	0.20±0.01	0.19±0.02	0.20±0.01	0.25±0.02	0.31±0.02
4% gelatin	0.20±0.01	0.20±0.01	0.19±0.01	0.21±0.01	0.20±0.01
6% gelatin	0.20±0.01	0.20±0.01	0.20±0.01	0.17±0.02	0.19±0.01
VACUUM PACKAGING					
Basal	0.24±0.01	0.21±0.01	0.27±0.01	0.32±0.02	0.60±0.02
2% gelatin	0.24±0.01	0.23±0.01	0.26±0.02	0.28±0.01	0.30±0.02
4% gelatin	0.24±0.01	0.24±0.01	0.25±0.02	0.26±0.01	0.27±0.02
6% gelatin	0.24±0.01	0.24±0.01	0.24±0.01	0.25±0.01	0.24±0.02
Supplemented	0.20±0.01	0.16±0.01	0.16±0.01	0.26±0.02	0.34±0.02
2% gelatin	0.20±0.01	0.19±0.01	0.20±0.01	0.20±0.02	0.25±0.02
4% gelatin	0.20±0.01	0.17±0.01	0.19±0.01	0.20±0.01	0.21±0.01
6% gelatin	0.20±0.01	0.19±0.01	0.20±0.01	0.20±0.01	0.19±0.01

Table 2. Effect of gelatin on the colour stability (Hunter 'a' values) of pepperoni slices manufactured from pigmeat which was both unsupplemented and supplemented with dietary α-tocopheryl acetate stored at 3°C in aerobic and vacuum packaging conditions

Treatment/Weeks	**0**	**1**	**3**	**5**	**7**
AEROBIC PACKAGING					
Basal	7.2±0.8	6.3±0.5	5.9±0.8	2.8±0.3	2.0±0.2
2% gelatin	7.2±0.8	7.2±0.8	6.9±07	6.0±0.3	5.3±0.3
4% gelatin	7.3±0.8	7.0±0.6	7.1±0.5	6.3±0.5	6.0±0.5
6% gelatin	7.2±0.8	7.2±0.6	7.2±0.6	7.1±0.5	7.0±0.6
Supplemented	9.0±1.7	8.7±0.4	6.3±0.7	4.9±0.9	3.9±0.2
2% gelatin	9.0±0.7	9.0±0.9	8.8±0.9	8.3±0.9	7.7±0.8
4% gelatin	9.0±0.7	9.0±0.9	9.0±0.8	8.7±0.7	8.0±0.7
6% gelatin	9.0±0.7	9.0±0.8	9.0±0.6	8.8±0.6	8.9±0.7
VACUUM PACKAGING					
Basal	7.2±0.8	7.6±0.8	7.3±0.7	7.1±0.4	7.1±0.3
2% gelatin	7.2±0.8	7.3±0.5	7.3±0.6	7.2±0.6	7.1±0.4
4% gelatin	7.2±0.8	7.2±0.7	7.5±0.6	7.2±0.5	7.3±0.4
6% gelatin	7.2±0.8	7.2±0.5	7.2±0.5	7.2±0.6	7.2±0.5
Supplemented	9.0±0.9	8.7±0.8	8.4±0.6	8.3±0.5	8.3±0.6
2% gelatin	9.0±0.9	9.1±0.7	9.0±0.7	9.0±0.6	8.9±0.4
4% gelatin	9.0±0.9	9.0±0.8	9.0±0.4	9.0±0.4	8.9±0.8
6% gelatin	9.0±0.9	9.0±0.7	9.0±0.8	9.0±0.3	9.1±0.5