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EFFECT OF CERTAIN INGREDIENTS ON THE GELATION BEHAVIOUR OF SURIMI PREPARED FROM LIZARD FISH *(SAURIDA TUMBIL)*

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In the preparation of surimi-based products, various ingredients are used, which influence the quality of the products. The present investigation was conducted to study the effect of four such ingredients, namely salt, starch, water and oil on the gel strength of surimi gels. Surimi was prepared from lizardfish, *Saurida tumbil* and kept at -35°C. After one day, the frozen surimi was thawed and mixed with table salt at 3% level. Then ingredients such as starch, water and oil were added separately at 5, 10, 15, 20, 25 and 30% level. To find out the effect of salt concentration, table salt was added separately at 1, 2, 3, 4, and 5% level to the thawed surimi. After thorough mixing with the ingredients, the surimi was stuffed into PVDC casings, sealed and kept at room temperature for 4 hours for setting. The samples were processed by boiling at 90°C for 30 min and cooled quickly in iced water. After overnight chill storage, gel strength was measured following standard method by a gelometer. Among different concentrations of salt, 2% showed the highest gel strength of 1084 g. mm. Starch-added surimi showed the highest gel strength of 3466 g. mm at 25% level. For water-added surimi, gel strength decreased with increase in water content with maximum gel strength of 536 g. mm at 5% level. In case of oil-added surimi, gel strength increased with increase in oil level up to 20% (1428 g. mm) beyond which it decreased.

INTRODUCTION

In the preparation of surimi-based products various ingredients are added to surimi which influence the gelation behaviour of surimi. The effect of ingredients on developing the gel strength has been reported by Okada and Yamaski (1959), Lee (1984), Wu *et al.* (1985) and Lanier (1986). The ingredients are salt, starch, water and oil. For the preparation of surimi gel, table salt (sodium chloride) is added which improves the binding ability of proteins by increasing the amount of salt-extractable proteins as well as altering the ionic strength and pH of the medium facilitating the formation of a coherent three-dimensional structure during the process of heating the proteins. Addition of starch considerably enhances the textural property of surimi gel by increasing the gelatinization. Addition of water to surimi causes a great reduction of shear stress while it has a slight impact on shear strain. Oil modifies the texture of surimi gels. It also improves freeze thaw stability, reduces rubberiness, prevents development of sponge-like structure and

minimizes the textural changes during cooking. Attempt was made to study the-effect of above ingredients on the gelation behaviour of surimi prepared from the lizardfish.

MATERIAL AND METHODS

Fresh lizardfish (*Saurida tumbil*) of 200-400 g in weight were dressed by removing head, scales and viscera. Minced meat was collected from dressed fish by using deboner with 3-4 mm perforation. Cold water of less than 10°C was used to wash the minced meat with the meat water ratio of 1:3 (w/v). Washing was done three times and dewatering was done manually. Cryoprotectants like sorbitol (1%), sucrose (1%) and sodium tri-polyphosphate (1%) were added to surimi, kept in a polythene bag and stored at -35°C. Proximate composition of minced meat before washing, after washing and the frozen surimi meat were calculated following AOAC (1995) method. After one day of storage the frozen surimi block was thawed and mixed with table salt at 3% level. Then ingredients such as starch, water and oil were added separately at 5, 10, 15, 20, 25 and 30% level. To find out the effect of salt concentration, table salt was added separately at 1, 2, 3, 4, 5 and 6% level to the thawed surimi. After thorough mixing with the ingredients the surimi was stuffed into PVDC casings, sealed and kept at room temperature for 4 hours for setting. The samples were processed by boiling at 90°C for 30 minutes and cooled quickly in iced water. After overnight chill storage, the test pieces of 30 mm thickness were measured for shear stress and shear strain by using Rheo Tex GeJometer. The gel strength was calculated by multiplying both shear stress and strain.

RESULTS AND DISCUSSION

The proximate composition of minced meat before washing, after 1st wash, 2nd wash, 3rd wash and frozen surimi after one day has been summarized in Table 1. After 3rd wash the moisture content was increased from 77.8 to 83.6%, but protein, fat and ash contents decreased from 19.5 to 16.0%, 0.8 to 0.2% and 1.6 to 0.9%, respectively due to water washing. After one-day storage of surimi at -35°C the moisture content decreased to 82.5% from 83.6% with the approximate increase of other compositions. Similar results were also observed by Dora and Chandrasekhar (1994).

Table 1. Proximate composition of minced meat at different treatments before the preparation of surimi gel

Composition (%)	Treatment				
	Before washing	After 1st wash	After 2nd wash	After 3rd wash	Frozen surimi after one day
Moisture	77.8	81.5	82.3	83.6	82.5
Protein	19.5	16.8	16.4	16.0	16.3
Fat	0.8	0.5	0.3	0.2	0.2
Ash	1.6	1.2	1.0	0.9	1.0

The gel strength of surimi at different concentrations of salt has been given in Table 2. With the increase in salt concentration to 2% the gel strength increased from 980.2 to 1083.6 g. mm and at 3% the gel strength was 1072.6 g. mm. But after 3%, gel strength again decreased. The shear stress and shear strain increased up to 3% and decreased after 3%. Suzuki (1981) reported that when 2-3% salt is added and ground with meat, the ground meet turns into a viscous paste with increasing gel strength and this change is caused by the dispersing myofibrillar protein due to high water retention. In case of higher salt concentration, salting out occurs and the protein does not dissolve in the salt solution.

Table 2. Gel strength of surimi at different concentrations of salt

Salt (%)	Shear stress (g)	Shear strain (mm)	Gel strength (g.mm)
1	60	16.9	980.2
2	63	17.2	1083.6
3	62	17.3	1072.6
4	61	16.5	1006.5
5	58	16.7	968.6
6	56	16.2	907.2

Table 3 represents the gel strength of surimi gel at different concentrations of starch. The gel strength increased up to 25% (3180.0 g.mm) but after this it was decreased. When the shear stress increased there was decrease in shear strain. Park (2000) reported that when the starch granules heated, reversible swelling of the granules occurs. If heating continues to reach the gelatinization temperature, the granules absorbed more water and expand until the gel matrix limits them, which represents the more gel strength. Gel strength can decrease if too much starch is added.

Table 3. Gel strength of surimi gel at different concentrations of starch

Starch (%)	Shear stress (g)	Shear strain (mm)	Gel strength (g.mm)
5	89	13.6	1210.4
10	182	10.2	1856.4
15	251	7.6	1907.6
20	318	7.4	2353.2
25	300	10.6	3180.0
30	304	8.2	2492.8

Table 4 represents the gel strength at different concentrations of water. When the water concentration is increased the gel strength is decreased. So the maximum gel strength was 535.6 g.mm at 5% level. The polar nature of water favours clustering of the

hydrophobic residues within the folded polypeptide chain to minimize the entropy that would result from the exposure of the hydrophobic residues to water at the surface. This also contributes to the conformational stability of protein molecules before heating and may become the basis for intermolecular bonding when hydrophobic sites on adjacent protein molecules are exposed to surface during heating. Thus, water serves to initially disperse the myofibrillar protein molecules, allowing a more expanded network to develop as protein bonds form during heating. Addition of water to surimi causes a decrease in shear stress and shear strain, while it has a slight impact on shear strain. The study has shown that the increase in water concentration decreases the shear stress and shear strain, as observed by Park (2000).

Table 4. Gel strength of surimi gel at different concentrations of water

Starch (%)	Shear stress (g)	Shear strain (mm)	Gel strength (g.mm)
5	52	10.3	535.6
10	47	7.8	366.6
15	35	6.1	213.5
20	30	7.0	210.0
25	23	8.7	200.1
30	20	8.2	164.0

The gel strength at different concentrations of oil is presented in Table 5. The maximum gel strength was 1428.0 g. mm at 20% level. It has been observed that the shear stress increased to 90 g at 10% level and shear strain increased to 21 mm at 20% level. Park (2000) reported that vegetable oil can replace the water 1:1 upto 6% without changing shear stress and strain but after this concentration there will be a variation. The study has shown that among the different ingredients starch can give more gel strength than others.

Table 5. Gel strength of surimi gel at different concentrations of oil

Starch (%)	Shear stress (g)	Shear strain (mm)	Gel strength (g.mm)
5	88	12.6	1108.8
10	90	13.3	1197.0
15	72	17.7	1274.4
20	68	21	1428.0
25	61	10.8	658.8
30	56	9.2	515.2

REFERENCES

AOAC, 1995. Official Methods of Analysis. 16th Edn. Association of Official Analytical Chemists, Arlington, Virginia.

Dora, K. C. and T. C. Chandrasekhar, 1994. Effect of water washing on the nutritional and gel characteristics of pink perch, *Nemipterus japonicus, J. Appl. Zool. Res.*, **5**: 71- 72.

Lanier, T. C., 1986. Functional properties of surimi. *Food Technol.,* **97**: 107-124.

Lee, C. M., 1984. Surimi gel and the US seafood industry. *Oceans,* **27**: 35.

Okada, M. and A. Yamaski, 1959. Enhancing effect of starch on jelly strength of fish meat jelly. Relationship between properties of starch and reinforcing ability. *Bull. Jap. Soc. Sci. Fish.,* **25**: 40-46.

Park, J. W., 2000. Ingredient Technology and Formulation Development. *Surimi and Surimi Seafood,* **12**: 343-388.

Suzuki, T., 1981, Kamaboko (Fish Cake). *Fish and Krill Protein Processing Technol.,* **II:** 107.

Wu, M. C., T. C. Lanier and D. D. Hamenn, 1985. Thermal transitions of mixed starch-fish protein systems during heating. *J. Food Sci.,* **50**: 20-25.