2012 International Conference on Nutrition and Food Sciences
IPCBEE vol. 39 (2012) © (2012) IACSIT Press, Singapore

Moisture Content and Physical Properties of Instant Mashed Potato

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Abstract. The objective of this research was to study effect of drying temperature and drying time on moisture content and physical properties of instant mashed potato. Instant mashed potato was prepared by drying at 60, 70 and 80°C and drying times of 5, 6.5 and 8 hr. After that, moisture content, water absorption, water solubility index and rehydration ratio of the dried product were determined. It was found that drying time and drying temperature at the studied condition did not affect water absorption and water solubility of the final product ($P>0.05$). However, increase drying temperature and drying time resulted in instant mashed potato with decrease moisture content and rehydration ratio ($P\leq0.05$). Instant mashed potato had moisture content of 4.5 to 8.5% (db) depend on the drying conditions. In addition, higher drying temperature resulted in starch granules with more damage and then decreases rehydration ability to the product.

Keywords: Instant mashed potato, Mashed potato, Moisture content, Physical property.

1. Introduction

Potato (*Solanum tuberosum* L.) is a starchy crop used as materials to many types of food and snack production. It consists of 63-83% moisture content, 13-30% carbohydrate, 0.7-4.6% protein and 0.44% ash. Moreover, potato is rich of vitamin and minerals such as vitamin C and B, calcium and phosphorus. Potato is one of the most popular food materials, consumed as main course with meat and vegetable in the form of mashed potato widely in many countries. It is made from minced cooked potato and/or mix with ingredients such as butter and salt. Mashed potato made from 100% fresh potato may be suitable for freezing as a ready-meal component or as a food product [1-2]. However, freezing of potato might have disadvantage in cost, transportation and storage. To make instant mashed potato could be useful to safe time for mashed potato production.

Many types of drying methods have been use to dry food products. Each type of drying methods and conditions affected qualities and properties of the dried products. This is because of the loss of moisture content during drying. Using of conventional hot air drying is one of the most popular applied to dry food products. It is cheap and takes less time during drying, however. Physical properties of the dried products changes during conventional hot air drying. Drying temperature and drying time affected physical properties such as shrinkage and rehydration ratio as well as structural property of the dried potato [3-5].

The objective of this research was to study effect of drying temperature and drying time on selected properties of instant mashed potato viz. moisture content, water absorption, water solubility index and rehydration ratio.

2. Methodology

2.1. Raw Materials Sample Preparation Materials

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Fresh potato (*Solanum tuberosum* Linn.) was purchased from a local supermarket and stored at 4°C. The sample was removed from the refrigerator to obtain room temperature.

2.1.1. Mashed Potato Preparation

Potato was peeled, rinsed with distilled water and sliced to 0.5 cm thickness. The sliced potato was then blanched in hot water at temperature of 100°C for 5 min. After that, blanched potato was cooled using of ice bath until room temperature (25°C) reached and soaked in 1%sodium metabisulfite for 5 min and boiled in hot water for 15 min.

2.1.2. Instant Mashed Potato Preparatio

Cooked potato was dried using conventional hot air tray dryer at temperatures of 60 70 and 80°C at different drying times (5, 6.5 and 8 hr). The product could not be dried until equilibrium moisture content reached to the final product since drying affected color acceptance to the dried product. The dried potato was milled using of chopper (Moulinex, model mnx-AW9, France) before properties determination.

2.2. Properties Determination

2.2.1. Moisture Content

Moisture content of the final dried product was determined [6].

2.2.2. Water Absorption and Water Solubility Index (WSI)

Water absorption and water solubility index (WSI) were measured according to [7-8]. Dried potato (approximately 2.5 g) was weighted into 50 ml centrifuge tube and 35 ml distilled water was added, along with a magnetic stirring bar. The centrifuge tube was sealed and vortexed for 30 s to break any clumps. Centrifuge tube was then inverted and stirred with magnetic stirrer for 30 min. The magnetic bar was removed and the sample was centrifuged at 3300xg for 10 min at room temperature (25°C). The supernatant was weighted and dried at 105°C in hot air oven for 5 hr. The dried supernatant was then recorded as soon as samples reached room temperature and calculated WSI according to equation (1). The centrifuge tube with the gel sediment was weighted the WAI was calculated using equation (2) [9-10].

$$WSI = \frac{(g\ of\ soluble\ sample)}{(g\ of\ original\ sample)} \tag{1}$$

$$WAI = \frac{(g\ of\ water\ absorbed)}{(g\ of\ original\ sample)(1 - soluble\ fraction)} \tag{2}$$

2.2.3. Rehydration Ratio

Rehydration ratio of instant mashed potato was determined by immersing the dried sample in hot water at 100°C for 5 min. The sample was drained and its masses, both before and after immersion, were measured with an electronic balance. The rehydration ratio of instant mashed potato is calculated as [11]:

$$R = \frac{M}{M_0} \tag{3}$$

where M and M_0 represented weight of sample after and before rehydration, respectively.

2.3. Statistical Analysis

All analysis was done in duplicate. An analysis of variance (ANOVA) was used to analyze the data and significant different between drying conditions to its moisture content and physical properties were compared at a significance level of 95%.

3. Results and Discussion

3.1. Moisture Content

Fig. 1 shows moisture content of instant mashed potato after different drying conditions. As expected, higher temperatures led to higher drying rate of the sample and reached lower moisture contents after 5, 6.5 and 8 hr. Potato dried at 60, 70 and 80°C and drying time of 5 hr had moisture contents of 8.5, 6.5 and 5.2%

(db). Potato dried at 60, 70 and 80°C and drying time of 6.5 hr had moisture contents of 7.8 6.5 and 5.2% (db). Potato dried at 60, 70 and 80°C and drying time of 8 hr had moisture contents of 7.8 5.2 and 4.5 %(db), respectively.

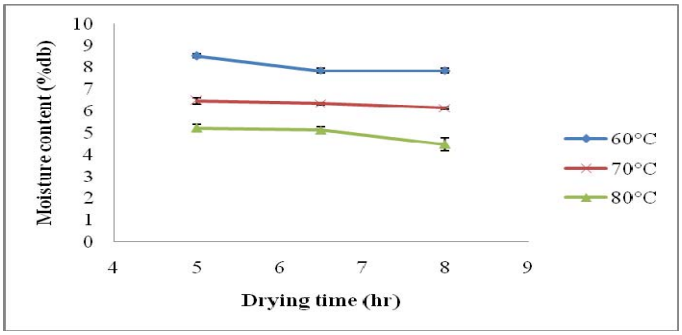

Fig. 1: Moisture content of instant mashed potato after different drying conditions.

3.2. Absorption and Solubility

Water absorption and water solubility ranges of the dried product were 6.13-7.11 g/g and 8.57-10.48%, respectively. Drying temperature and drying time did not have an interaction on water absorption and water solubility index of the instant mashed potato (not shown). Moreover, it was found that drying temperature at the study conditions did not affect water absorption and water solubility (Table 1). Result was in the same trend as in the case of drying time (Table 2).

3.3. Rehydration

Drying temperature and drying time did not have an interaction on rehydration ratio of instant mashed potato (not shown). However, it was found that increase drying temperature and drying time resulted in instant mashed potato with decreased rehydration ratio (Table 1-2). Higher drying temperatures led to products with higher rehydration ratios [2]. However, it was found in Table 1 that increase of drying temperature resulted in instant mashed potato with significantly decrease rehydration ratio (P≤0.05). Potato structure consists mainly of cell walls, water and starch granules. Higher drying temperature resulted in starch granules with more damage and then decrease rehydration ability to the product.

Table 1: Physical properties of instant mashed potato after different drying temperatures

Drying temperature (◦C)	Water absorption^{ns}	Solubility (%)^{ns}	Rehydration ratio
60	6.13 (0.16)	8.57 (0.87)	11.21 (1.05)^{a}
70	7.11 (0.55)	10.48 (3.51)	10.77 (0.17)^{b}
80	6.32 (0.25)	8.78 (0.25)	9.96 (0.51)^{c}

^{ns} Means in the same column are not significantly different (P>0.05)
^{a,b,c} Means with different letters in the same column are significantly different (P≤0.05)

The samples that were dried at higher drying time led sample achieve their temperatures and sample hence suffered more structural damage such as collapse of porous structure than those of drying at lower drying time [12].

Table 2: Physical properties of instant mashed potato after different drying time

Drying temperature (hr)	Water absorption^{ns}	Solubility (%)^{ns}	Rehydration ratio
5	6.58 (0.63)	10.13 (0.76)	11.10 (0.73)^{a}
6.5	6.89 (0.06)	10.09 (3.66)	10.40 (0.96)^{b}
8	6.40 (0.64)	8.11 (1.32)	10.44 (0.73)^{b}

^{ns} Means in the same column are not significantly different (P>0.05)
^{a,b,c} Means with different letters in the same column are significantly different (P≤0.05)

4. Conclusions

Drying time and drying temperature at the studied condition did not affect water absorption and water solubility of the final product ($P>0.05$). However, increase drying temperature and drying time resulted in instant mashed potato with decrease moisture content and rehydration ratio ($P\leq0.05$). Instant mashed potato had moisture content of 4.5 to 8.5% depend on the drying conditions. In addition, higher drying temperature resulted in starch granules with more damage and then decreases rehydration ability to the product. Results could be used develop products from instant mashed potato.

5. Acknowledgements

The authors express their sincere appreciation to Faculty of Agro-Industry, King Mongkut's Institute of Technology Ladkrabang (KMITL), Thailand for supporting the study financially.

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