International Journal of Applied Engineering Research ISSN 0973-4562 Volume 13, Number 2 (2018) pp. 1332-1335

Production of Fish Cake from Siamese Mud Carp

[1]Minh N. P.[*], and [2]Nga N. H.

[1]Faculty of Food Technology - Biotech, Dong A University, Da Nang City, Vietnam.
[2]Department of Health, Soc Trang province, Vietnam.
**Corresponding author*

Abstract

From the tenth to eleventh months of the lunar calendar, the flooding season comes to Mekong Delta. But that marks the start of the migratory Siamese mud carp (*Henicorhynchus siamensis*) season*, a* vast multitude of fish species in the Mekong River. In Vietnam, catching or farming aquatic resources forms a vital part of rural people's livelihoods and contributes a major source of protein. With a huge volumn of Siamese mud carp (*Henicorhynchus siamensis*) caught a year, Vietnamese farmers ussually process them into fermented fish sauce. There is not much research mentioned to processing this valuable fish. In order to improving the added value of this fish, we investigated a production of fish cake from Siamese mud carp. By investigation different parameters probably affecting to gelation, we noticed that we would get the best physicochemical properties and sensory characteristics of fish cake by the addition of carrageenan 1.0%: gelatin 1.0%.

Keywords: *Siamese mud carp, fish cake, carrageenan, gelatin, gelation,* physicochemical properties

INTRODUCTION

Hydrocolloids are a heterogeneous group of long chain polymers (polysaccharides and proteins) characterised by their property of forming viscous dispersions and/or gels when dispersed in water. Presence of a large number of hydroxyl (-OH) groups markedly increases their affinity for binding water molecules rendering them hydrophilic compounds. Further, they produce a dispersion, which is intermediate between a true solution and a suspension, and exhibits the properties of a colloid. Hydrocolloids have a wide array of functional properties in foods. These include thickening, gelling, emulsifying, stabilisation, and controlling the crystal growth of ice and sugar though the basic properties for which hydrocolloids find extensive use are thickening and gelling. Hydrocolloids disperse in water to give a thickening or viscosity producing effect. This water-thickening property is common to all hydrocolloids and is the prime reason for their overall use (Dipjyoti Saha, 2010). Carrageenan is a hydrocolloid that finds maximum application because of its ability to form gels at much lower concentrations compared to any other gelling agent (Puvanenthiran et al. 2003; de Vries 2004; Verbeken et al 2004). Gelatin exhibits a wide range of functional properties. Gelatin gels melt at relatively low temperature (melt-in mouth). Gelatin melts at much lower temperature because the junction zones are only bound by weak hydrogen bonds (Dipjyoti Saha, 2010).

The Siamese mud carp (*Henicorhynchus siamensis*) is a species of freshwater cyprinid fish, a variety of Asian carp native to the Mekongand Chao Phraya Rivers in Southeast Asia, especially in Cambodia, Laos, Thailand and Vietnam. *Henicorhynchus siamensis* is a synchronous, i.e. single spawned species that clearly shows a single peak of gonadosomatic index in June to September and the highest in August (Suvarnaraksha et al. 2010). During the wet season, this species migrates into floodplains for spawning (Fukushima et al. 2014). Eggs and larvae grow in the floodplains and the larvae migrate back to rivers when the floodwaters begin to recede at the starting of dry season (Rainboth 1996; Fukushima et al. 2014). *Henicorhynchus siamens* is also adapts to lentic environmental conditions, such as lakes and reservoirs, and contributes a significant portion in fish catches (Suvarnaraksha et al. 2010). Not only does this fish provide protein, but also vitamins and minerals to the people (Roos et al. 2007).

Siamese mud carp is a major source of income for many families in the delta in the flooding season (Piyathap Avakul, 2015). A family can catch 100 kg of the fish or above a day on average, which is retailed to local residents or wholesaled to traders. The volume of Siamese mud carp caught a year depends on rainfall in the rainy season. Viraxay Bandavong et al. (2016) performed isolation and screening of protease producing halotolerant bacteria from fermented freshwater fishes. In this research, they used Siamese mud carp as a material for examining. We didn't see any research mentioned to fish cake production from Siamese mud carp. Therefore, we focused on examining different aspects affecting to siamese mud carp cake production such as carrageenan, gelatin concentration supplemented into fish paste, mixture of carrageenan and gelatin.

MATERIAL & METHOD

Material

We catched Siamese mud carp from An Giang province, Vietnam.. After harvesting, they must be kept in ice chest (< 4^{o}C) and conveyed to laboratory within 2 hours for experiments. Besides Siamese muad carp, we also used other materials such as NaCl, monosodium glutamate (MSG), pepper, sugar, garlic, carrageenan, gelatin. Lab utensils and equipments included grinder, weight balance, thermometer, autoclave, ice chest, texture analyzer. We evaluated moisture content, texture, color in fish cake.

Research method

Investigate the effect of carrageenan to physicochemical properties and sensory characteristics of fish cake

Siamese mud carp was kept under 4ºC in 2 hours before being grinded thoroughly. Salt 1%, MSG 0.2%, sugar 0.5%, pepper 2% and garlic 2.5% were used as food ingredients. It was grinded into paste in 2 minutes at 0-4ºC. Then we added different carrageenan concentration (1.0, 1.5, 2.0, 2.5 and 3.0%) into fish paste. Fish cake was then formed and sterilized at 121ºC in 10 minutes. Texture, color, and moisture were tested to identify the optimal carrageenan concentration.

Investigate the effect of gelatin to physicochemical properties and sensory characteristics of fish cake

Siamese mud carp was kept under 4ºC in 2 hours before being grinded thoroughly. Salt 1%, MSG 0.2%, sugar 0.5%, pepper 2% and garlic 2.5% were used as food ingredients. It was grinded into paste in 2 minutes at 0-4ºC. Then we added different gelatin concentration (1.0, 1.5, 2.0, 2.5 and 3.0%) into fish paste. Fish cake was then formed and sterilized at 121ºC in 10 minutes. Texture, color, and moisture were tested to identify the optimal carrageenan concentration.

Investigate the effect of mixture (carrageenan: gelatin) to physicochemical properties and sensory characteristics of fish cake

Siamese mud carp was kept under 4ºC in 2 hours before being grinded thoroughly. Salt 1%, MSG 0.2%, sugar 0.5%, pepper 2% and garlic 2.5% were used as food ingredients. It was grinded into paste in 2 minutes at 0-4ºC. Then we added different carragenan: gelatin ratio (2.0%:0%, 0:2.0%, 1.0%:1.0%, 1.5%:0.5, 0.5%:1.5%, respectively) into fish paste. Fish cake was then formed and sterilized at 121ºC in 10 minutes. Texture, color, and moisture were tested to identify the optimal carrageenan concentration.

Statistical analysis

Data were statistically summarized by Statgraphics.

RESULT & DISCUSSION

Effect of carrageenan to physicochemical properties and sensory characteristics of fish cake

Hydrocolloids are widely used in many food formulations to improve quality attributes and shelf-life. The two main uses are as thickening and gelling agents. Hydrocolloids with their unique characteristics are of great interest in processed meat due to their abilities to bind water and form gels (Candogan and Kolsarici, 2003).

Table 1. Effect of carrageenan concentration to texture firmness of fish cake

Carrageenan concentration (%)	Texture firmness of fish cake (g/mm^2)
Control	8.72^{d}
1.0	9.85^{c}
1.5	11.79^{b}
2.0	**12.01^{ab}**
2.5	12.13^{a}
3.0	12.19^{a}

Table 2. Effect of carrageenan concentration to color of fish cake

Carrageenan concentration (%)	Color of fish cake (a value)
Control	57.45^{c}
1.0	58.73^{bc}
1.5	59.91^{b}
2.0	**62.13^{ab}**
2.5	62.58^{a}
3.0	62.67^{a}

Table 3. Effect of carrageenan concentration to moisture content of fish cake

Carrageenan concentration (%)	Moisture content of fish cake (%)
Control	65.01^{c}
1.0	66.74^{b}
1.5	66.98^{b}
2.0	**69.23^{a}**
2.5	69.56^{a}
3.0	69.64^{a}

From table 1, 2 and 3 we will get the best physicochemical properties and sensory characteristics of fish cake by the addition of carrageenan 2.0%. Similarly, Nicomrat et al. (2016) demonstrated the effect of carrageenan on quality of frozen Moo yor. The result showed that carrageenan favorably affected cooking loss and expressible moisture content better than tapioca starch.

Effect of gelatin to physicochemical properties and sensory characteristics of fish cake

Gel formation is the phenomenon involving the association or cross-linking of the polymer chains to form a three

dimensional network that traps or immobilises the water within it to form a rigid structure that is resistant to flow. The formation of gel involves the association of randomly dispersed polymer segments in dispersion in such a way so as to form a three-dimensional network that contains solvent in the interstices.

Table 4. Effect of gelatin concentration to texture firmness of fish cake

Gelatin concentration (%)	**Texture firmness of fish cake (g/mm^2)**
Control	8.72^{d}
1.0	9.93^{c}
1.5	11.55^{b}
2.0	**11.97^{ab}**
2.5	12.05^{a}
3.0	12.11^{a}

Table 5. Effect of gelatin concentration to color of fish cake

Gelatin concentration (%)	Color of fish cake (a value)
Control	57.45^{c}
1.0	58.68^{bc}
1.5	59.25^{b}
2.0	61.96^{ab}
2.5	62.11^{a}
3.0	62.20^{a}

Table 6. Effect of gelatin concentration to moisture content of fish cake

Gelatin concentration (%)	Moisture content of fish cake (%)
Control	65.01^{c}
1.0	66.59^{b}
1.5	66.67^{b}
2.0	69.11^{a}
2.5	69.27^{a}
3.0	69.32^{a}

From table 4, 5 and 6 we will get the best physicochemical properties and sensory characteristics of fish cake by the addition of gelatin 2.0%. N. C. Brake and O. R. Fennema (1999) proved that frozen minced mackerel was added 1% gelatin, the rate of lipid hydrolysis at -10^{o}C decreased as compared to that in controls.

Effect of mixture (carrageenan: gelatin) to physicochemical properties and sensory characteristics of fish cake

Table 7. Effect of carrageenan: gelatin ratio to texture firmness of fish cake

Ratio of carrageenan:gelatin	Texture firmness of fish cake (g/mm^2)
Carrageenan 2.0%	12.01^{c}
Gelatin 2.0%	11.97^{c}
Carrageenan 1.0%: Gelatin 1.0%	14.24^{a}
Carrageenan 1.5%: Gelatin 0.5%	13.17^{b}
Carrageenan 0.5%: Gelatin 1.5%	13.08^{b}

Table 8. Effect of carrageenan: gelatin ratio to color of fish cake

Ratio of carrageenan:gelatin	Color of fish cake (a value)
Carrageenan 2.0%	62.13^{cd}
Gelatin 2.0%	61.96^{d}
Carrageenan 1.0%: Gelatin 1.0%	64.25^{a}
Carrageenan 1.5%: Gelatin 0.5%	63.29^{b}
Carrageenan 0.5%: Gelatin 1.5%	62.55^{c}

Table 9. Effect of carrageenan:gelatin ratio to moisture content of fish cake

Ratio of carrageenan:gelatin	Moisture content of fish cake (%)
Carrageenan 2.0%	69.23^{d}
Gelatin 2.0%	69.11^{d}
Carrageenan 1.0%: Gelatin 1.0%	73.08^{a}
Carrageenan 1.5%: Gelatin 0.5%	72.35^{b}
Carrageenan 0.5%: Gelatin 1.5%	71.29^{c}

Firmness and tenderness for optimum texture, as well as the retention of moisture for optimum juiciness were strongly affected by these hydrocolloids. From table 7, 8 and 9 we will get the best physicochemical properties and sensory characteristics of fish cake by the addition of carrageenan 1.0%: gelatin 1.0%. The blending of different polysaccharides (carragenan and gelatin) offers an alternative route to the development of new textures. The major interest lies in the development of synergistic mixtures with improved or induced gelation.

CONCLUSION

Fish and its products play a highly important role in the food and nutritonal security of rural, urban and coastal populations throughout Mekong river delta in the flooding season. Siamese Mud Carp is a famous specialty as the floods

approaching. The little fish is sweet and soft with edible bones. Fermented fish paste was the most commonly consumed product from Siamese mud carp. We have successfully investigated the effect of carrageenan and gelatin to Siamese mud carp fish cake production.

REFERENCE

[1] Candogan, K. and Kolsarici, N. Storage stability of low-fat beef frankfurters formulated with carrageenan or carrageenan with pectin. *Meat Science* 64(2): 207–214 (2003a).

[2] Candogan, K. and Kolsarici, N. 2003b. The effects of carrageenan and pectin on some quality characteristics of low-fat beef frankfurters. *Meat Science* 64(2): 199–206 (2003b).

[3] de Vries J. Hydrocolloid gelling agents and their applications. In: Philips GO, Williams PA, editors. Gums and stabilizers for the food industry, vol 12. *Oxford: RSC Publ;* pp. 22–30 (2004).

[4] Dipjyoti Saha and Suvendu Bhattacharya. Hydrocolloids as thickening and gelling agents in food: a critical review. *J Food Sci Technol.* 47(6): 587–597 (2010).

[5] Fukushima, M., T. Jutagate, C. Grudpam, P. Phomikong and S. Nohara. Potential effects of hydroelectric dam development in the Mekong River Basin on the migration of Siamese mud carp (*Henicorhynchus siamensis* and *H. lobatus*) elucidated by otolith microchemistry. *PLoS ONE* 9:1-13 (2014)

[6] N. C. Brake and O. R. Fennema. Lipolysis and lipid oxidation in frozen minced mackerel as related to tg9, molecular diffusion, and presence of gelatin. *Journal of Food Science* 64(1): 25-32 (1999)

[7] Nicomrat, K., Chanthachum, S. and Adulyatham, P. Effect of carrageenan on quality of frozen Moo yor. *International Food Research Journal* 23(2): 904-908 (2016).

[8] Piyathap Avakul and Tuantong Jutagate. Effects of water temperature on embryonic development, hatching success and survival of larvae of siamese mud carp (*Henicorhynchus siamensis). Asian Fisheries Science* 28: 143-153 (2015).

[9] Puvanenthiran A, Goddard SJ, Mekinnon IR, Augustin MA. Milk-based gels made with κ carrageenan. *J Food Sci.* 68:137–141 (2003)

[10] Verbeken D, Bael K, Thas O, Dewettinck K. Interaction between κ-carrageenan, milk proteins and modified starch in gelled dairy desserts. *Int Dairy J.* 16:482–488 (2006).

[11] Viraxay Bandavong, Kridsada Unban, Apinan Kanpiengjai and Chartchai Khanongnuch. Isolation and screening of protease producing halotolerant bacteria from fermented freshwater fishes. *Food and Applied Bioscience Journal* 4(1): 1–11 (2016).

[12] Rainboth, W.J. Fishes of the Cambodian Mekong: FAO species identification field guide for fishery purposes. *FAO, Rome, Vienna.* 310 pp. (1996).

[13] Roos, N., M.A.Wahab, C. Chamnan and S.H. Thilsted. The role of fish in food-based strategies to combat vitamin A and mineral deficiencies in developing countries. *Journal of Nutrition* 137: 1106-1109 (2007).

[14] Suvarnaraksha, A., S. Lek, S. Lek-Ang and T. Jutagate. Life history of the riverine cyprinid *Henicorhynchus siamensis* (Sauvage, 1881) in small reservoir. *Journal of Applied Ichthyology* 27: 995-1000 (2010).