Proximate and Physical Characteristics of Cookies Made of Cassava Starch and Wheat Flour Blends Containing Soymilk Waste Powder

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Abstract: Blends of cassava starch (CS) and wheat flour (WF) containing soymilk waste powder (SWP) were prepared using gelatinization process for cookies dough, and then baked in the presence of 10% margarine, 1% cane sugar, and 0.1% table salt. It was found that after cookies baking, optimum composition of cookies possesses comparable disintegration time with that of control (fresh wheat flour) was obtained when used weight ratio of CS/WF/SWP = 60/40/20. It was also found that increase fibre and protein as well as other nutrition contents in the cookies dough have been revealed when compared to that of standard cookies using fresh wheat four. DSC analysis of cookies sample containing SWP showed addition of exothermic temperature peak due to decomposition of SWP. SEM micrograph of cookies sample containing SWP showed bigger granules due to aglomeration of SWP covered with CS/WF matrix.

1 INTRODUCTION

Cookies are food products that are baked and made of flour, sugar, fat, and eggs with a moisture content less than 4% and can be stored for a long time, (4-6 months). Cookies have a small shape and will run out in two bites, usually used as snacks, and its texture is less dense, dry, and crispy. Flour as main ingredient of cookies can be varied using various source of natural flours, but quality of the cookies depends on type of flour used (Saeed et al., 2012). Before baking process all ingredients of cookies are blended as a dough with addition of various enzymes (Panghal et al., 2011). Cookies ingredients, such as flour and egg have been replaced with gluten free replacers and affecting physicochemical and sensory properties of the cookies (Julianti et al., 2016).

Cassava (Manihot Esculenta Crantz), has been long cultivated in Indonesia but not been used intensively as main and staple foods, due to its lower preference and considered as cheap and low quality of food products. However, nutritional content of cassava has been reported suitable for various food products (Oluwaseun et al., 2015). Budijanto and Yuliana (2015) have reported food diversification in Indonesia to reduce imported food raw materials. Whereas Anggraini, et al., have characterised blends of casava flour, red sweet potato and carrot powders for alternative food raw materials (Anggraini et al, 2016).

On the other hand, soybean powder has been utilised as alternative staple food ingredient to improve protein content (Tharise et al., 2014). In this, work, cassava starch (CS) and wheat flour (WF) with addition of soymilk waste powder (SWP) have been blended as dough for cookies products. Main objectives of this works is utilised cassava starch (CS) and soymilk waste powder (SWP) to reduce use of imported wheat flour (WF) as well as to improve nutrition (protein and fibre contents) for alternative cookies dough.

2 METHOD

In this works soymilk waste powder (SWP) were collected from soymilk home industries in Percut Sei Tuan, Deli Serdang, Sumatera Utara, vacuum dried, milled and shieved to 80 mesh powder size. Preparation of cookies samples was based on gelatinisation process reported by previous researchers (Julianti et al., 2016; Panghal et al., 2011; Saeed et al., 2012). Whereas further blending of the cookies dough were carried out in a

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single screw extruder similar to that used for blending of thermoplastic materials (Ismail et al., 2002 and Wirjosentono et al., 2004), at constant temperature of 80ºC. Whereas Mishra, et.al. (2012) have used extrusion technology for preparation of rice analogous. Weight ratio of casava starch and wheat flour was maintained constant at (CS/WF = 60/40), whereas loading of SWP were varied (0, 15, 20, and 25 phm: per hundred matrix), in the presence of margarine, cane sugar, and table salt (10, 1, and 0.1 phm, respectively). Moreover, cookies samples and control were prepared by baking the related dough in a constant temperature oven at 150ºC, for 15 minutes. Optimum composition of cookies sample was taken from its disintegration time in water and boiling water (30, and 100ºC), compared to that of control without SWP. Proximate analysis of cookies includes water (%), fat (%), fibre (%), carbohydrate (%), and protein (%) contents. Thermal and morphological characteristics of cookies samples were carried out using differential scanning calorimeter and scanning electron microscopy (DSC and SEM).

3 RESULTS AND DISCUSSION

3.1 Preparation of Cookies Made of Cassava Starch (CS) and Wheat Flour (WF) with Various Loading of Soymilk Waste Powder (SWP)

Results of disintegration time of cookies samples measured in cold water (30ºC) and boiling water (100ºC) were shown in Table 1. It was shown that addition of cassava starch in wheat flour blends increased disintegration times of cookies samples both in cold and boiling waters, which due to formation of cassava starch gelatin. However, when the blends were added with SWP their disintegration times were decreased again because of that the SWP absorbs more water than the CS/WF blends do. Therefore optimum composition of cookies sample possesses comparable disintegration time with that of control cookies (made of 100 % WF) is that made of CS/WF/SWP: 60/40/20, (Cookies sample B).

3.2 Proximate Analysis of Cookies Samples

Data of proximate analysis of cookies samples (CS/WF/SWP) containing various loading of SWP: 0, 15, 20, and 2 phm) were shown in Table 2.

Table 1: Composition of cookies dough samples (phm unit: per hundred matrix) at various loading of SWP (soymilk waste powder: 0, 15, 20, 1nd 25 phm).

No	Cookies Sample	Disintegration time (min)	
		Cold water (s)	Boiling water (s)
1	Control CS/WF/SWP 0/100/0	36	16
2	Cookies A CS/WF/SWP 60/40/15	49	29
3	Cookies B CS/WF/SWP 60/40/20	37	17
4	Cookies C CS/WF/SWP 60/40/25	25	11

It was shown that their water contents were improved (from 3.2 – 5.9%) when loading of SWP was increased, which may be due to that the SWP contribute to high water absorption capacity compared to other ingredients. In the case of fat content, however, did not show any considerable changes due to the SWP also did not possesses high fat content. Interestingly, carbohydrate contents of cookies samples decreased (from 9.6 – 4.2 %) although the fibre contents also decreased slightly (from 85.08 – 80.97 %), whereas the protein increased significantly (from 1.9 – 8.7 %). Therefore, it is revealed that addition of soymilk waste powder (SWP) as raw material for cookies samples has improved nutrition contents of the cookies samples.

Table 2: Proximate analysis data (water, fat, carbohydrate, fibre and protein contents) of cookies samples at various loading of soymilk waste powder (SWP: 0, 15, 20, 25 phm).

Code	Carbohydrate (%)	Fat (%)	Protein (%)	Fibre (%)
Control	9.6	0.22	1.9	85.08
A	7.1	0.28	4.4	83.92
B	6.6	0.24	7.3	80.36
C	4.2	0.26	8.7	80.94

3.3 Differential Scanning Calorimetry (DSC) Analysis

Figure 1 is DSC thermogram of cookies sample containing (CS/WF/SWP: 60/40/20, Sample B), which showed endothermic peak of water evaporation at 108.41ºC (peak start at 67.82ºC and end at 154.25ºC). In addition, the thermogram also showed two exothermic peaks of thermal decomposition of the cookies sample at, (start at

270.46ºC end at 287.59ºC) and at peak 302.06ºC (start at 275.07ºC end at 319.64ºC). The first exothermic peak (275.07ºC) representing decomposition of CS/WF blend, whereas the later (302.06ºC) is due to decomposition of SWP, and in which at 319.64ºC all the cookies constituents have been burnt completely.

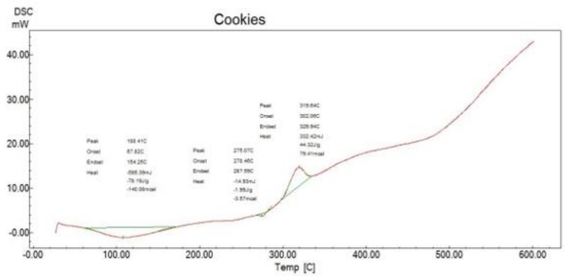

Figure 1: DSC thermogram of cookies sample containing (CS/WF/SWP: 60/40/20, Sample B).

When compared to that of cookies control made of (WF only) he DSC thermogram (Figure 2) also exhibited endothermic peak at 108.41ºC (start at 67.82ºC and end at 154.25ºC) due to evaporation of its water content. In this case single exothermic peak was observed at 269.73ºC (starts at 262.47ºC, end at 271.51ºC), which represents decomposition of the CS/WF blend.

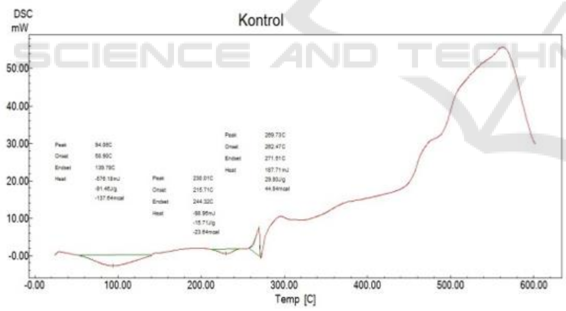

Figure 2: DSC thermogram of cookies control made of wheat flour only.

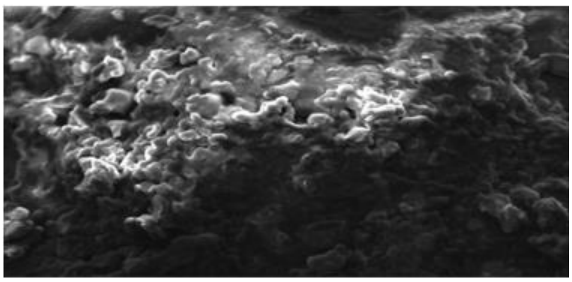

Figure 3: Surface SEM micrograph (magnification 1000x) of cookies sample (CS/WF: 60/40) with the addition of soymilk waste powder (SWP: 20phm).

4 CONCLUSIONS

Optimum composition of cookies sample posseses comparable disintegration time with that of control cookies (made of 100 % WF) is that made of CS/WF/SWP: 60/40/20, (Cookies sample B). Interestingly, optimum cookies sample has improved nutrition cantents: carbohydrate contents decreased (from 9.6 – 4.2 %) although the fibre contents also decreased slightly (from 85.08 – 80.97 %), whereas the protein content increased significantly (from 1.9 – 8.7 %). DSC thermograph of the optimum cookies sample showed two exothermic peaks, first at 275.07ºC (representing decomposition of CS/WF blend) and at 302.06ºC (due to decomposition of SWP). Surface SEM micrograph of optimum sample showed bigger granules due to SWP fibres interact well physically and covered with the CS/WF matrix

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