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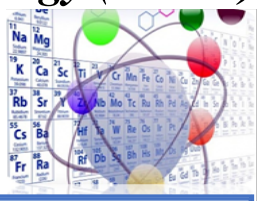

Optimization of Drying with a Food Dehydrator on the Quality of Tinuktuk Powder

Meidy Citra Pratiwi, Fitri Mutia, Shafira Sugiri, Marini Damanik*

Department of Chemistry, Faculty of Mathematics and Natural Sciences, Universitas Negeri Medan, Medan 20221, Indonesia

**Corresponding author: marini@unimed.ac.id*

ABSTRACT

Tinuktuk is a traditional Simalungun food product with immunomodulatory properties. To enhance convenience and extend shelf life, tinuktuk can be consumed as a powder produced by drying. In this study, drying optimisation was conducted using a food dehydrator at 40°C with drying times of 5, 6, 7, and 8 hours. Subsequently, tests were conducted to determine the quality of tinuktuk by analysing pH, water content, and ash content. The results showed that tinuktuk with optimal performance was obtained at 8 hours, as indicated by its pleasing texture and dryness. Specifically, the pH was 5.4, the water content was 8.20%, and the ash content was 6.31%.

Keywords: tinuktuk, spices, drying, food dehydrator

1. INTRODUCTION

Indonesia's natural resources are valuable resources that can be developed. Natural ingredients contain active ingredients that have the potential to be developed into traditional foods. Herbal spices have various benefits, including antibacterial, anti-inflammatory, antioxidant, antihypertensive, antithrombotic, and chemopreventive effects, and can be used to treat metabolic health problems.

Spices are organic plants that contain phytochemical compounds with various health benefits. Spices contain secondary metabolites, such as gingerols, that possess antioxidant properties, among others. One effect of secondary metabolites is their antioxidant activity, which can protect cells from oxidative stress and prevent premature ageing and cell damage. Indonesia's natural resources are valuable resources that can be developed. Natural ingredients contain active ingredients that have the potential to be developed into traditional foods.[1]

Spices and herbs are cultivated for their health benefits.[2] Herbal spices offer various benefits, including antibacterial, anti-inflammatory, antioxidant, anti-hypertensive, antithrombotic, and chemopreventive effects, which can be utilised to treat various metabolic health issues. Spices are organic plants that contain phytochemical compounds with various health benefits. Spices contain secondary metabolites, such as

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gingerols, that possess antioxidant properties, among others. One effect of secondary metabolites is their antioxidant activity, which can protect cells from oxidative stress and prevent premature aging and cell damage.[3]

Tinuktuk is a traditional spice preparation from the Simalungun people, used as a herbal remedy. Tinuktuk can be consumed mixed into soups, in hot drinks such as tea, and as an accompaniment to other staple foods.[4] The tinuktuk processing process has a unique characteristic: it does not use water, so this product can last for 1 to 1.5 years without going stale or mouldy.[5]

Although spices offer numerous health benefits, several considerations arise when consuming processed spices. Spices are considered perishable foods due to their high water content and temperature sensitivity.[6] Therefore, spices are dried to extend their shelf life.[7]

Water content determines the shelf life of a food product. Water content can be reduced through drying. The water content of food products is highly susceptible to microbial contamination, which can cause spoilage and render the product unfit for consumption. Microorganisms not only degrade product quality but can also cause foodborne illness when consumed.[8]

Drying is a natural preservation method that evaporates water from wet food using heat. Low water activity in food can inhibit microbial activity, inactivate enzymes, and prevent chemical reactions that can lead to quality degradation.[9] Dried food is more stable and has a longer shelf life. The drying process has variables that affect product quality, namely temperature and time. The higher the drying temperature, the faster the drying rate; however, this can damage the product because the outer layer dries too quickly while the interior remains moist.[10]

The drying process involves removing water from food, either naturally or artificially, under controlled conditions to prevent microbial spoilage, which can affect food shelf life The drying process can degrade food quality relative to fresh food. An imbalance in temperature and pressure on the food causes this reduction in quality.[11]

There are several drying methods, including air-drying, freezing, microwave-drying, and sunlight. Air-drying can produce products with a longer shelf life, whereas conventionally dried products generally have lower quality than fresh produce.[12] The resulting low quality is attributable to the reduced capacity of secondary metabolites to confer health benefits. Flavonoids are secondary metabolites that are sensitive to temperature. High temperatures cause the degradation of thermolabile compounds.[13]

A food dehydrator is a drying technology that effectively and efficiently reduces the water content of food. This method uses a combination of temperature control, airflow, and ventilation to remove moisture from food gradually.[14] Food dehydrators are used to preserve various foods, such as fruits and vegetables, by removing moisture from the ingredients. There are two essential elements in a food dehydrator: a heating element and a fan. The heating element's primary function is to serve as a catalyst, increasing the equipment's temperature, while the fan circulates air to remove moisture. Therefore, these two components achieve the desired drying results.[15]

The food dehydrator is a convection dryer. This method utilises convection as the heat transfer mechanism. This method has the advantage of allowing precise control of the drying temperature, air velocity, and drying time during the drying of plants and herbs.[16] The downside of this drying method is significant degradation of aromatic compounds in spices due to the high drying temperatures used, resulting in the

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evaporation of volatile compounds and moisture, as well as product shrinkage. Volatile compound yields decrease as the drying temperature increases.[17]

Important parameters to consider are temperature and drying time. Processing food by exposing it to high heat, light, or oxygen will result in nutrient loss.[18] Other parameters, such as water content, ash content, and pH, affect food quality.

2. EXPERIMENTAL

2.1. Chemicals, Equipment and Instrumentation

The materials are red ginger (*Zingiber officinale* Roscoe), black pepper (*Piper nigrum*), andaliman (*Zanthoxylum acanthopodium* DC), aromatic ginger (*Kaempferia galanga*), cikala acid (*Etlingera elatior*), shallots (*Allium cepa* L.), garlic (*Allium sativum*), candlenut (*Aleurites moluccanus*) and Himalayan salt. Chemical is aquadest (H_2O). The tools used in this study are electric scale, grinder, stove, frying pan, spoon, plastic container, knife, cutting board, beaker, desiccator, porcelain cup, measuring cup, petri dish, an analytical balance, food dehydrator (*Kris*), oven (*Memmert*), furnace (*Gallenkamp*), and a pH meter (*pH-010*).

2.2. Research Procedure

1. Drying of tinuktuk

The wet tinuktuk is evenly distributed on racks and placed in a dehydrator. It is dried at 40°C for 5, 6, 7, or 8 hours. The dried product is ground using a grinder to produce a fine-textured tinuktuk powder.

2. Chemical Characteristics Analysis of Tinuktuk

a. Analysis of pH Levels

A total of 5 g of tinuktuk was used to determine pH with a pH meter. Add 100 mL of Aquadest and stir until mixed. The pH meter is first calibrated with buffer solutions at pH four and pH 7. The electrode is rinsed with distilled water and dried. The pH meter is inserted into the sample solution. The pH value is obtained by reading the scale.

b. Moisture Content Analysis

Moisture content was measured by weighing an empty sterile petri dish that had been oven-dried for 1 hour using an analytical balance to determine its empty weight. Approximately 10 g of tinuktuk was weighed into the petri dish. The tinuktuk was then dried in an oven at 105°C for 3 hours, cooled in a desiccator, and then weighed. It was then oven-dried for 1 hour, cooled, and weighed until a constant weight was achieved for the Petri dish and the dry sample.

c. Ash Content Analysis

Ash content was measured by dry ashing in a furnace. A porcelain cup was oven-dried at 105°C for 1 hour, cooled in a desiccator, and weighed. 2 g of tinuktuk was placed in a porcelain cup. The tinuktuk was placed in a furnace at 600°C for 2 hours until white ash formed, then cooled in a desiccator and weighed.

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3. RESULTS AND DISCUSSION

3.1. Analysis of drying results with a food dehydrator

Tinuktuk dried in a food dehydrator at 40°C for 5, 6, 7, and 8 hours showed different results. Based on visible physical characteristics, the optimal drying results were observed at the 8-hour variation, characterised by the most tremendous change in dryness levels, smooth texture, and good colour, among the variations. At 5 and 6 hours, there was no substantial change from tinuktuk before drying. At the 6-hour variation, tinuktuk has experienced a slight decrease in moisture. The results of the 7-hour drying variation indicate that tinuktuk undergoes drying, marked by changes in texture, a brown colour, and a distinctive tinuktuk aroma. However, when ground, the results cannot be formed into powder.

3.2. Effect of pH

Drying was carried out at 40°C. The pH value affects the drying temperature. If the drying temperature is higher, it will increase the material's pH because it causes evaporation of acidic components when heated.[19] The data in the image below show that the pH values for the 5-hour, 6-hour, 7-hour, and 8-hour variations are 4.7, 5.2, 5.5, and 5.4, respectively. The lowest pH value is observed at the 5-hour time point.

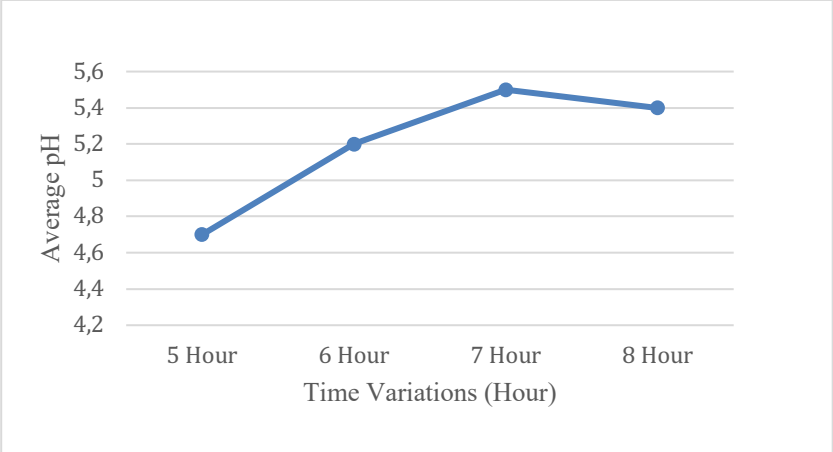

Figure 1. The pH level of tinuktuk in 5-8 hours

The pH value affects the drying temperature because the organic acid content in the material evaporates during drying, thereby reducing the material's acid resistance. The thermal degradation of food components, such as sugars and proteins, can produce new acid compounds, thereby increasing the product's acidity.[20]

3.3. Effect of Moisture Content

The moisture content values ranged from 8% to 11% in Figure 2. The moisture content of tinuktuk powder still meets the quality requirements for powdered spices, as specified in SNI 01-3709-1995, with a maximum moisture content of 12.0%. Food quality is related to its moisture content. Food with low moisture content has a longer shelf life than food with high moisture content.[21]

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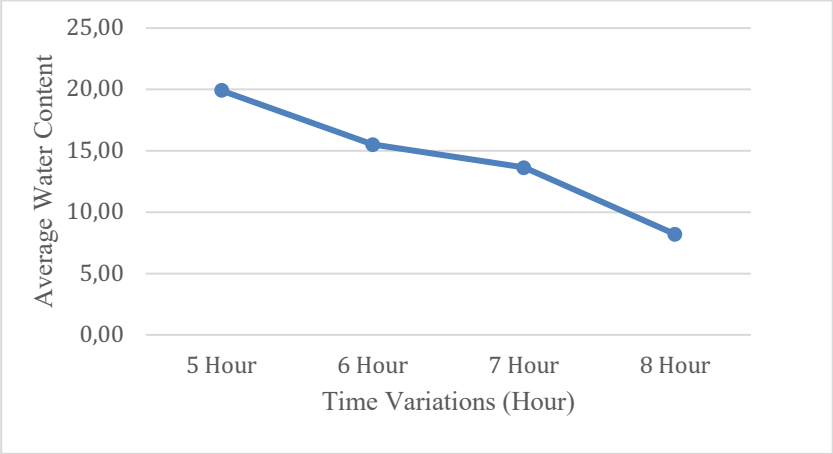

Figure 2. Tinuktuk water content in 5 – 8 hours

Water is a growth medium for microbes. Therefore, increasing water content can increase water activity, thereby encouraging microbial growth.[22]

3.4. Effect of Ash Content

Ash is the residue from the combustion of organic materials, consisting of inorganic substances. Its composition and content depend on the material and the ashing method. Ash content is used to determine nutritional value and indicates the total amount of toxic minerals in the material.[23] The minerals in the material can be two types of salt, namely organic and inorganic salts.[24] High ash content can also indicate heavy metal contamination or dust particles from the drying or storage process[25]. Based on the SNI 01-3709-1995 quality standard, the maximum ash content in spices is 7%.[26]

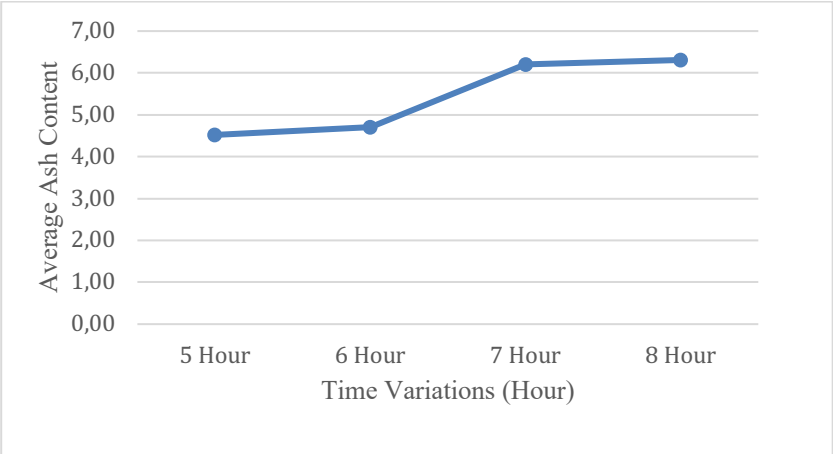

Figure 3. Tinuktuk ash content in 5 – 8 hours

Figure 3 shows that the ash content of tinuktuk influences the drying time. Based on the results, the lowest ash content was 6.31% at 8 hours, and the highest was 16.39% at 5 hours. These results are consistent with the view that higher temperatures and longer drying times result in greater water evaporation, thereby increasing the material's ash content.[27]

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4. CONCLUSION

The conclusion that can be drawn from the research that has been conducted on tinuktuk with a drying process at a temperature of 40°C between 5 to 8 hours in terms of chemical analysis characteristics is that at a time variation of 8 hours with good drying results, color, and texture, a pH value of 5.4, a water content value of 8.20%, and an ash content of 6.31%.

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