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Research Article

Preparation and characteristics of fish seasoning powder

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Abstract

The effect of fish species including imbricated stingray (*Dasyatis (Amphotistius) imbricatus*), oxeye scad (*Selar boops*), ornate threadfin bream (*Nemipterus hexodon*) and red tilapia (*Oreochromis niloticus*) on the characteristics of fish seasoning powder (FSP) was investigated. The moisture content and a_w of all FSPs were found in the ranges of 4.08-5.16 and 0.43-0.52, respectively. The highest protein content of FSP was observed in the formula of 50% oxeye scad with 10% monosodium glutamate (MSG) and 40% mixed ingredients and the formula of 50% ornate threadfin bream with 50% mixed ingredients ($p<0.05$). All FSPs exhibited a low content of lipid (not more than 5%) and ash (1.08-1.38%). The FSP produced from 50% red tilapia with 10% MSG and 40% mixed ingredients possessed the highest b^* value concurrent with the highest DPPH° scavenging activity ($p<0.05$). L^* and a^* values of all FSPs were found in the ranges of 60.82-70.68 and 0.81-2.57, respectively. All FSPs were completely solubilized (5% (w/v) in water, 80°C) within 5 min. Sensory evaluation revealed that the FSP produced from 40-50% red tilapia with 10% MSG and 40-50% mixed ingredients showed the highest overall acceptance score. Therefore, the optimum formula for FSP production was 50% dried red tilapia powder with 10% MSG and 40% mixed ingredients.

Keywords: MSG, muscle-food, sensory evaluation, Maillard reaction products, Thailand.

Introduction

Muscle-based seasoning powder commonly produced from pork, chicken and beef has been widely accepted in Thailand. This seasoning powder was mainly made by mixing dried meat powder with other seasoning ingredients such as salt, sugar, MSG, pepper and garlic powder at an appropriate ratio [1, 2]. Fish are one muscle food which is rich in proteins, essential fatty acids and other bioactive compounds including bioactive peptides with antihypertensive, antioxidant, antimicrobial and antihypoallergenic activities [3]. The protein content of most raw fish flesh is in the range of 17-22%, with an average of 19% [4]. Dried fish powders prepared from threadfin bream (*Nemipterus japonicus*), lizardfish (*Saurida tumbil*) and purple-spotted bigeye (*Priacanthus*

tayenus) by cooking, dehydration and grinding of fish meat contained a high content of protein and these powders were good sources of all the essential amino acids [3, 5, 6]. Therefore, the utilization of fish as a seasoning ingredient should be a promising means to transform fish resources into human food. However, the characteristics of FSP might depend on the composition of fish muscle, which might be affected by the species and freshness of the fish, as well as on the processing parameters. As a consequence, the objective of this study was to investigate the effect of fish species on the characteristics of FSP.

Materials and Methods

Materials

Imbricated stingray (*Dasyatis (Amphotistius) imbricatus*), oxeye scad (*Selar boops*), ornate threadfin bream (*Nemipterus hexodon*) and red tilapia (*Oreochromis niloticus*) representing marine elasmobranches fish, dark-fleshed marine teleost fish, white-fleshed marine teleost fish and freshwater fish, respectively, were used for production of FSP. Dried fish powders were prepared by drying shredded-steamed fish mince at 65°C for 15 h until the a_w reached 0.60-0.65 using a hot air drier [7]. Thereafter, dried fish were ground using a grinder and passed through a 35-mesh sieve [1]. The dried fish powders obtained were packed in aluminum foil bag and stored at ambient temperature (25-28°C) until used. Twelve formula of FSPs were prepared by mixing 40 or 50% (w/w) dried fish powder with MSG (0 or 10%, w/w) and 40 or 50% (w/w) mixed dried ingredients including salt, sugar, garlic powder, pepper powder and ginger powder (Table 1). FSPs were subjected to analyses for proximate composition, a_w, colour (L^*, a^* and b^* value), DPPH-radical scavenging activity, solubility and overall acceptability.

Table 1. Formula composition of FSPs.

Formula	Fish species	Fish powder (%)	MSG (%)	Mixed seasoning ingredients (%)
1	Imbricated stingray	50	0	50
2	Imbricated stingray	50	10	40
3	Imbricated stingray	40	10	50
4	Oxeye scad	50	0	50
5	Oxeye scad	50	10	40
6	Oxeye scad	40	10	50
7	Ornate threadfin bream	50	0	50
8	Ornate threadfin bream	50	10	40
9	Ornate threadfin bream	40	10	50
10	Red tilapia	50	0	50
11	Red tilapia	50	10	40
12	Red tilapia	40	10	50

Methods

Compositional analysis

Protein, ash, fat and moisture contents of FSPs were determined according to the methods of AOAC [8].

Determination of a_w

The a_w of FSPs was determined using a CX2, AquaLab (Decagon Devices, Inc. USA).

Determination of colour
The colour of FSP was determined by measuring a* (+red to –green component) and b* (+yellow to –blue component) values using a colorimeter (Juki Corp, Tokyo, Japan). Samples were placed into a 5-cm diameter glass petri dish and illuminated with D65-artificial daylight (10° standard angle).

Determination of DPPH radical-scavenging activity
DPPH radical-scavenging activity was determined according to the method of Yen and Hsieh [9] with slight modification. To 1 g of FSP, 10 ml of distilled water was added. The mixture was homogenized at 13,500 rpm for 1 min at room temperature (25-28°C) and centrifuged at 3,000 *x*g for 20 min at room temperature. The supernatant with 40-fold dilution was subjected to analysis of DPPH-radical scavenging activity. To 400 µl of water soluble fraction of FSP samples, 2 ml of 0.12 mM DPPH in methanol was added. The mixture was then mixed vigorously and allowed to stand at room temperature in the dark for 30 min. The absorbance of mixtures was measured at 517 nm using a UV-1601 spectrophotometer. The control was prepared in the same manner except that deionized water was used instead of samples. The blank was conducted in the same fashion but deionized water was used instead of DPPH solution. DPPH radical-scavenging activity was calculated as follows:

$$\text{Radical scavenging activity (\%)} = [1-(A_{sample}/A_{control})] \times 100$$

Solubility measurement
Five grams of FSP were added to 100 ml of hot distilled water (80°C) in a temperature-control water bath with continuous stirring. The time consumed for complete solubilization, indicated by the clarity of solution after heating, was monitored. However, the tiny debris of garlic, ginger and pepper might be found in the clear solution.

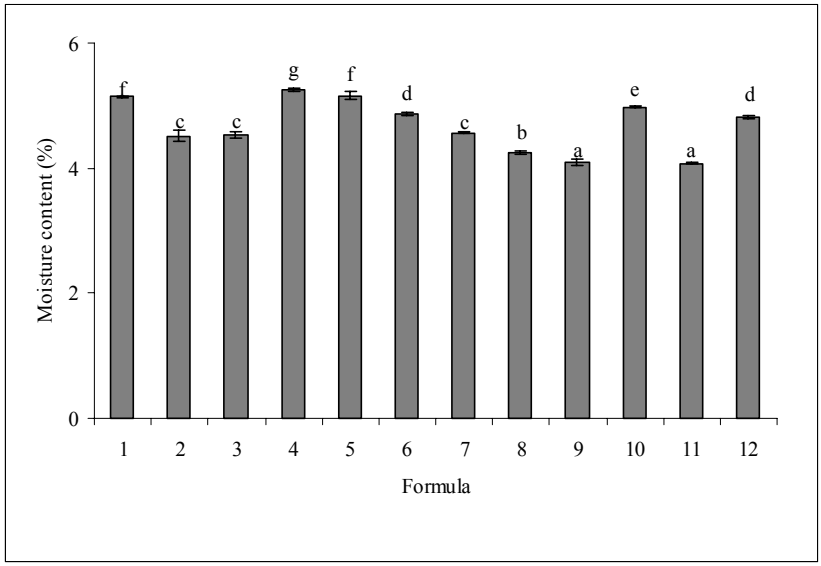
Sensory evaluation
FSPs were evaluated for acceptance by an untrained 30-member panel. The panelists were under-graduate students in Food Technology program of age ranging from 19 to 21 years, School of Agricultural Technology, Walailak University. A nine-point hedonic scale, in which a score of 1 = dislike extremely, 5 = neither like nor dislike and 9 = like extremely, was used for evaluation [10]. The panelists evaluated each sample for overall liking from both original FSPs and stirred fried cabbage made by adding FSPs.

Statistical analysis
Data were subjected to analysis of variance (ANOVA). Comparison of means was carried out by Duncan's multiple-range test [11]. Statistical analysis was performed using the Statistical Package for Social Science (SPSS 8.0 for Windows, SPSS Inc., Chicago, IL).

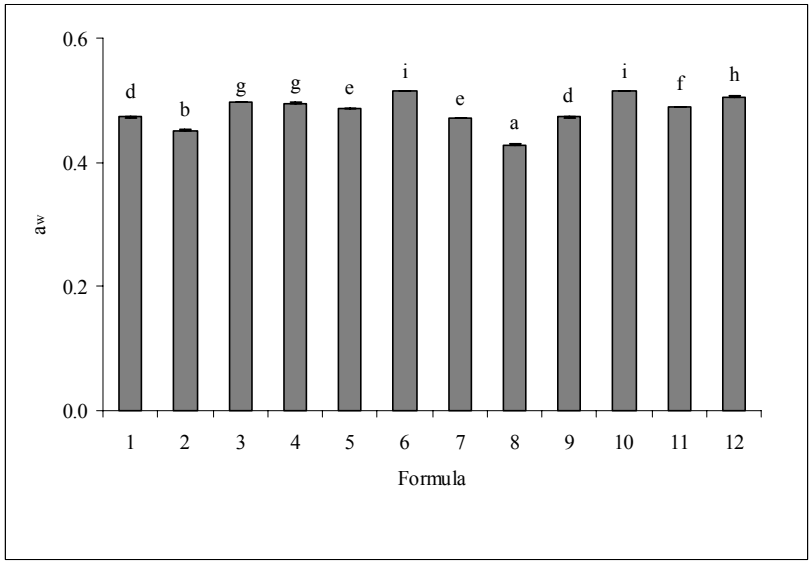
Results and Discussion

Proximate composition, a_w and colour of FSPs
The moisture contents (Fig. 1A) and a_w (Fig. 1B) of all FSPs were found in the ranges of 4.08-5.16 and 0.43-0.52, respectively. The a_w of all FSPs was in agreement with Thai Industrial Standard [12] in which the value of not over 0.65 is required. The protein content of all FSPs was approximately 25-50%, depending on fish species and formula composition. From the result, the highest protein content was observed in the formula of 50% oxeye scad with 10% monosodium glutamate (MSG) and 40% mixed ingredients (formula 5) and the formula of 50% ornate threadfin

bream with 50% mixed ingredients (formula 7) ($p<0.05$; Fig. 1C). Lipid and ash contents of FSPs are depicted in Fig. 2A and 2B, respectively. All formulae of FSPs exhibited a low content of lipid (not over 5%) (Fig. 2A) and ash (1.08-1.38%) (Fig. 2B). *L**, *a** and *b** values of FSPs are shown in Fig. 3A, 3B and 3C, respectively. The FSP produced from 50% red tilapia with 10% MSG and 40% mixed ingredients (formula 11) possessed the highest *b** value ($p<0.05$). This might be due to the highest formation of brown pigment generated in this FSP via Maillard reaction or other colour reactions. *L** and *a** values of all FSPs were found in the ranges of 60.82-70.68 and 0.81-2.57, respectively. Generally, the FSPs made from red tilapia powders (formula 10, 11 and 12) tended to have the highest *a** and *b** values indicating the dark brown colour of these FSPs. The red and yellow colour compounds could occur in FSPs produced from red tilapia to the highest extent compared with those from other fish species.



(A)



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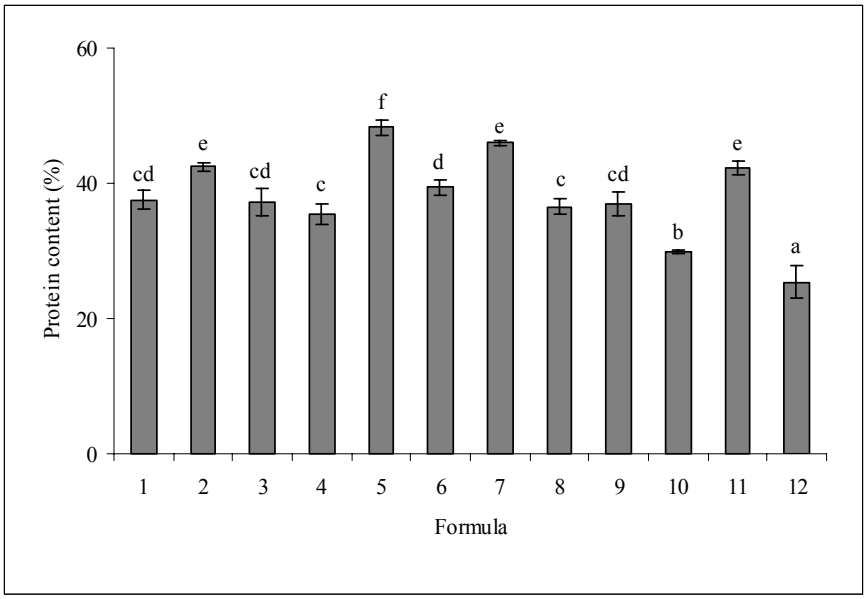
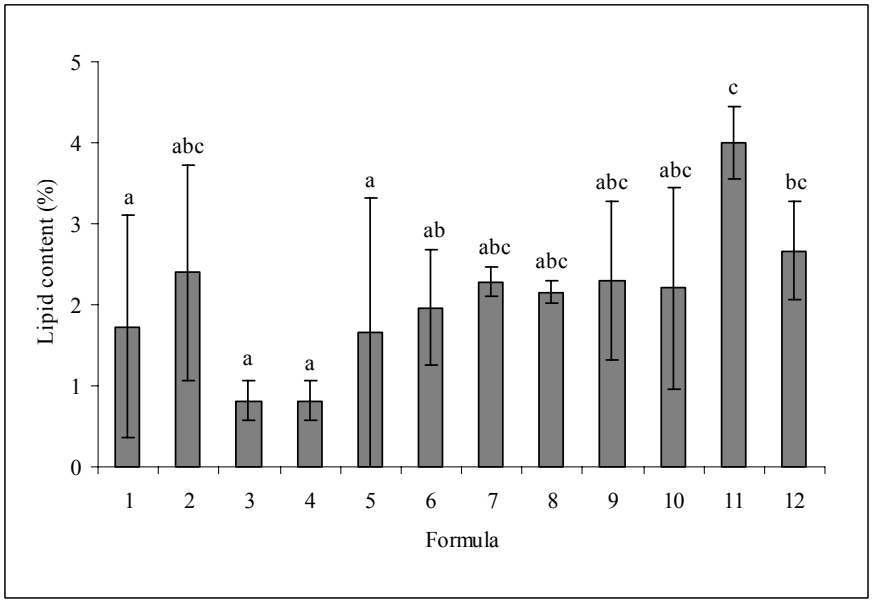
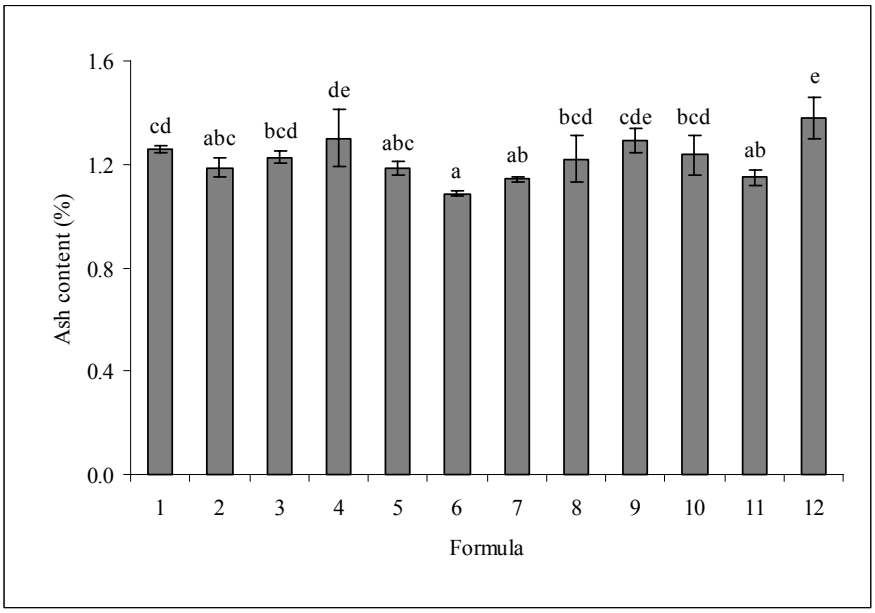


(C)

Figure 1. **Moisture content (A), ^{aw} (B) and protein content (C) of FSPs.**
Bars represent the standard deviation from triplicate determinations.
Different letters indicate significant differences ($p<0.05$).

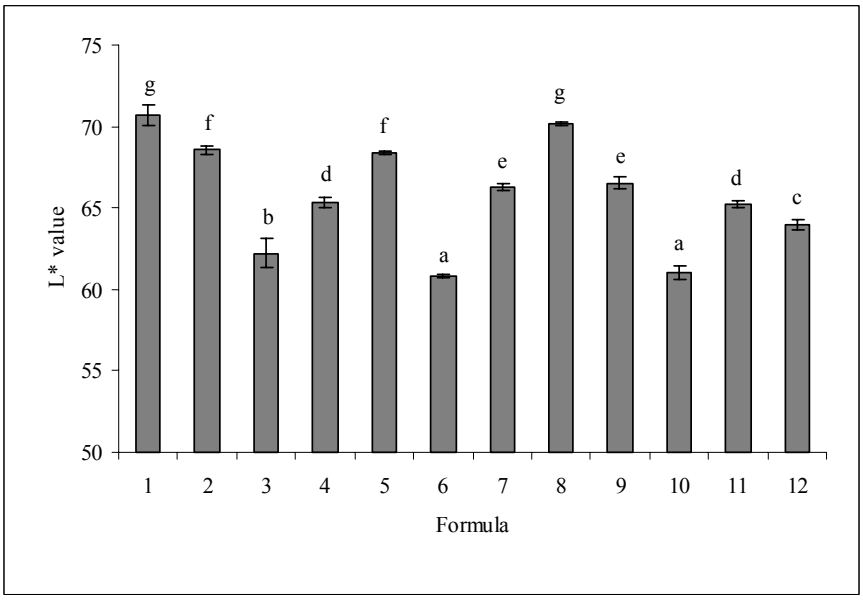


(A)

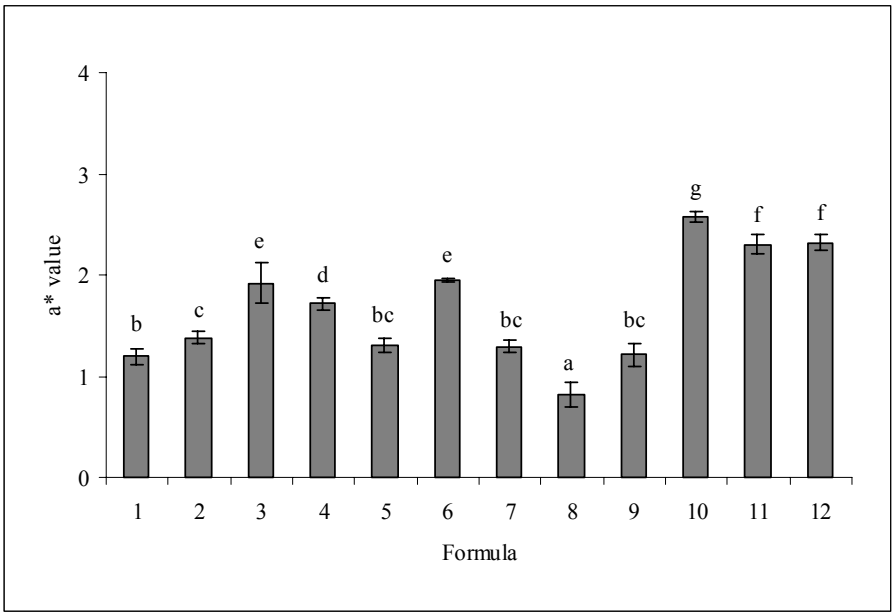


(B)

Figure 2. **Lipid (A) and ash (B) contents of FSPs.**
Bars represent the standard deviation from triplicate determinations.
Different letters indicate significant differences ($p<0.05$).



(A)



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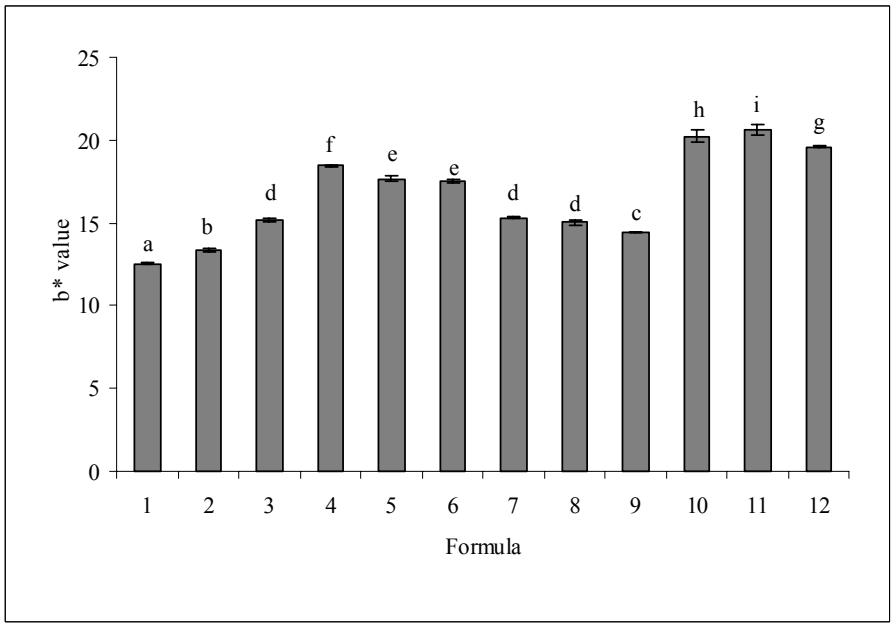


(C)

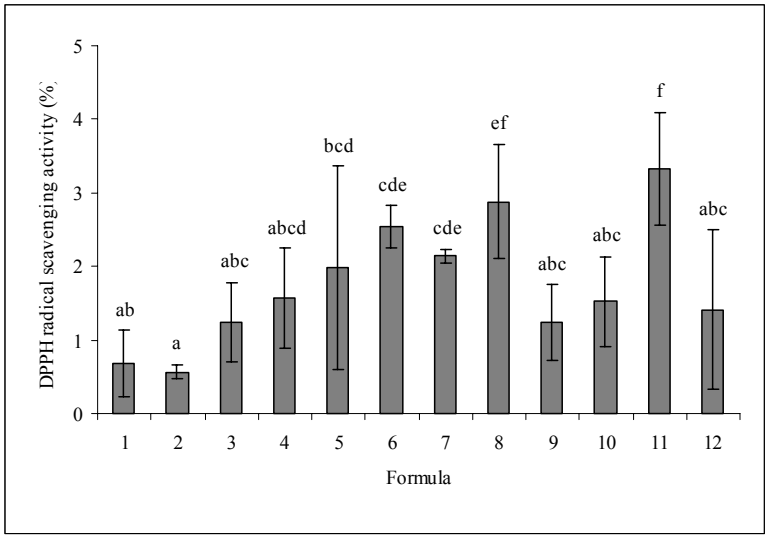
Figure 3. **The *L** (A), *a** (B) and *b** (C) values of FSPs.**
Bars represent the standard deviation from triplicate determinations.
Different letters indicate significant differences ($p<0.05$).

Antioxidant activity, solubility and overall acceptability of FSPs

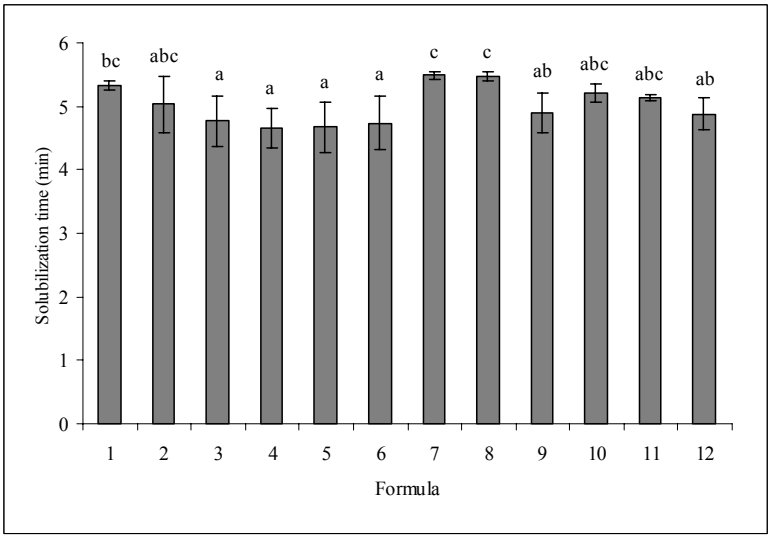
The DPPH° scavenging activity of FSPs is depicted in Fig. 4(A). The FSP produced from 50% red tilapia with 10% MSG and 40% mixed ingredients (formula 11) possessed the highest DPPH° scavenging activity ($p<0.05$). The result indicated that this FSP can terminate the free-radical induced lipid oxidation itself during storage to some extent. As a consequence, the highest oxidative stability during storage should be found in this formula. The highest antioxidant activity was in agreement with the highest *b** value found in this formula (Fig. 3C). This FSP might contain the greatest number of antioxidant compounds derived from Maillard reaction. Maillard reaction products (MRPs) have been shown to possess antioxidant activity *in vitro*, *in vivo* and in food systems [13]. It was considered that the electron donor, the chelating properties for metals

and the reducing properties of melanoidins are the main causes for the antioxidative effect of MRPs [13]. From the results, the antioxidant activity of FSPs was not only affected by MRPs generated, but other active compounds such as fish peptides and some seasoning ingredients also influenced the antioxidative activity. These active compounds might have different contents in the different formulas.

Solubility of FSPs is shown in Fig. 4(B). From the result, all FSPs were completely solubilized (5% (w/v) in water, 80°C) within 5 min. Solubility is often considered to be a prerequisite for the performance of a protein in food applications. Therefore, these FSPs can be applied to several food commodities including soup and stirred fried food. Sensory evaluation revealed that the FSP produced from 40-50% red tilapia with 10% MSG and 40-50% mixed ingredients (formulas 11 and 12) showed the highest overall acceptance score ($p<0.05$) (Fig. 4C).



(A)



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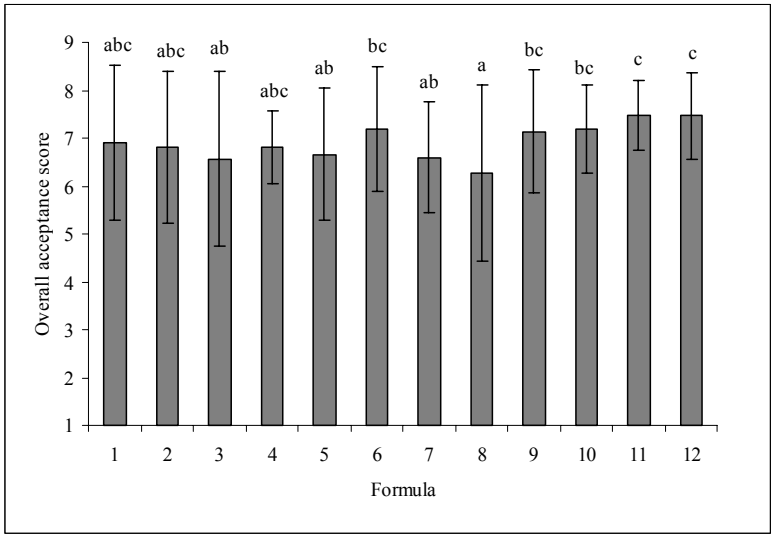

(C)

Figure 4. **Antioxidant activity (A), solubility (B) and overall acceptability (C) of FSPs.**
Bars represent the standard deviation from triplicate determinations for A and B and from 30 determinations for C. Different letters indicate significant differences ($p<0.05$).

Conclusion

All FSPs showed proximity in composition and characteristics. However, the optimum formula for FSP production was 50% dried red tilapia powder with 10% MSG and 40% mixed ingredients because this formula exhibited the highest antioxidant activity with the highest overall acceptability.

Acknowledgments

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References

1. Panpipat, W., Kantungkul, T., Rahethan, P. and Chaijan, M. (2009). Production of high calcium seasoning powder. Proceedings of the 11th Agro-Industrial International Conference, BITEC, Bangkok.

2. Panpipat, W., Kantungkul, T., Rahethan, P. and Chaijan, M. (2009b). Quality changes of high calcium seasoning powder during storage. Proceedings of the 11th Agro-Industrial International Conference, BITEC, Bangkok.

3. Venugopal, V. (2009). Marine products for healthcare: functional and bioactive nutraceutical compounds from the ocean. CRC Press, New York.

4. Venugopal, V. and Shahidi, F. (1996). Structure and composition of fish muscle. ***Food Research International,*** 12; 175-197.

5. Huda, N., Abdullah, A. and Babji, A.S. (2001). Functional properties of surimi powder from three Malaysian marine fish. ***International Journal of Food Science and Technology,*** 36; 401-406.

6. Venugopal, V., Chawla, S. P. and Nair, P. M. (1996). Spray dried protein powder from threadfin bream: preparation, properties and comparison with FPC type-B. ***Journal of Muscle Foods,*** 7; 55-71.

7. Mjos, S.A. and Solvang, M. (2006). Patterns in volatile components over heated fish powders. ***Food Research International,*** 39; 190-202.

8. AOAC (2000). Official Methods of Analysis (16th ed). Association of Official Analytical Chemists. Washington, D. C.

9. Yen, G.C. and Hsieh, P.P. (1995). Antioxidative activity and scavenging effects on active oxygen of xylose-lysine Maillard reaction products. ***Journal of the Science of Food and Agriculture,*** 67; 415-420.

10. Chamber, E. and Wolf, M.B. (1996). Sensory testing methods (2nd ed.). American Society for Testing and Materials, Philadelphia.

11. Steel, R.G.D. and Torrie, J.H. (1980). Principle and procedure of statistics; a biometrical approach (2nd ed.). MacGraw-Hill, New York.

12. Thai Industrial Standards. (2004). Seasoning powder (TCPS 494/2547). Thai Industrial Standards Institute, Ministry of Industry (in Thai).

13. Chuyen, N.V., Ijichi, K., Umetsu, H. and Moteki, K. (1998). Antioxidative properties of products from amino acids or peptides in the reaction with glucose. In: Process-induced chemical changes in food. Shahidi, F., Ho, C. T. and Chuyen, N. V. (eds). Plenum Press, New York, p. 201-212.