EFFECT OF PRE-EMULSIFIED FAT FROM SOY PROTEIN HYDROLYSATE ON QUALITIES OF CHICKEN EMULSION SAUSAGE

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Abstract - Fat is an important ingredient for emulsion sausage, it affects emulsion stability, flavor, texture and acceptability. Pre-emulsified fat (PEF) from vegetable oil has been studied using as animal fat substitution in meat product due to health concern and possibly be another choice for halal food. This work conducted on comparing 3 different fat sources; 1) PEF from soy protein hydrolysate (PEF-SPH), 2) sunflower oil and 3) chicken skin on qualities of sausages. Physical properties eg. total expressible fluid (TEF), water holding capacity (WHC), cooking loss and color were analyzed as well as some chemical compositions and sensory evaluation. The sausage made by PEF-SPH showed higher emulsion stability since it had less TEF and cooking loss but higher in WHC. The texture of sausage had less hardness than those produce from chicken skin, but higher than the sunflower oil treated. Comparing of sensory evaluation using 7-point hedonic scale, the PEF-SPH added had the highest overall liking score 6.28. The other benefit of the sausage made from PEF-SPH was the lowest fat content of 6.17% and there was no suspicious ingredient for the Halal food application. Thus, it can be another choice of low fat meat product and Halal food production.

Key words - emulsion sausage, pre-emulsified fat, protein hydrolysate, low fat sausage

I. INTRODUCTION

An alternative fat source in meat product has been interesting for the product development. Pre-emulsified fat (PEF), a vegetable oil homogenized with water and emulsifier, can be used as fat substitution in an emulsion sausage for low fat meat product and Halal food since it does not contain suspicious substances. However, our previous work (Pakdeechanuan and Saowapak 1) showed that the PEF prepared from soy protein concentrate (SPC) had the low emulsion capacity and stability and was improved by hydrolysis the protein with papain enzyme in a certain degree of hydrolysis. Thus, this work was aimed to investigate the application of PEF from soy protein hydrolysate (PEF-SPH) in the chicken emulsion sausage compared to sunflower oil and chicken skin. Some physical properties, textural properties and chemical composition of the sausages were analyzed.

II. MATERIALS AND METHODS

Soy protein hydrolysate preparation
Soy protein concentrate was hydrolyzed by 0.2% of papain (w/w) (EC number: 3.4.22.2, activity >30,000 USP units/mg, Merck, Germany) for 40 min and then stop the reaction by heated at 95^{O}C for 5 min. The hydrolysate had a degree of hydrolysis 7.25%, Surface hydrophobicity 12.54, Emulsion Stability Index 28.3 min and Emulsifying activity index 4.95 m^2/g (Pakdeechanuan and Saowapak 1).

Pre-emulsified fat preparation
Pre-emulsified fat was produced from soy protein hydrolysate (SPH), sunflower oil and K-carrageenan at 4%, 62% and 1%, respectively. All ingredients were homogenized at 9,000 rpm for 6 min in a Homogenizer (Nissei, AM-8, Japan)

Sausage preparation
Three different fats; PEF-SPH, sunflower oil and chicken skin were used to prepare chicken emulsion sausage. All formulations were prepared with the same ingredients; 51.5% raw chicken meat, 26% added fat, 22% ice, 3.5% spices, 1.2% salt and 0.2%

mixed phosphate (modified from Sallam *et al*. 2).

Measurements

Total expressible fluid (TEF) and water holding capacity of sausages were analyzed according to the method of Aktas and Gençcelep (3) and Lin and Huang (4) by using centrifugation methods. Cooking loss was measured by the method of (Crehan and Hughes (5). Color of sausages were measured by Hunterlab chromometer (Kayaard and Gok 6) reported in L*, a* and b* value. The textural properties were evaluated using texture analyzer (TA, TA-XT2i) measured the textural profile analysis (TPA) according to method of Braipson-Danthine and Deroanne (7). Protein, fat and moisture content were analyzed using AOAC (8) method. Sensory evaluation was done by using 7-point hedonic scale with 40 panelists. Micrographs of the sausage samples were taken with a scanning electron microscope (JSM -5800LV, JEOL, Japan) according to method of Andrés *et al*. (9).

Statistical analysis

All data were subjected to analysis of variance (ANOVA). Significant differences between the treatments were analyzed by Duncan's multiple range test (DMRT) at a 5% probability level ($p < 0.05$).

III. RESULTS AND DISCUSSION

The pre-emulsified fat obtained in this study was white, high viscosity paste and consistency (Figure 1.). It had 0% TEF and 1.43 N in hardness when analyzed with texture analyzer. Addition of the PEF-SPH in sausage formulation compared to sunflower oil and chicken skin showed differences of TEF, water holding capacity, and cooking loss of the sausages (Table 1.). The PEF-SPH adding had less TEF and cooking loss ($p < 0.05$) and high in water holding capacity ($p < 0.05$). This could conclude that the PEF-SPH added had higher emulsion stability and capacity than those prepared from other fat sources.

The color of sausages reported as L*, a* and b* also showed a significantly different particularly the L* value. Sausages made from chicken skin had significantly less L* but higher b* means the sausage was darker than those made from vegetable oil both the sunflower oil and the PEF-SPH. This was because of pigments in chicken skin eg. carotenoids (Kim *et al*. 10; Sirri *et al*. 11). It showed the color difference in visual observing as well.

Figure 1 Pre-emulsified fat from soy protein hydrolysate

Hardness, cohesiveness and springiness of the sausage had slightly different among treatments. The sausage with chicken skin added had the texture firmer than those from PEF-SPH and oil added. Proximate analysis of fat, protein and moisture content showed significantly different among types of fats. The sausage prepared from PEF-SPH had 6.17% fat, less than those prepared from chicken skin (8.49% fat) and sunflower oil (16.08% fat). Sensory evaluation showed the emulsion chicken sausage prepared from the PEF-SPH was rated highest amongst the samples ($p < 0.05$) on overall liking.

The microstructures of the sausages were determined using a scanning electron microscope (SEM) and presented in Figure 2. The sausage produced from sunflower oil showed some large oil droplet in emulsion structure, whereas the sausage made from chicken skin could observe some connective tissue all over the sample which was a reason of a slightly higher hardness than other treatments. The micrograph of PEF-SPH treated found some small droplet of oil and quite more consistent. This might explain why the TEF and cooking loss of the sausage was low when compared to others. Comparing to our previous work (Pakdeechanuan and Saowapak 1), the micrograph of sausage made from PEF (not a

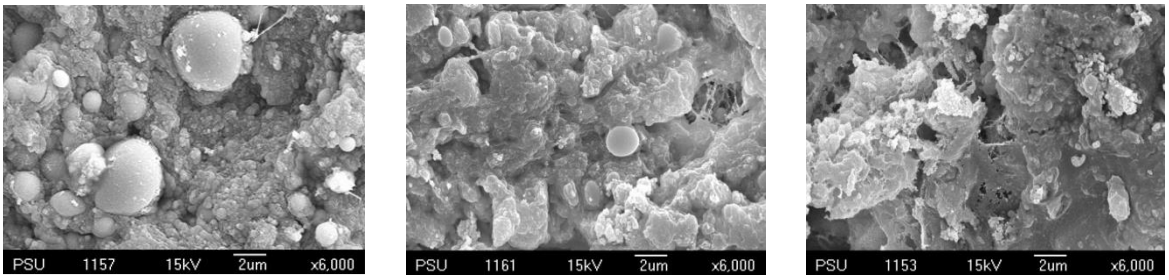
hydrolysate but added k-carrageenan) had less consistency than the PEF-SPH in this study. In addition, it had less of some physical properties related to sausage qualities as well. The PEF-SPH in this study showed higher effective to support emulsion system and acceptable to use in emulsion sausage.

Table 1 Some properties of chicken emulsion sausage produced from different source of fat

	Fat sources		
	Sunflower oil	PEF-SPH	Chicken kin
TEF (%)	11.56 ± 0.38[b]	3.74 ± 0.35[c]	18.90 ± 0.54[a]
WHC (%)	89.97 ± 0.44[b]	92.10 ± 0.33[a]	89.20 ± 0.29[c]
Cooking loss (%)	10.65 ± 0.97[a]	9.24 ± 0.94[b]	11.34 ± 1.04[a]
L*	87.78 ± 0.18[a]	87.20 ± 0.15[b]	80.03 ± 0.30[c]
a*	1.84 ± 0.08[a]	1.88 ± 0.06[a]	1.66 ± 0.10[b]
b*	12.52 ± 0.34[b]	12.60 ± 0.21[b]	17.17 ± 0.18[a]
hardness (N)	2.71 ± 0.06[b]	2.68 ± 0.11[b]	2.94 ± 0.15[a]
cohesiveness	0.86 ± 0.05[c]	1.03 ± 0.07[b]	1.41 ± 0.08[a]
springiness	1.25 ± 0.02[c]	1.36 ± 0.06[b]	1.51 ± 0.07[a]
Protein (%wb)	11.36 ± 0.20[c]	12.30 ± 0.21[b]	14.09 ± 0.28[a]
Fat (%wb)	16.08 ± 0.43[a]	6.17 ± 0.22[c]	8.49 ± 0.34[b]
Moisture (%)	57.30 ± 0.10[c]	67.40 ± 0.41[b]	70.23 ± 0.78[a]
Appearance*	5.60 ± 0.50[b]	6.25 ± 0.54[a]	5.65 ± 0.48[b]
Overall liking*	5.58 ± 0.50[b]	6.28 ± 0.60[a]	5.75 ± 0.60[b]

PEF-SPH = Pre-emulsified fat from soy protein hydrolysate
* sensory evaluation using 7-point hedonic scale
[a-c] Different letters in the same row indicate significant differences ($p < 0.05$) in the Duncan's multiple range test.

Figure 2 Scanning electron micrograph of chicken emulsion sausage from different fat sources



A. sunflower oil B. PEF-SPH C. chicken skin.

PEF-SPH = Pre-emulsified fat from soy protein hydrolysate

IV. CONCLUSION

Three different types of fat; 1) pre-emulsified fat from soy protein hydrolysate (PEF-SPH), 2) sunflower oil and 3) chicken skin were studied their effect on the qualities of emulsion sausage. The PEF-SPH was obviously support emulsion stability and capacity of the chicken sausage better than other fats since the sausage made from this fat had less total expressible fluid and cooking loss but higher in water holding capacity. In addition, the sausage with PEF-SPH added had the lowest fat content of 6.17%. Therefore, the PEF-SPH was possible to use in low fat sausages and also in Halal products since it is made from plant component not contain suspicious animal fat.

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