Edible Protein Films from Fish Myofibrillar Proteins

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One of the uses of thermally stable dispersions of fish myofibrillar proteins is as edible film. A modified method of preparation of thermostable dispersions was developed which involves acidification of meat water homogenate. The dispersions were cast in glass trays and dried in an oven at 50°C. Dried dispersions yielded light yellow, translucent films with good flexibility. The films became brittle if dried further or stored at low humidity. Heating the dispersions prior to casting excluded air bubbles and thus improved the quality of films.

Key words: Protein films, myofibrillar protein, thermostable dispersions

Actomyosin or the myofibrillar fraction of fish muscle is responsible for the high solution viscosity, emuslifying property, water holding capacity and gel-forming. Thermally stable aqueous dispersions from Atlantic mackerel (*Scomber scombrus*) and herring (*Clupea harengus*) have been prepared utilising the property of stability of myofibrillar protein to heat and acid (Venugopal and Shahidi, 1994; Shahidi and Venugopal, 1994). These thermostable dispersions were spray dried and made into films, but process details are not available (Venugopal *et. al.*, 1995). Results of studies to reduce the time for preparation of thermostable dispersions and a process to prepare edible films from it are reported in this paper.

Materials and Methods

Milkfish (*Chanos chanos*), collected from local culture farms was filleted, skinned, washed and cut into small pieces of size 2-3 mm. The pieces were washed in 3 volumes of ice cold water for 30 min while being stirred over a magnetic stirrer. The temperature at the end of stirring was 2-5°C. The washings were drained off and washing was repeated under similar conditions two more times. A final wash was given with 0.5% aqueous solution of sodium bicarbonate under similar conditions. Meat was collected on a mesh, drained for 10 min and lightly pressed to remove excess water.

Dispersions were prepared by blending the washed meat with water in the ratio 1:4 in a commercial blender first at low speed and then at high speed till it became a uniform thick paste. Glacial acetic acid was then added in 0.1 ml increments and blending continued till it attained sufficient fluidity to allow uniform spreading over a glass plate. pH of the slurry was noted. Glycerol at 20 and 30% on dry solid basis was added to the dispersions, which were then seived to remove coarse particles. Filtered dispersions were poured into glass trays having 5 mm thick rims smeared with few drops of coconut oil. The loading of the dispersion was 0.39-0.41 g/sq.cm.

Both dispersions were then divided into two portions. To one portion of the 20% glycerol dispersion sodium sulfite (0.2% of dry solids) and to the other pre-gelatinized starch (1.2% of dry solids) were added. To one portion of 30% glycerol dispersion sodium chloride (0.2% of dry solids) was added before casting on the glass plates. The dispersions containing glycerol-sodium chloride and glycerol-starch were heated in a water bath to 70-80°C with stirring and then cast on the plates as before. The dispersions after casting were dried at 50°C in an oven for 18-20 h and the films were carefully detached from the glass plates.

Results and Discussion

The process of Venugopal and Shahidi (1994) calls for overnight soaking of the fish meat in three volumes of water at 10°C. In the present process this long soaking was replaced by washing the meat three times in ice cold water with stirring, thus considerably reducing the time as well as refrigeration needs. When muscle was minced instead of chopping into small pieces, the washed muscle swelled enormously after the third washing, making it difficult to remove water. Washing the meat in water after soaking in sodium bicarbonate (Venugopal and Shahidi, 1994) was not adopted. It did not affect preparation of film.

On homogenising the washed meat a thick paste was initially obtained which was quite difficult to blend further. At this point, addition of small increments of acetic acid brought down the viscosity. This facilitated efficient dispersion. When the fluidity was sufficient for uniform spreading the pH attained was 4.4 to 4.5. The addition of 0.7-0.9 ml of glacial acetic acid per 100 ml of dispersion was sufficient to bring the pH to 4.4-4.5.

Properties of the films prepared are presented in Table 1. Loading less than 0.39 0.41 g/sq. cm of dispersion resulted in films having no sufficient thickness and strength to be detached from the glass plate without breaking. The optimum loading was found

Table 1. Properties of films from *Chanos chanos* actomyosin

Washed meat in dispersion, %	Additives, % on dry solids basis	Whether heated	Properties of film
20	Glycerol 20; Sodium sulfite 0.2	No	Light yellowish brown translucent film, easily detached from the plate, slightly stiff, top surface rough.
20	Glycerol 30	No	Same as above, but more flexible film.
20	Glycerol 30 Sodium chloride 0.2	Yes	Light yellowish brown translucent film, easily detached from plate, flexible, top surface smooth.
20	Glycerol 20 Starch 1.2	Yes	Pale yellow translucent film, very thin, not easily detached, brittle.

to be 0.39-0.41 g/sq.cm. Sodium sulfite was used as an additive as it is reported to facilitate protein solubilisation (Redl *et. al.*, 1996), but this was found not necessary as it did not improve film forming ability or the quality of the film. Similar was the case with added sodium chloride. However, increasing the glycerol level, which functions as a plasticizer, from 20 to 30% increased the flexibility of the films. It was seen that further drying of the films after detachment, made the films extremely brittle. Brittleness was also observed when films were stored in a desiccator. Keeping at ambient humidity (70-85%) for 10-15 min restored the flexibility.

Heating the dispersion reduced the viscosity considerably and enabled easy filtration. Heating also removed most of the air bubbles in the dispersion and produced a smoother film with very few entrapped air bubbles. Heating the acidified myofibrillar dispersions even to 100°C for 30 min did not cause precipitation (Shahidi and Venugopal, 1994).

References

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