DRYING CARROTS

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ABSTRACT

Trade and storage are two aspects of the purpose of handling agricultural products. One factor that needs to be considered post-harvest is the water content of the material. The average moisture content of the crop is an aspect of trade that affects the selling price. While in the storage aspect, the moisture content determines the shelf life. The purpose of the Carrot Drying practicum is to understand the basic principles of food drying (carrots), to be able to calculate the wet basis moisture content and dry basis moisture content of the material during drying and to be able to explain the drying process based on the drying rate curve of the material. The method used in this practicum is by drying directly under the sun. The results obtained are KABB in samples 1 and 2 and KABK in samples 1 and 2 which show the relationship between the length of drying time and drying. The conclusion is that drying is one of the processes that can be done to reduce the water content in a food ingredient.

Keywords: Moisture Content, Food, Drying

INTRODUCTION

Background

Indonesia is a country that has fertile land, many of its inhabitants work as farmers and the majority are farmers. So it is very important for farmers to know the maximum limit of moisture content in crops to meet the set standards, because the moisture content of food is one of the factors that can affect the price of the product and the quality of the crop. Trade and storage are two aspects of the purpose of handling agricultural products. One of the factors that need to be considered post-harvest is the water content of the material. The average moisture content of the crop is an aspect of trade that affects the selling price. While in the storage aspect, the moisture content determines the shelf life.

Drying is defined as a process of removing the water contained in foodstuffs, by evaporating or sublimating the water (partially or completely) using heat energy. The energy content of carrots is instant energy, which is easily available in a short time, so it is useful in providing instant calorie needs. Carrot carbohydrates are a very good energy reserve to use and can be quickly available to the body. The drying process is one of the post-harvest processing processes to maintain the nutrients contained in carrots. The drying process is able to determine the amount of water content contained in carrots. Because bananas basically have a short shelf life. Therefore, not all banana production can be consumed in the form of fresh fruit.

Based on the description above, it is necessary to carry out this Solar Energy Drying practicum in order to understand how the principle of drying food ingredients, be able to calculate changes in moisture content of wet base and dry base, be able to explain the drying process based on the drying rate curve and be able to apply the drying process in agriculture such as determining the right moisture content in food ingredients.

Purpose and Usefulness of Practicum

The purpose of the Carrot Drying practicum is to understand the basic principles of food drying (carrots), to be able to calculate the wet basis moisture content and dry basis moisture content of the material during drying and to be able to explain the drying process based on the drying rate curve of the material.

The purpose of the Carrot Drying practicum is to be able to know how to dry food ingredients (carrots) and can be applied in determining the proper moisture content of food ingredients for the final product.

LITERATURE REVIEW

Frying

Drying is one of the oldest and most natural preservation methods, which is done by evaporating a certain amount of water from wet food with the help of heat. Reduced water content will also lead to a decrease in water activity (Aw) value. A low Aw value will inhibit the potential growth of microorganisms, inactivate enzymes and prevent various potential chemical and biochemical reactions that cause food quality deterioration. Thus, the dried food will be more stable and have a longer shelf life. The drying method can also be chosen as an appropriate preservation method especially if there is no cold storage space available or there are constraints on limited storage capacity. This is because the drying process will make the material experience mass shrinkage and volume shrinkage, thus dry products only require relatively smaller storage space [1].

Drying Principle

The principle of drying will usually involve two events: firstly heat must be applied to the material and secondly water must be removed from the material. These two phenomena involve inward heat transfer and outward mass transfer. What is meant by mass transfer is the transfer of water out of the food material. In food drying, maximum drying speed is generally desired, hence all efforts are made to accelerate heat transfer and mass transfer. Heat transfer in the drying process can occur in two ways, namely direct drying and indirect drying. Direct drying is where the heat source is in contact with the material being dried, while indirect drying is where the heat from the heat source is passed through the surface of a solid object (conventer) and the conventer is in contact with the food material [2].

In practice, the drying process consists of two stages, namely the preparation of the drying medium (air) and the drying process of the material. The preparation of heating media can be done through heating the air by using heat sources either natural (sun, geothermal) or artificial (electricity, burning wood, charcoal, rice husks, coal, natural gas, fuel oil, microwaves or from magnetic fields). The heating

medium (air) that has been heated is then used to evaporate water from the material by utilizing sensible heat (heat to raise the temperature without changing the phase) and latent heat (heat to change the phase/evaporate water). When viewed microscopically, during the drying process there are heat and mass transfer phenomena that occur simultaneously, namely: heat transfer from the drying medium to the material and water mass transfer from the material to the drying medium [1].

Drying Methods and Equipment

The utilization of solar heat is very important because of the tropical climate. Most of the activities of Indonesian people utilize heat energy derived from sunlight to support their activities, such as household, agricultural, and industrial activities. Drying has been done since ancient times with various purposes, including to extend storage life, improve quality and ensure the availability of seasonal products. Seasonal products, the drying process aims to reduce the moisture content contained in foodstuffs. Water content contained in foodstuffs, reduce the water activity (aw) in the food and inhibit microbial activity in it so as to increase the durability of the product, as well as for certain economic purposes such as reducing weight, increasing the flavor of the food, and improving the quality of the product. Economic purposes such as reducing weight, improving product flavor, or others [3].

Solar Dryer is a tool made for the drying process of food, agricultural products and fishery products with the aim of accelerating the drying process without reducing the quality of the material being dried. In 2016, Suprayitno conducted research on the Experimental Review of Direct Solar Dryer Active Direct Heating (Direct Solar Dryer Active) Shaped Jajar Genjang Cabinet Type which resulted in the average temperature of the drying room using solar thermal energy is 49.44 ℃. From the results of research that has been done [3].

Solar Energy Drying

Direct drying in the open sun is one of the simplest traditional drying methods and is still widely practiced by many farmers in Indonesia. Many obstacles are experienced with this method such as weather unpredictability, product contamination, hygienic issues, and various things that ultimately affect the quality and quantity of agricultural products. On the other hand, the use of modern drying machines adds to the cost of production and is not affordable to farmers, in addition to the negative impacts that occur as a result of burning fossil energy sources in the machine. The proposed solution is the utilization of solar dryers. Solar power is a clean energy source, its availability is abundant, especially in areas around the equator including Indonesia, and can be obtained freely to anticipate erratic weather, the solar dryer system is smothered with heat obtained from burning biomass. Solar dryer refers to a drying device designed by utilizing solar energy itself as a source of energy for drying directly in the sun in an open space. In general, there are various types and types of solar dryers that can be classified according to each way of utilizing solar radiation, tools and type of product being dried. Based on how the material being dried gets heat from solar radiation, solar dryers are divided into [3].

Moisture Content

Moisture content is one of the most important chemical laboratory test methods in the food industry to determine the quality and resistance of food to damage that may occur. The higher the moisture content of a food ingredient, the greater the possibility of damage both as a result of internal biological activity (metabolism) and the entry of destructive microbes. Reducing the moisture content of food ingredients will result in reduced availability of water to support the life of microorganisms and also for the ongoing physicochemical reactions. Thus, both the growth of microorganisms and physicochemical reactions will be inhibited, and food ingredients will last longer from damage. The regulation of moisture content is one of the most important bases and keys in food technology [4].

Measurement of moisture content in food ingredients can be determined by several methods, namely by drying method (thermogravimeri), distillation method (thermovolumetry), physical method and chemical method (Karl Fischer Method). Of all the methods that can be used to determine the moisture content of food ingredients, in general, the determination of moisture content is carried out by drying the material in an oven at 105-110 ℃ for 3 hours or until a constant weight is obtained. This method is known as the drying method or thermogravimetric method which refers to SNI 01-2891-1992 [4].

PRACTICUM METHODOLOGY

Time and Place

Carrot Drying Practicum was held on Tuesday, October 5, 2022, at 13.00 WITA-complete, at the Soil and Water Engineering Laboratory, Bechelor Programme In Agricultural Engineering, Department of Agricultural Technology, Faculty of Agriculture, Hasanuddin University.

Tools

The tools used in the Carrot Drying practicum are scales, knives and rulers.

Materials

The material used in the Carrot Drying practicum is potato.

Practicum Procedure

Carrot Drying practicum procedure, viz:

1. Prepare tools and materials.
2. Cut the carrots into 1x1x1 and 2x1x1 sizes.
3. Weighing the initial weight of carrots.
4. Performing the drying process under the sun.
5. Measuring each sample weight after drying until it reaches a constant weight.

Formula Used

The formula used in the Carrot and Potato Drying practicum is:

a. Wet basis moisture content

$$KAbb = \frac{Wm}{Wm+Wd} \times 100\%$$

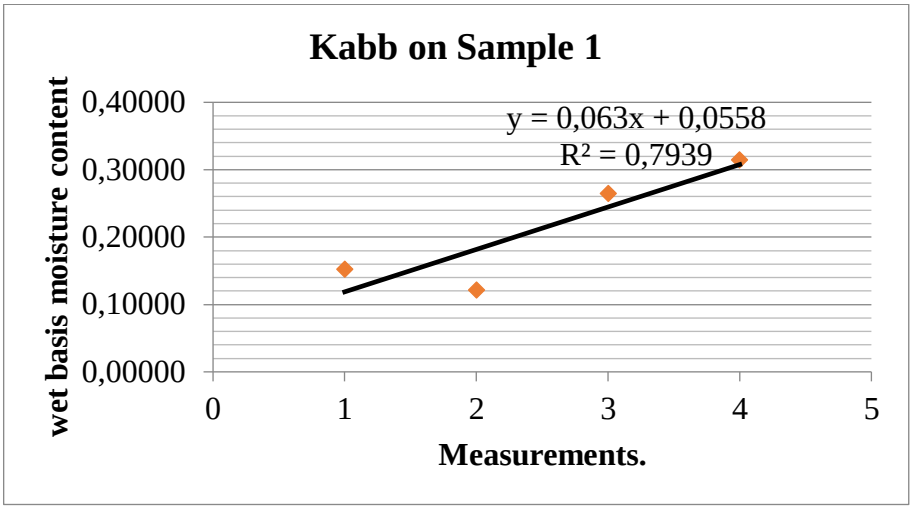
Description:
KAbb = wet basis moisture content (%)
W_m = weight of water in the material (g)
W_d = weight of solids in the material (g)

b. Dry basis moisture content

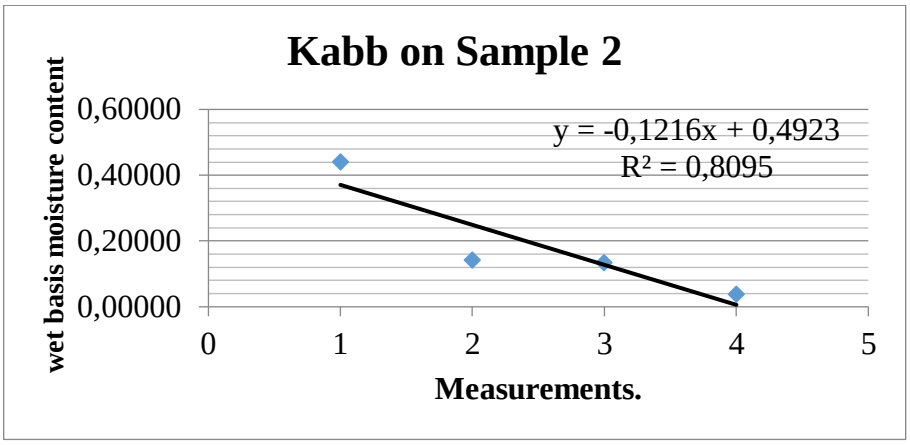
$$KAbk = \frac{Wm}{Wd} \times 100\%$$

Description:
KAbk = dry basis moisture content (%)
W_m = weight of water in the material (g)
W_d = weight of solids in the material (g)

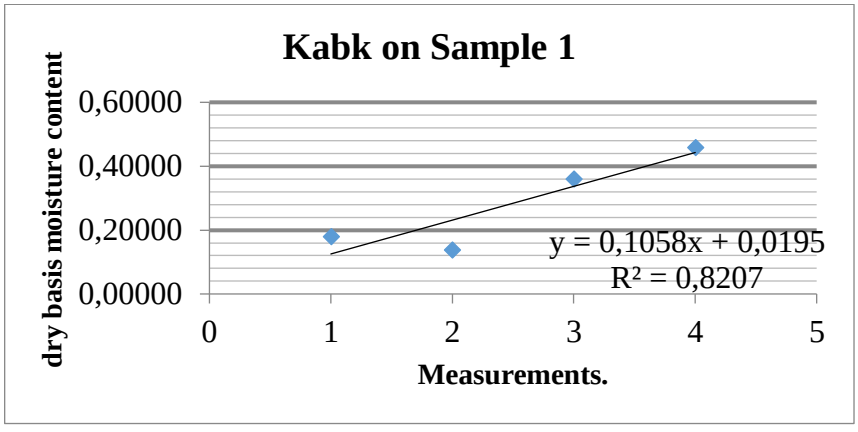
RESULT AND DISCUSSION



Based on the graph of the wet base moisture content (KABB) above, it can be seen that the wet base moisture content of sample 1. The use of samples used in the practicum is carrot samples. The relationship between the wet base moisture content and the exponential value of the wet base moisture content is directly proportional. This can be seen from the resulting curve. If the value of the wet base moisture content until 1 value increases, the value of the exponential of the wet base moisture content also increases. Meanwhile, if the value of the wet base moisture content decreases, the exponential value of the wet base moisture content of the sample also decreases. This is because the value shows the value of the percentage of weight to the wet material in sample 1 used which are interconnected with each other. This is in accordance with the opinion of [4], that the reduction in material moisture content results in a reduction in the availability of water that supports the life of microorganisms.

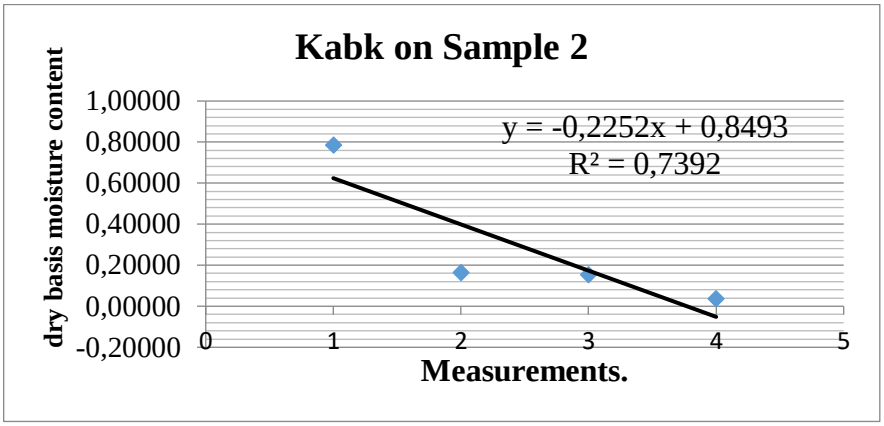


Based on the graph of the KAbb value in the 2nd sample, it can be seen that the longer the drying time, the lower the moisture content of the wet base contained in the carrots. This happens because the water content contained in carrots evaporates when the carrots are dried in the sun. Heat from sunlight will greatly affect the evaporation process of the water content in carrots so that the longer the carrots are dried, the water content in the carrots will decrease. The surface area of the carrots will also affect the amount of water content, where the more surface area of the carrots, the more water content is contained so that the surface area and initial natural water content greatly affect the moisture content of the wet base after drying. This is in accordance with the statement of [3], that the drying process aims to reduce the water content contained in food ingredients, reduce water activity (aw) in these food ingredients and can inhibit the process of microbial activity in it so as to increase product durability.



Based on the graph of the dry basis moisture content (DBA) in sample 1, it can be seen that the dry basis moisture content is the percentage of the dry basis moisture content of the food samples used after undergoing the drying process. Based on the graph, it can show the relationship between the dry basis moisture content and the measurement results, where the longer the drying process time, the greater the percentage of dry basis moisture content of a sample. The amount of water

contained in the material expressed in percent can be referred to as moisture content. This is in accordance with the statement of [4], that the higher the moisture content of a food ingredient, the greater the possibility of damage both as a result of internal biological activity (metabolism) and the entry of destructive microbes.



Based on the graph of dry basis moisture content (KABK) in sample 2, the results obtained are along with the length of drying that has been done, there is an increase in dry basis moisture content which is due to heat transfer in the drying process can occur in two ways, namely direct drying and indirect drying. Direct drying is a heat source related to the material being dried, while indirect drying is heat from a heat source passed through the surface of a solid object (conventer) and the conventer is related to the food material. This is in accordance with the statement of [2], which states that drying can occur due to the direct heat transfer process that occurs in the sample.

CONCLUSIONS

Based on the drying practicum that has been carried out, it can be seen that drying is one of the processes that can be done to reduce the water content in a food ingredient. As well as from this Carrot Drying practicum can understand the basic principles of drying food ingredients (carrots), able to calculate the wet base moisture content and dry base moisture content of the material during drying and also able to explain the drying process based on the drying rate curve of the material that has been obtained by finding the value of dry base moisture content and also wet base moisture content.

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