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CONTENTS

UTILIZATION OF CAWTAIL RAY MEAT FOR KAMABOKO MANUFACTURE

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ABSTRACT

An experiment on the utilization of cawtail ray meat for kamaboko manufacture was carried out.

The effects of tapioca addition levels (0,5 and 10%), sodium tripolyphosphate addition levels (0, 0.2, and 0.4%) and storage at 5°C on the product quality and stability were investigated. During storage, kamaboko was analyzed for moisture, TVB, TBA and urea content. In addition, elasticity, total plate count and sensory properties were also observed during storage. The results showed that the best product could be produced by using 5% tapioca and 0.4% STPP. Tapioca and STPP addition prolonged the shelf life of kamaboko to a range of 20-35 days.

1. INTRODUCTION

In Indonesia, utilization of rays, especially cawtail ray is limited to some low value products, such as dried salted ray. This might be due to specific undesirable odours found in ray meat which originate from the decomposition process of urea into ammonia. The amount of urea in ray meat is relatively high, thus treatments are required to remove the odour before further use. Utilization of ray meat into kamaboko is a possibility, since kamaboko processing involves a washing step which may be able to reduce the urea content of the meat (Tanikawa *et al.*, 1985).

Kamaboko is an elastic fish cake popular in Japan. This product is cooked by steaming and/or boiling. The various types of kamaboko are manufactured from a variety of fish species. Headed and eviscerated flesh are washed to prevent any dark materials, such as kidney, the black peritoneum, or intestines, from getting into the minced flesh. Dark flesh or flesh containing blood causes an undesirable darkening of the final product. Intestinal materials often contain protease which interferes with development of "ashi" (elasticity), the resilient texture of high quality kamaboko (Wheaton and Lawson, 1985).

These experiments study the effect of tapioca and STPP addition on the quality of kamaboko. In addition, the quality changes in kamaboko during storage were also investigated.

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2. MATERIALS AND METHODS

2.1 Materials

Fresh cawtail ray (*Tryygon sephen*) was purchased from Dadap Z Fish Auction, Intramayu, West Java. After dressing, the wing parts were iced in an insulated box and transported to Slipi Research Station for Marine Fisheries, Jakarta. The meat was then removed and cut into fillets.

2.2 Kamaboko Processing Method

Kamaboko was made by following the procedure as outlined below:

Cawtail ray
:
Dressing
:
Filleting
:
Mincing
:
Washing by using 5°C water
:
Dewatering
(washing and dewatering: 4 times)
:
Washed minced ray meat
:
Meat homogenizing by using silent cutter
:
Kneading ← Tapioca; 2% spices*); STPP; 0.75% MSG; 2.5% salt
:
Forming
:
Steaming, 30 minutes
:
Cooling at room temperature
:
Packing in polyethylene bags

Note: *) Spices consisted of shallot, garlic and ginger at a ratio of 15:3:1.

2.3 Experimental Steps

2.3.1 Preliminary study

A preliminary study was done to select a suitable filler for kamaboko: the fillers used were tapioca, wheat flour and corn flour. The levels tested were 0%, 5%, 10%, 15% and 20%.

A further preliminary study also investigated the level of sodium tripolyphosphate which could give a reasonable "ashi": the levels tested were 0%, 0.2%, 0.4% and 0.6%. In order to avoid the occurrence of interactive effects between STPP and tapioca, they were not used together during the preliminary studies.

Results of the preliminary studies were subject to further investigation in the main study.

2.3.2 Main study

Results of the preliminary studies suggested tapioca as the filler as well as the binder material. Variables and levels studied in the main experiment were as follows:

A. Tapioca levels: 0, 5 and 10%
B. STPP levels: 0, 0.2 and 0.4%
C. Storage time at 5°C: 0, 5, 10, 15, 20, 25, 30 and 35 days.

The experiment was run in two replications.

2.4 Analyses

Raw material and kamaboko were analyzed for proximate composition (AOAC, 1984). During storage the following parameters were studied for moisture content, total volatile base (TVB) (Conway microdiffusion method), thiobarbituric acid (TBA) value (Pearson, 1973), urea content (AOAC, 1984), total plate count (TPC) (pour plating method) and sensory evaluation (a nine-point hedonic scale). Product elasticity was determined using an Instron 1140.

3. RESULTS AND DISCUSSION

3.1 Composition of Ray Meat and Washed Minced Meat

Proximate composition and the results of other chemical analyses of raw ray meat and minced ray meat (washed four times in 5°C water) are shown in Table 1.

The results showed that washing four times could significantly reduce the urea content of ray meat and improve the odour.

Table 1

Chemical composition of raw and washed minced ray meat

Analysis	Raw ray meat	Ray meat washed four times
Moisture (%)	76.96	82.79
Protein (%)	19.99	12.85
Fat (%)	0.61	0.25
Ash (%)	0.38	0.18
TVB (mgN%)	25.14	7.22
Urea (mg/g)	4.11	0.36
pH	6.38	6.07

3.2 Selection of Filler Materials and STPP Levels

Tapioca was regarded as a better filler material for kamaboko making in comparison to wheat flour and corn flour in terms of elasticity and sensory properties. The tapioca level suggested for further investigation should be in the range of 0 - 10%.

Wheat flour gave a kamaboko with a good elasticity, but the colour was blackish. In addition, kamaboko made with corn flour addition was less elastic, even though the product had acceptable colour.

Results of sensory and elasticity analyses indicated that the STPP addition should not be more than 0.4%.

3.3 Changes in Kamaboko During Storage at 5°C

3.3.1 Moisture content

Levels of tapioca induced differences in moisture content of kamaboko. The higher the tapioca addition, the lower the moisture content. Moisture content of kamaboko fluctuated during storage at 5°C (Figure 1).

3.3.2 pH

Kamaboko obtained in this experiment had 9 pH range of 6.49 - 6.92 as seen in Figure 2. During storage pH increased which might be due to enzyme activity producing ammonia. Ammonia is a decomposition product from urea and protein (Sukarsa, 1978). Tyrosine and trimethylamine also increase the pH value of fishery products during storage (Tomyasu and Zenitani, 1957).

The pH values decreased as a result of tapioca addition but STPP addition up to 0.4% did not show any significant effect on pH value.

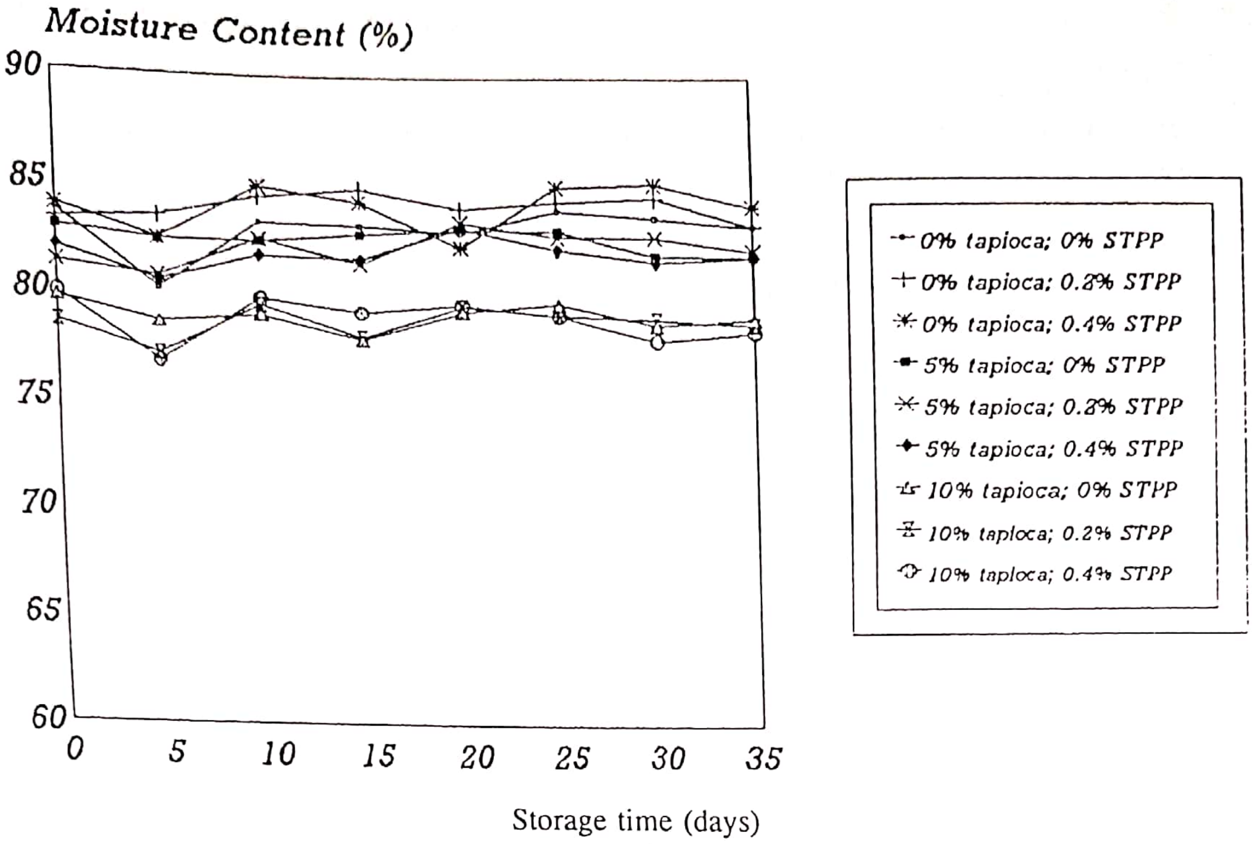


Figure 1 Moisture content changes in kamaboko during storage at 5°C

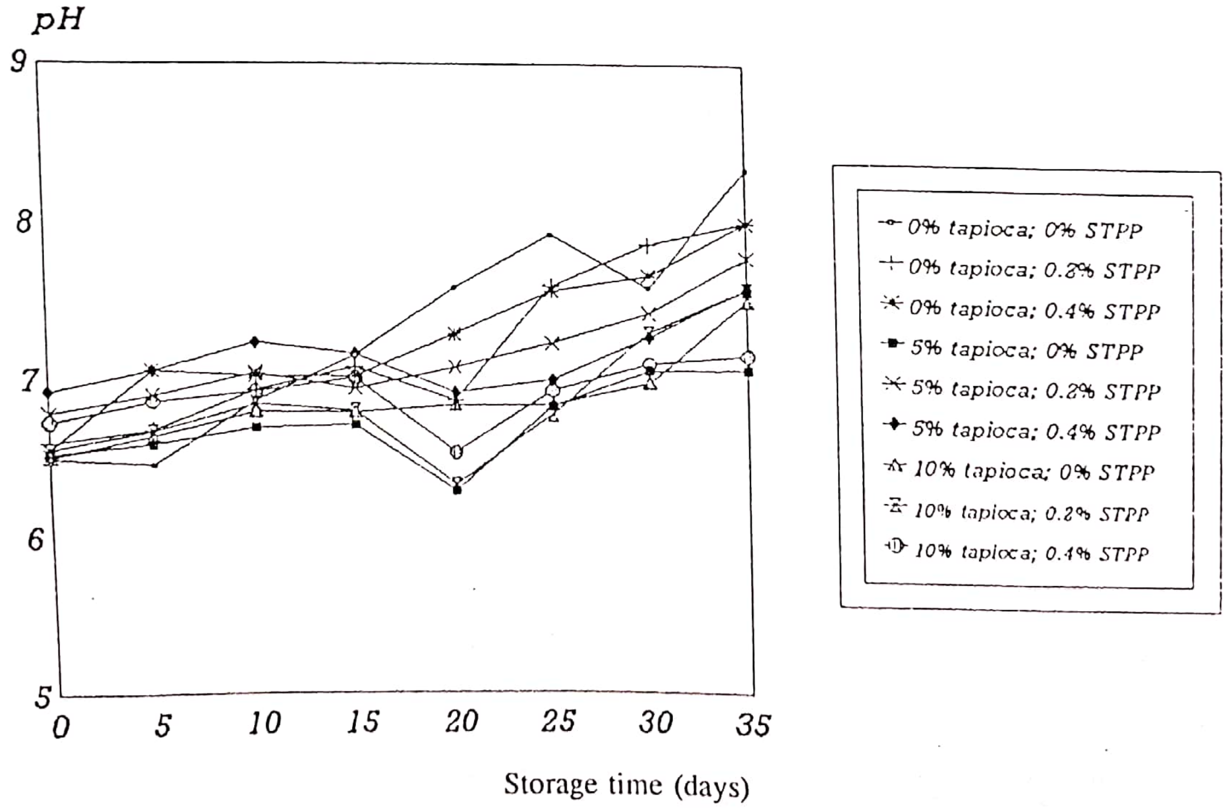


Figure 2 pH changes in kamaboko during storage at 5°C

3.3.3 Total Volatile Base (TVB) value

TVB value of kamaboko increased during storage (Figure 3). The initial TVB values were in the range of 4.86-19.80 mgN%, but those values increased to 34.81-109.80 mgN% after 35 days storage. The fast increase occurred after 20 days storage. TVB increase during quality deterioration was due to degradation of protein and its derivates by putrefactive bacteria into ammonia, trimethylamine, histamine and hydrogen sulphide (Sukarsa, 1978). Effects of tapioca and STPP addition at several tested levels were not detected.

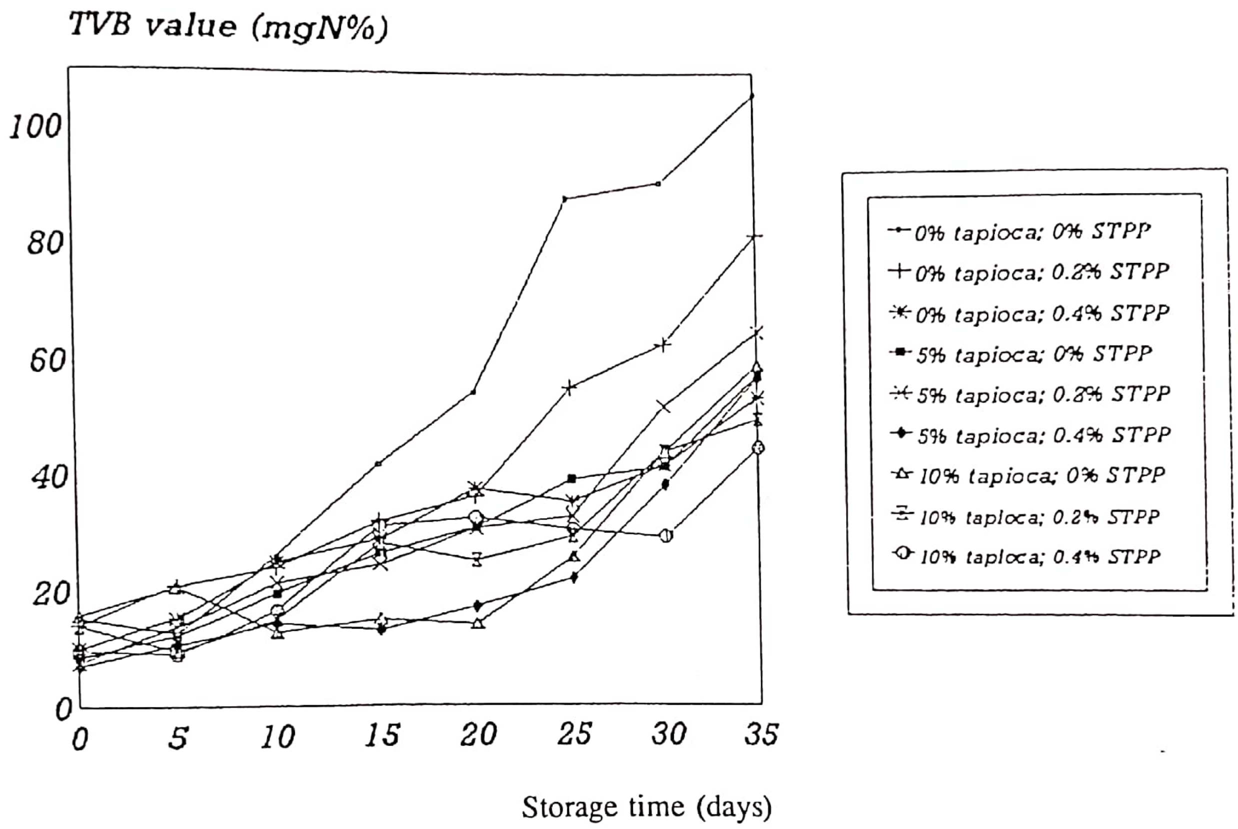


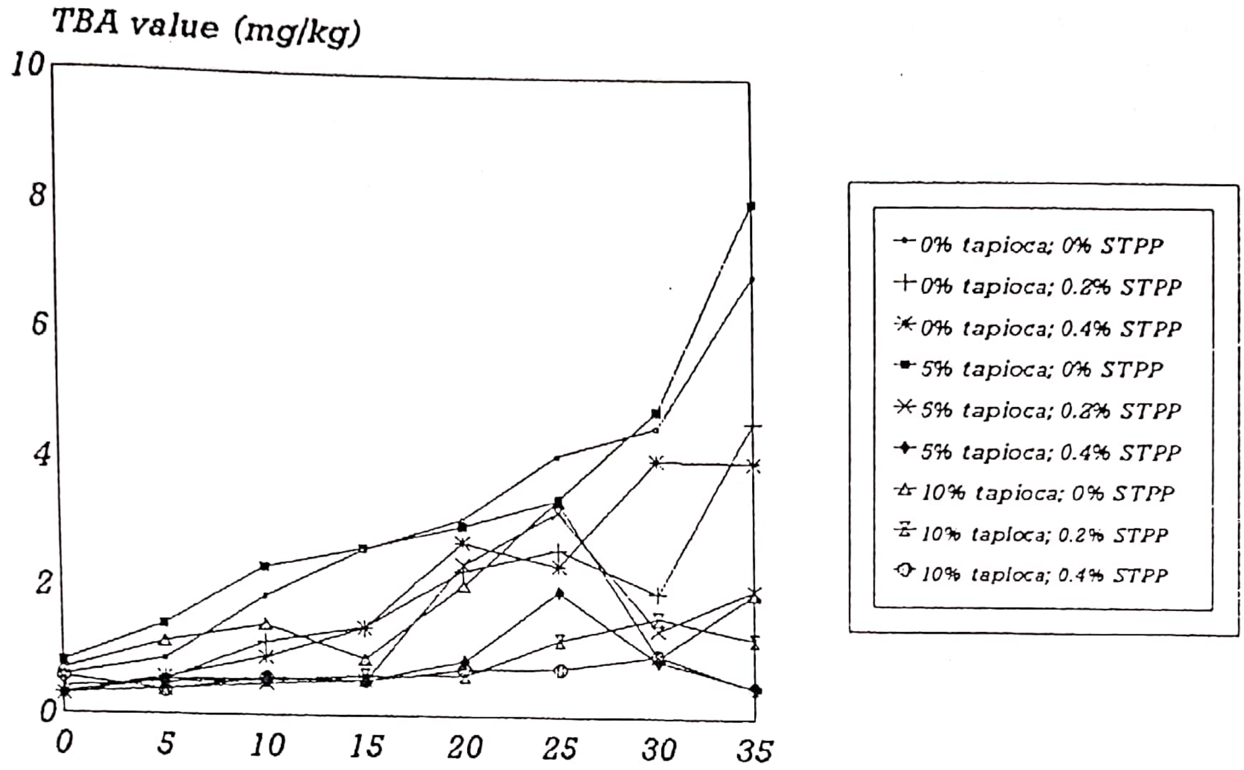
Figure 3 TVB values changes in kamaboko during storage at 5°C

3.3.4 Thiobarbituric Acid (TBA) values

TBA values increased during storage (Figure 4). The increase might be due to oxidation process attacking fat, producing malonaldehyde measured as TBA value. Fish is rich in polyunsaturated fatty acids, containing from 4 to 9 double bonds (Zaitsev *et al.*, 1969) which are susceptible to oxidation. Higher levels of tapioca and STPP tended to limit Malonaldehyde production and TBA value.

3.3.5 Urea content

In general, urea content of kamaboko decreased during storage (Figure 5). The initial urea contents were in the range of 8.18-15.44 mg/g and decreased to 0.28-2.79 after 35 days storage. Decomposition of urea by bacteria into volatile bases, mainly ammonia, might lead to the decrease of urea content. Urea content in the product may also affect total volatile base content (Stansby *et al.*, 1968). Tapioca and STPP addition did not indicate any clear trends in urea content changes.



Storage time (days)

Figure 4 TBA values changes in kamaboko during storage at 5°C

3.3.6 Product elasticity

STPP addition improved product elasticity. Sodium tripolyphosphate splits the actomyosin complex and extracts myosin, which gels upon cooking. This improves particle-particle binding and also helps to retain water in the product (Shimp, 1985). This occurrence improves product elasticity. Concerning elasticity values of the product, 0.2% and 0.4% STPP addition did not show any significant difference. Tapioca addition was also able to increase elasticity value. The addition of 5% and 10% tapioca did not significantly affect elasticity.

Elasticity values decreased during storage (Figure 6). The initial elasticity values were in the range of 1.0502 - 1.544 and reduced to 0.410 - 0.923 after 35 days storage.

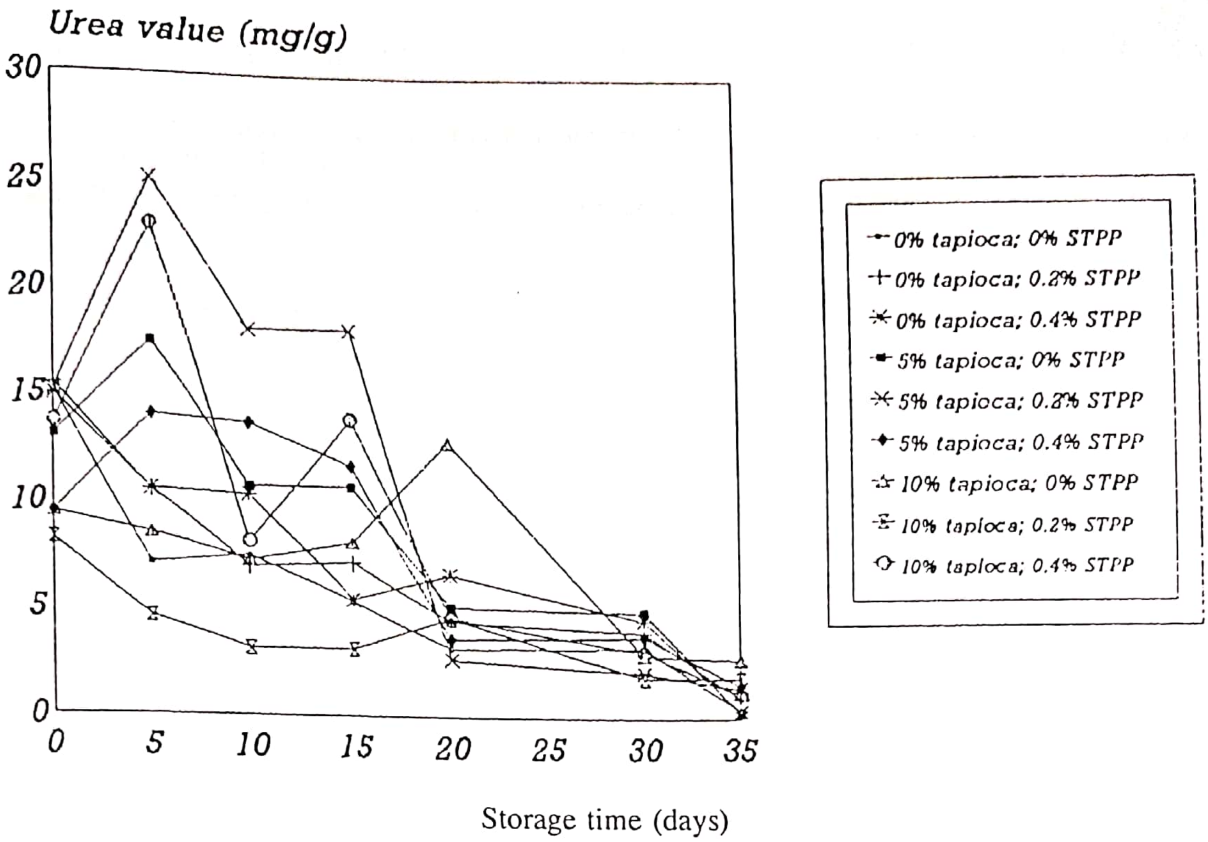


Figure 5 Area content changes in kamaboko during storage at 5°C

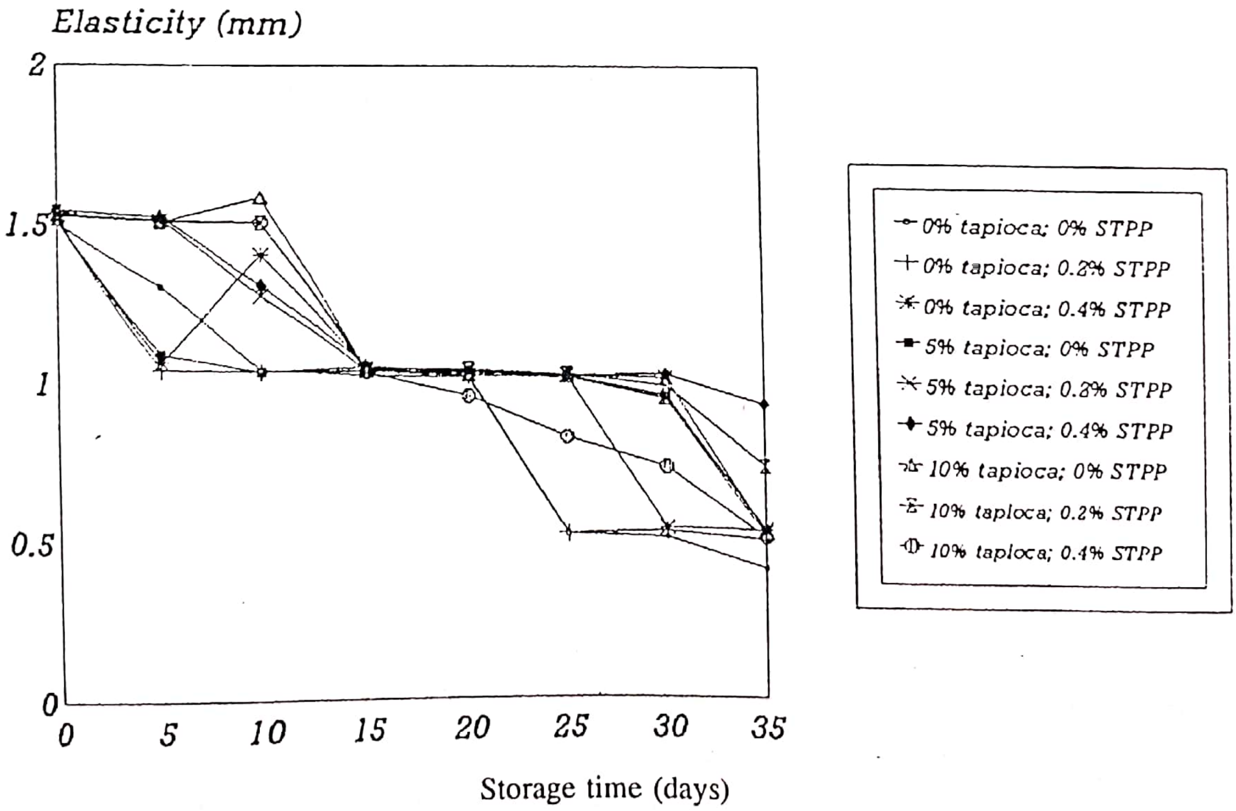


Figure 6 Elasticity changes in kamaboko during storage at 5°C

3.3.7 Total Plate Count (TPC)

Tapioca and STPP addition did not affect the TPC. According to Shimp (1985) phosphates have little impact on bacteria and enzymes. Storage time affected the TPC of kamaboko. During storage TPC tended to increase, but with fluctuations (Figure 7).

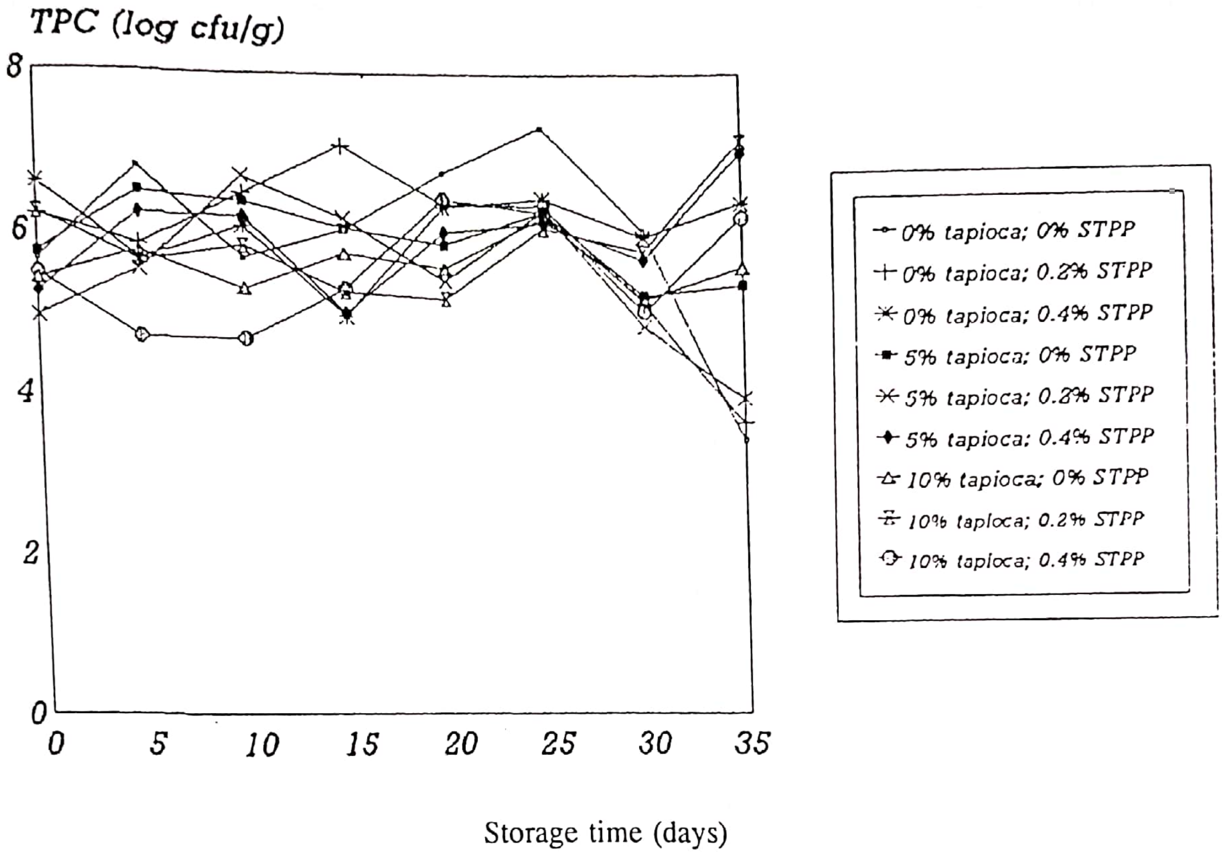


Figure 7 TPC changes in kamaboko during storage at 5°C

3.3.8 Sensory evaluation

Tapioca and STPP addition improved product acceptability, in terms of appearance, taste, odour and texture as shown in Figures 8, 9, 10 and 11. The use of 5% and 10% tapioca in kamaboko had an insignificant effect on taste and texture. Effects of STPP addition levels were different, but 0.4% STPP addition was regarded as the optimum level and produced the best product. According to Deman and Melnychin (1971), STPP stabilizes flavour, colour and odour of the product by minimizing the changes due to oxidation process. In addition, kamaboko texture was improved by STPP addition (Tanikawa *et al.*, 1985).

Tapioca and STPP addition also improved product stability during storage. Kamaboko without tapioca and STPP addition was rejected by panellists after the twentieth day storage. While, rejection time for others varied between the twenty and thirty-five days. Rejected products had a strong ammonia odour.

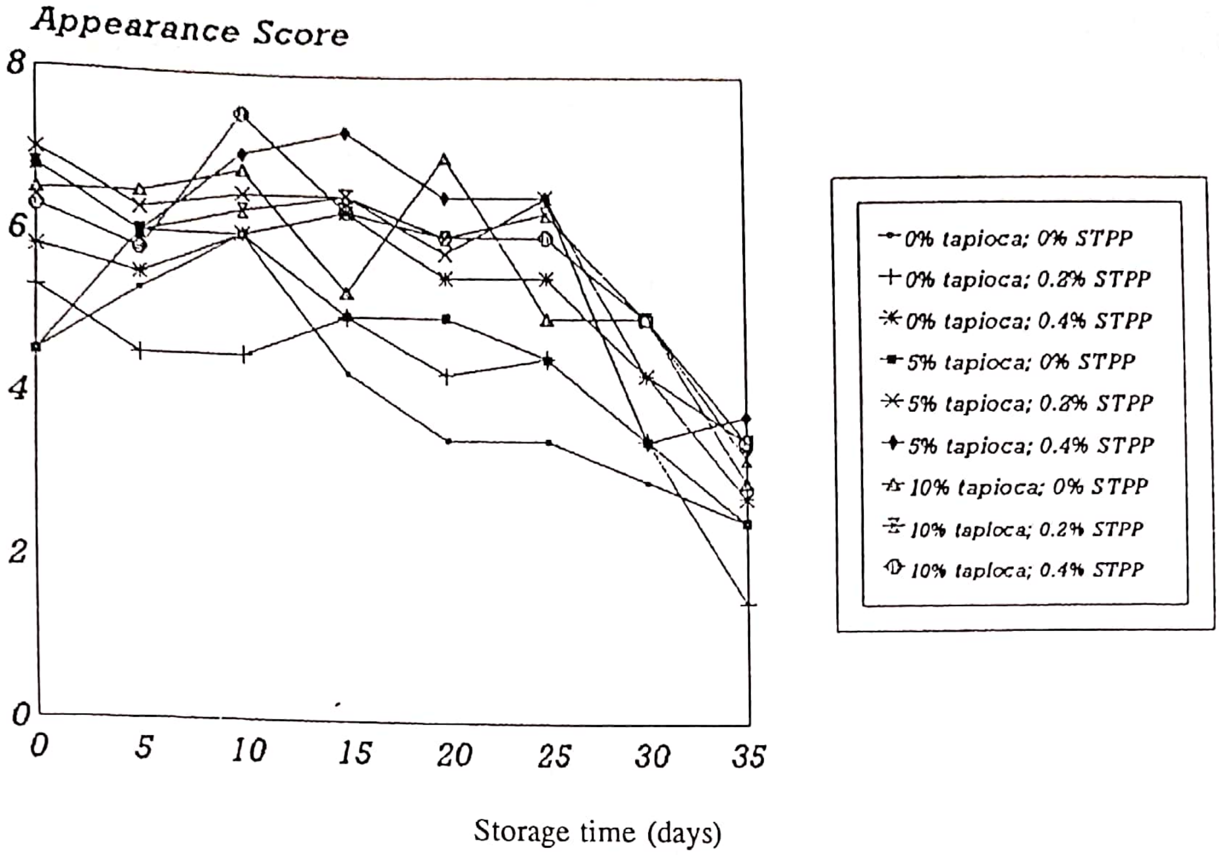


Figure 8 Appearance score changes in kamaboko during storage at 5°C

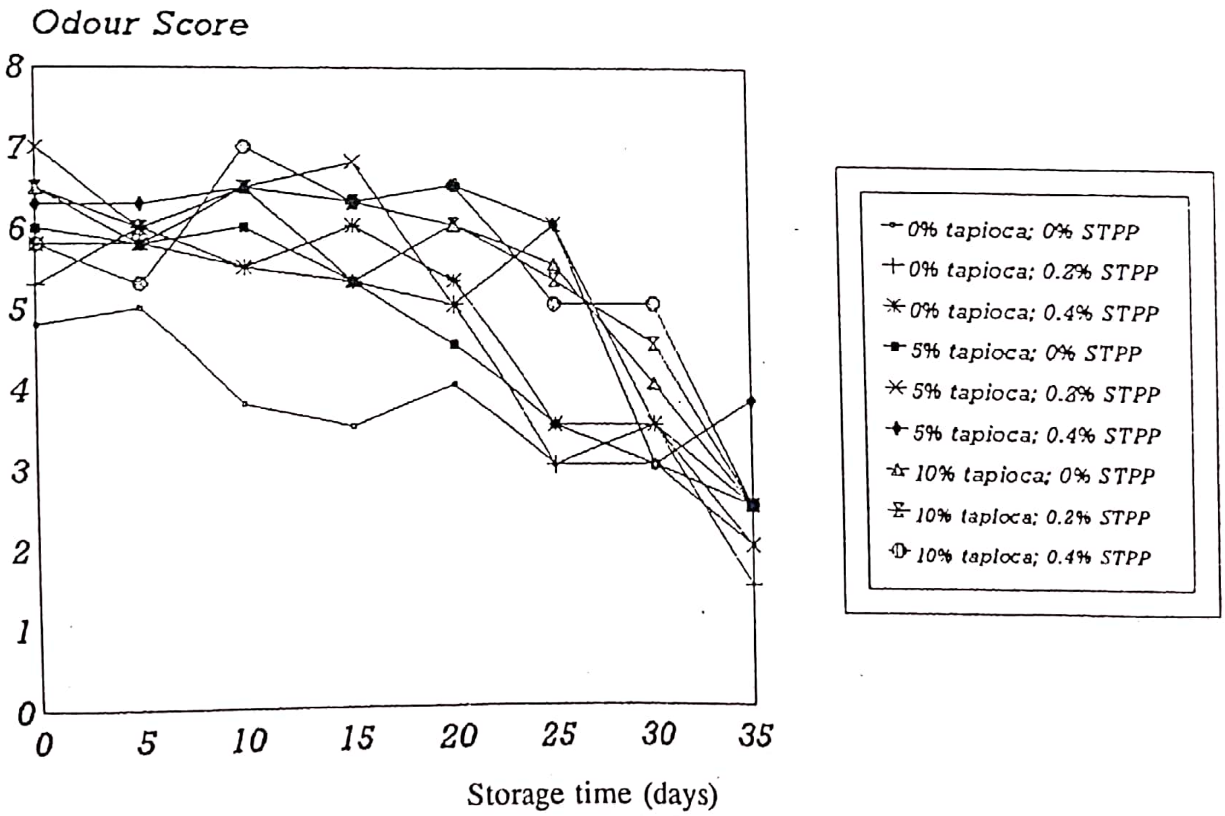


Figure 9 Odour score changes in kamaboko during storage at 5°C

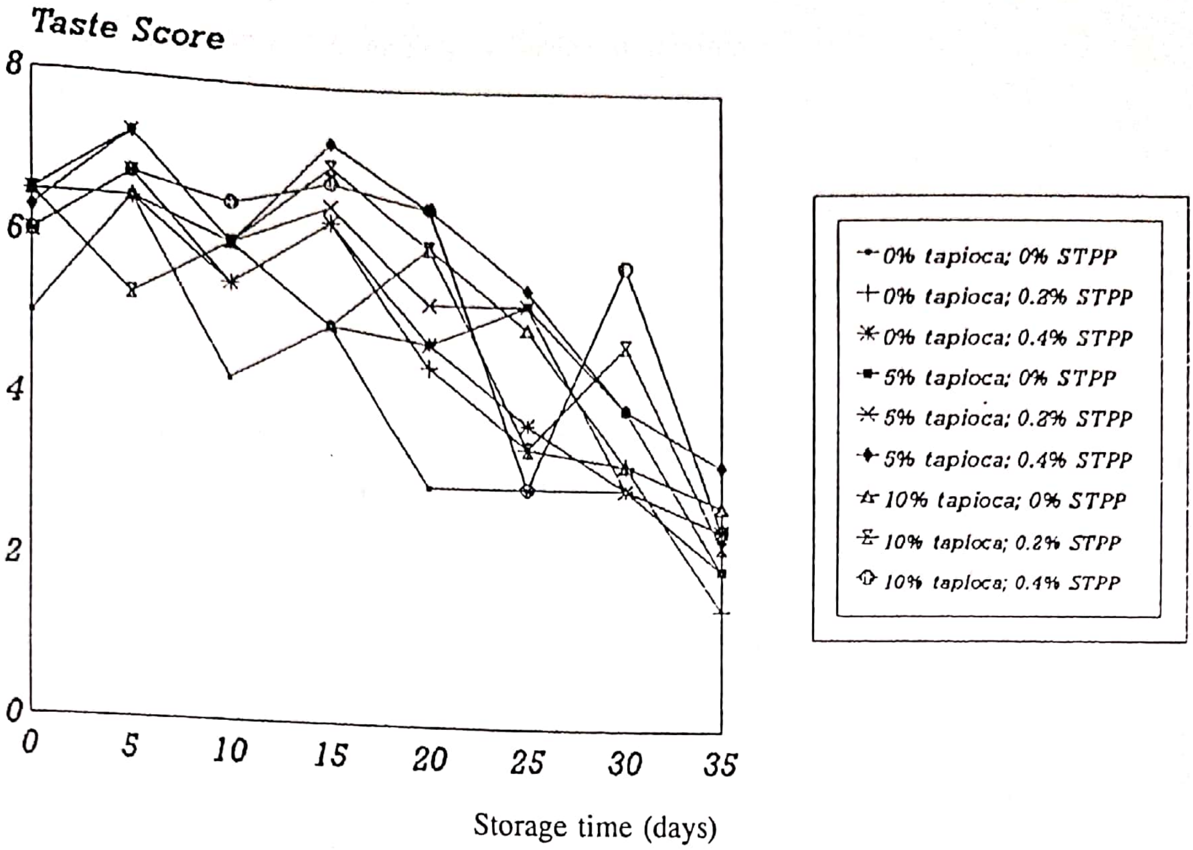


Figure 10 Taste score changes in kamaboko during storage at 5°C

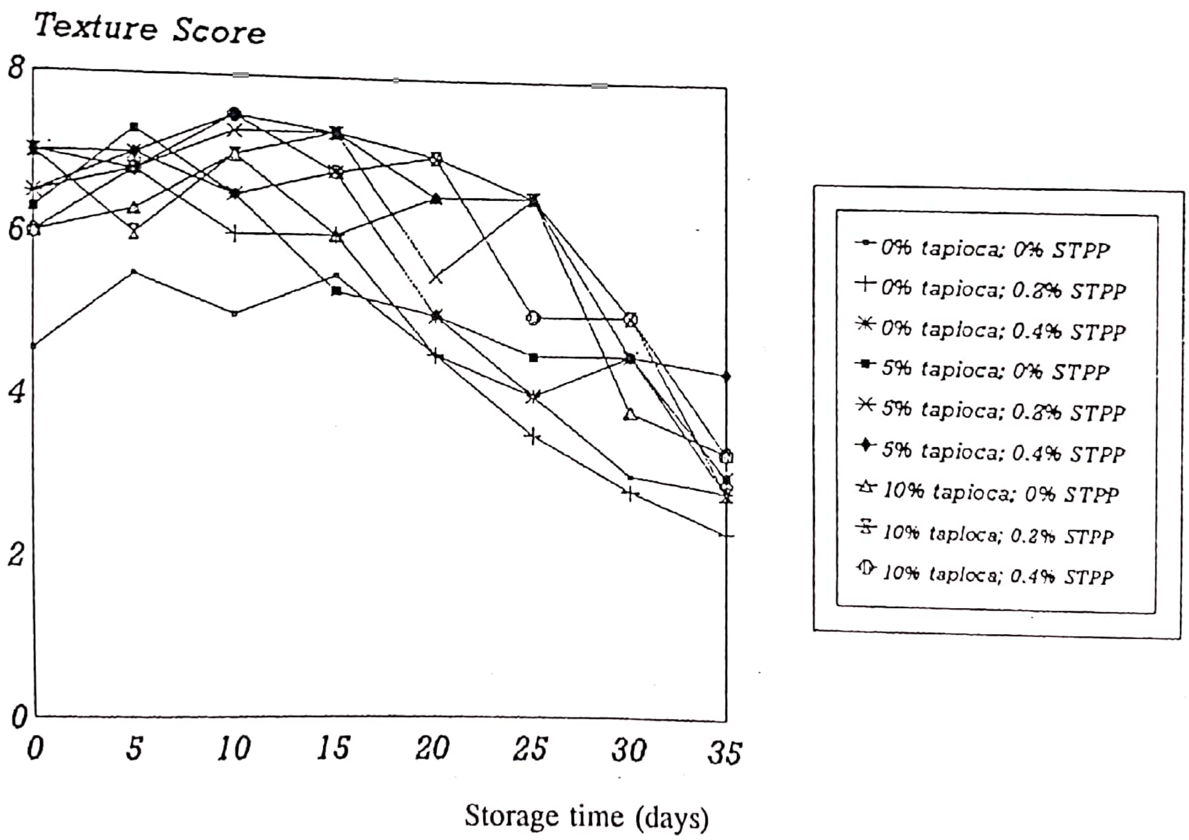


Figure 11 Texture score changes in kamaboko during storage at 5°C

Score sheet for the sensory evaluation of kamaboko.

Date:................................

Name:................................

Code:............ (V)

	Appearance	Odour	Taste	Texture
9. Extremely acceptable				
8. Very acceptable				
7. Acceptable				
6. Slightly acceptable				
5. Unacceptable				
4. Slightly unacceptable				
3. Unacceptable				
2. Very unacceptable				
1. Extremely unacceptable				

4. CONCLUSIONS

A washing treatment for minced meat was an important factor in the production of kamaboko made from cawtail ray meat. The treatment removed undesirable odour and blood. Tapioca and STPP improved product shelf life and acceptability in terms of appearance, odour, taste and texture.

The best product was produced with addition qf 5% tapioca and 0.4% STPP.

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