Research article

Analysis of Requisite Quality of Cassava and Temperature for Baking Cookies

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Received 16 December 2012 Accepted 10 June 2013 (*Corresponding Author)

Abstract Cookies are a kind of food product made from flour and other ingredients such as butter, egg, sugar, milk, and baking soda. This research was conducted to find the optimum temperature and the optimum proportion of cassava flour required in cookie production. The experiment was divided into nine treatments with three replications, different temperatures included 160 °C, 170 °C ; 180 °C and proportions of cassava flour trialed were 50 %, 75 %; 100 %. The processing and sensory testing were conducted in the food processing laboratory of the Faculty of Agro-Industry, Royal University of Agriculture (RUA) while the analysis of chemicals was done in the Industrial Laboratory Centre of Cambodia (ILCC). The results show that using 50%, 70% and 100% 5 % and 100 % of cassava flour at the temperature of 160 °C, 170 °C and 180 °C affected the chemical properties of cookie products such as ash, moisture, protein, fat, sugar, carbohydrate, and energy. Also, they affected the color, texture, odor, as well as flavor and crispness, factors which all related to consumers identifying cookies as their favorites. Among nine treatments, the second treatment which used 50% of cassava flour at the temperature of 170 °C was the best treatment; whereas, the ninth treatment which used 100% of cassava flour at the temperature of 180 °C had the lowest quality. Therefore, results show that 50 % of cassava flour baked at the temperature of 170 °C for 8 minutes is the optimum configuration to use in cookie production.

Keywords processing, temperature, sensory test, cassava, cookies

INTRODUCTION

Cassava is a kind of plant that mostly grows in tropical area in South America. The root of Cassava has poisonous substances, but the rest of the plant is edible and provides a lot of essential nutrients. Cassava is rich in Carbohydrate and low lipids that play a role in providing energy to the human body. Energy from Cassava is related to the density of calories, where 100 gram provides 160 calories (Willett, 2005). Cassava is known and grown by Cambodian farmers since 19th century. It was grown for starch production for commercial purpose, livestock feed and used for human.

Before 1970, this crop was planted in small areas, especially on black soil, along the river, and upland areas and red soil in some areas of the country.

Between 1975 and 1979, this crop becomes a staple, and people eat cassava instead of rice. This is a very popular crop among farmers in southeastern and eastern areas of the country, especially for people living in upland areas. However, some farmers living in lowland areas also grow this crop on the space around their house, and they consume it as their food (MAFF, 2003).

The cassava yield increased from 535,600 tons in 2005 to 2 million tons in 2007. This is the result of increasing lands for growing cassava crops. Cassava was planted on 30,000 hectares in 2005 and 1,000,000 hectares in 2007 and the yield rose from 17.9 tons/ha to 20.5 tons/ha (CIAT, 2008). Cassava has an important role in the development of rural areas because it is the raw material in industrial productions such as animal feed, starch, ethanol, bioethanol and other food processes in bakery production, such as ice cream, cakes, and biscuits (Willett, 2005).

OBJECTIVE

This research was aimed at finding the optimum temperature and the amount of cassava flour required in cookie production.

METHODOLOGY

Study site

This research included processing cookies, analyzing chemical contents and sensory testing and was conducted at the laboratory of the faculty of Agro-Industry, Royal University of Agriculture (RUA). The analysis of chemical contents in processed cookies was done at the Industrial Laboratory Centre of Cambodia (ILCC), Phnom Penh, while the sensory test was done at RUA. The research study was conducted between May and August, 2012.

Experimental design and treatments

The factorial Complete Randomized Design (CRD) was used in this experimental method; there are three factors including temperature (160ºC, 170 ºC and 180 ºC), cassava flour (50%, 75% and 100%), and wheat flour (50% and 25%) as shown in table 1.

Table 1 Divisions of experimental treatments

Treatments	Temperature (ºC)	Cassava flour (%)	Wheat flour (%)
T_1	160		
T_2	170	50	50
T_3	180		
T_4	160		
T_5	170	75	25
T_6	180		
T_7	160		
T_8	170	100	00
T_9	180		

Raw materials of the cookies were cassava flour, wheat flour, sugar, egg, butter, baking soda, blue berries and milk. 11% of egg white was mixed by a hand mixer and then 31. 25% of butter was added in the egg port. 31. 25% of sugar, 6.25% of milk, 16% of blue berries and 1% of baking soda were subsequently mixed in the egg and butter port. The cassava flour and wheat flour were added and compressed into cookie dough 1 cm thick before baking in the oven for eight minutes in each temperature that had already been set. Noticeably, before using the oven, it needed to be

heated 250 ºC for 20 minutes. Taken out from the oven, the cookies were placed on the tray in ambient temperature for 10 minutes before packing in a plastic bag.

Chemical analysis

After getting the processed cookies, all were taken to test chemical contents such as ash, energy and sensory test (color, texture, odor, flavor and crisp). Recorded data was organized for analysis using Microsoft Excel to specifically determine comparative, quantitative and qualitative analysis.
A. Ash: Dry the cup of ash in an oven with temperature of 150 ºC for 1 hour and then take the cup to further dry in desiccators for 30 minutes before weighting. Then, put a sample of about 2 g in the cup. Weigh and record the weight. Take the sample to dry in the oven with the temperature 600 ºC for 3 hours. Lastly, take it to put in desiccators and weight it again (AOAC, 2005).
B. Energy: Energy consists of carbohydrate, fat and protein (Willett, 2005).

$$Total\ energy =)Protein \times 4\ cal/g) + (fat \times 9\ cal/g) + (carbohydrate \times 4\ cal/g)$$

Where, protein 100 g, energy 100 g, fat %, carbohydrate 100 g
C. Sensory test: The questionnaires designed to test, color, texture, odor, flavor, and crispness. Preference was recorded from 30 participants. The score ranged from 1 to 5 (1: dislike, 2: somewhat dislike, 3: like, 4: somewhat like and 5: like very much).

RESULTS AND DISCUSSION

Ash

Figure 1 showed that the fourth treatment used cassava flour 75% and wheat flour 52% in temperature of 160 °C had the highest ash of 0.978% and the third, sixth, seventh, eighth and ninth had similar percentage of ash. On the other hands, the second treatment used cassava flour 50% and wheat flour 50% in 160 °C had the lowest ash of 0.95 %. In general, food products that made of flour had ash between 0.3 to 1.4 %.

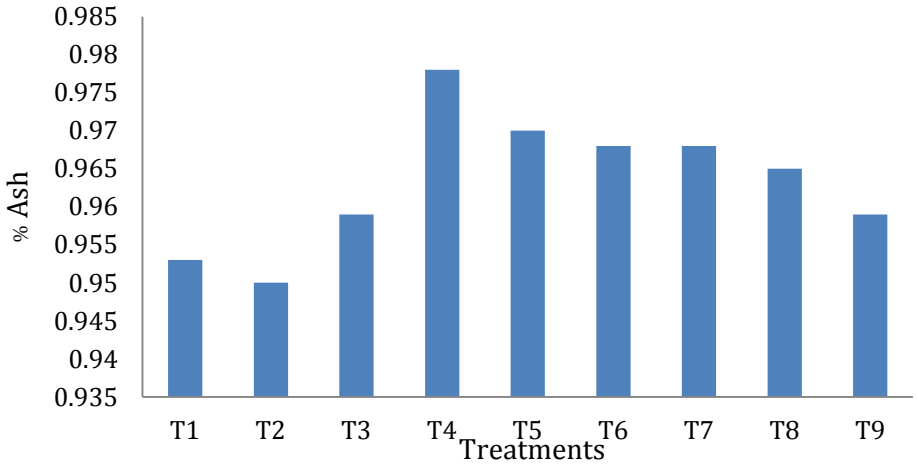

Fig. 1 Ash analysis in each treatment

Energy

Figure 2 showed that the fourth treatment using cassava flour 50% and wheat flour 50% at the temperature of 160 °C has energy of 454 kilocalories, which was the highest energy of all treatments. Conversely, the ninth treatment using 100% of cassava flour in temperature of 180 °C to 160 °C had energy 445.544 kilocalories, which was the lowest energy of all treatments.

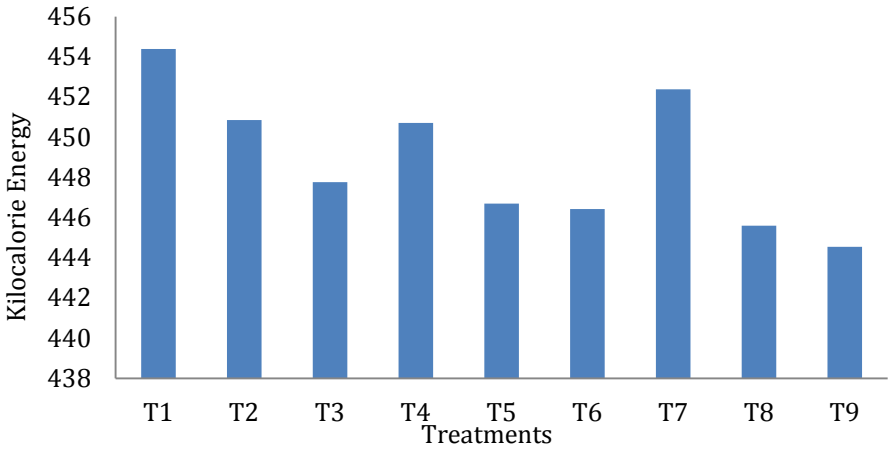

Fig. 2 Energy analysis of each treatment

Color

The second treatment using cassava flour 50% and wheat flour 50% in the temperature of 170 °C scored 4 out of 5, which was the highest mark. Conversely, the ninth treatment using cassava flour 100% without using wheat flour in the temperature of 180 °C scored 3.37 out of 5, which was the lowest mark. The changing score was because the cookie's color changed. Baking cookies in a temperature of 160 °C gave a pale color, in a temperature of 180 °C the cookies had a dark color, and in a temperature of 170 °C the outcome was a pleasing golden color, which was the favorite cookie for participants. The cookie's color changed because of the changing temperature.

Texture

Figure 3 shows that the second treatment using cassava flour 50% and wheat flour 50% at a temperature of 170 °C was the highest mark of 4 out of 5, and the ninth treatment using cassava flour 100% without using wheat flour at a temperature of 180 °C was the lowest mark of 3 out of 5. The changes in marking were because the temperature of 160 °C and 180 °C made the cookies crack. Baking cookies in a temperature of 170 °C resulted that a cookie was red and shinier than both of the others. The changes of food texture were caused by the changes of temperature; in addition to, the changes of texture also made cassava flour changes in color and brightness.

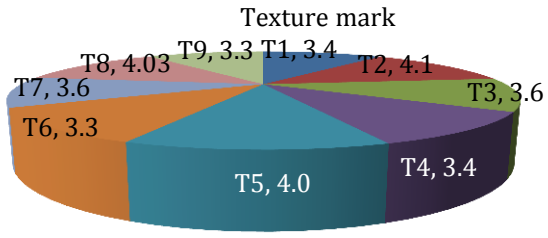

Fig. 3 Evaluation on texture of cookie in each treatment

The results above showed that the second treatment that used cassava flour 50% at temperature of 170 ^{o}C was the best treatment out of the nine treatments because in this treatment pH value, moisture, ash, protein, fat, and energy were in appropriate level when compared to the standard of Hard biscuit or Hard Cookie that contains pH 7.6, humid 2.6%, ash 2%, protein 7.6%, lipid 10% and carbohydrate 77.8%. Moreover, in outcomes of sensory testing of color, texture, odor, sweet flavor, hardness, and crispness, the second treatment was the favorite one for participants, followed by first and third treatments. However, treatment nine, which used 100%

cassava flour at a temperature of 180 ^{o}C was the least appropriate treatment of all because this treatment contained the lowest protein and energy, and it was also the least favorite treatment from the participants' point of view.

CONCLUSION

Using more than 50% of cassava flour in cookie production produced less quality cookies. In cookie processing, the temperature range from 160 to 180 ^{o}C could affect chemical properties such as humidity, proteins and lipids and also lower the calories. This problem showed that the higher the temperature we used the lower quality of chemical properties the cookie had. 50 % of cassava flour baked at a temperature of 170 °C for 8 minutes should be recommended and used in cookie production.

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