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Vacum Evaporator Application in Drinking Red Ginger Instant Using Rotary Crystalizer

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Abstract

The process of evaporating red ginger extract using vacuum evaporator if the barometric condenser requires a large enough energy, to save energy, it is necessary to design a vacuum evaporator that can lower the boiling point of water and also energy-efficient by using vacuum pumps equipped condensate container. This type of vacuum pump uses a small energy when compared to using a steam jet ejector and is expected to use vacuum evaporator with this vacuum pump will be able to save electricity. Evaporator using vacuum pump with a level of vacuum reaches 0.5 atm or 360 mm Hg can lower the temperature of water evaporation to 80^{0}C so it is expected that the content in the red ginger is not much changed. The evaporation of red ginger extract to continue to become crystal used a rotary crystallizer equipped with a heater. Heating is kept at 100 ° C with a spin of 75 rpm and crystals are formed with a relatively quick 20 minutes time when compare with using stirred crystallization.

Keywords: Evaporator, rotary crystalyzer, vacum pump

INTRODUCTION

In the process of making instant beverage powder requires great energy where the vacum process uses a condensor equipped with a steam ejector, the function of the evaporator is to evaporate water in the red ginger extract until it becomes thick before entering the crystallization process. The evaporator is carried out by evaporation of a dilute extract to an extract that has a certain thickness.

The initial moisture content will affect where high water content will affect the quality of the product and result in perishability and susceptibility to environmental influences where the product will be oxidized and will change the existing components (Abdussamad, 2014). To save energy usage in the evaporator, the pressure in the evaporator is made vacum so that the boiling point of the water will be low so that the content in the extract is not changed much from the original.

Paying attention to the advantages and disadvantages of the evaporation process a solution is all focused on making the vacuum pressure on the evaporator, if the vacuum pressure can be made low then the boiling point of the water will be small and cause the energy requirements for evaporation to decrease.

To make the vacum condition so far use condensor barometric which is equipped with steam ejector which requires considerable energy, to overcome the high energy needs can use the Vacuum Pump (Converti & Borghi, 2005).

The vacuum pump used is the Positive Displacement type by expanding the volume of space by the pump so that a partial vacuum pressure decreases. The sealing system prevents gas from entering the chamber, then the pump

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performs exhaustion, and returns to expand the space that. If done cyclically and repeatedly, a vacuum will form in the room. The process that makes steam come out of the evaporator into condensate is by installing a condenser. Condenser is a device for condensing steam from the evaporator under vacuum conditions, steam from the evaporator enters from the top side of the condenser and then condenses as a result of heat absorption by cooling water. The condenser used is the surface condensor type where the steam coming out of the evaporator does not come in direct contact with the cooling fluid but the cooling process occurs in heat exchangers which are generally in the form of Shell and Tube Heat Exchanger (Kern, 1978).

The process to make a product crystalline requires a crystalliser, crystallization is the process of forming solid crystals from a homogeneous mother liquor, this crystallization process is one of the most important solid-liquid separation techniques in the industry, because it can produce up to 100% product purity, process Crystallization can occur in the manufacture of granulated sugar and the manufacture of instant drinks.

In food crystallization products occur in the formation of structures in food ingredients or products into crystals, various food products such as instant powder drinks and chocolate contain structures in the form of crystals. Components of foodstuffs that primarily play a role in forming crystals are water, sugar and starch.

Instant beverage products are made by crystallization where crystallization is a technique in microencapsulation which is generally similar to the technology of packing solids into a form of microcapsules (Permata & Sayuti, 2016). The formation of crystal size in instant ginger will be influenced by the time of crystallization (Buston et al., 2008).

In this study using red ginger material which was taken from Ginger or zingiber officinale has long been known in Indonesia as a healthy plant, ginger rhizomes can be used widely as a flavor and flavor to food and can be made a healthy drink. Ginger contains anti- oxidants, oleoresin, known as gingerol (Firdausni, 2011).

Ginger can also be used as a drug maker and traditional herbal medicine industry while young ginger can be eaten as fresh vegetables. Ginger has a heat effect when used, ginger is widely used as a health drink, as ginger herbal plants in countries such as China, India and Arabia are widely used as ingredients for making medicines. Two components present in ginger are gingerol and oleoresin 14-25% and shogoal in oleoresin 2.8 - 7% Zick et al., 2008).

Red ginger or zingiber offciniale var rubrum is one of the usual species of ginger but the rhizome of this type of red ginger is smaller while the taste is more spicy and red outside and yellow to pink in the inside. Red ginger is widely used as food ingredients and traditional medicine for various diseases. Red ginger plants grow in many rural areas and are now widely cultivated as fresh and healthy drinks. Red ginger contains oleoresin, a non-volatile compound that contains essential oils 15-35%, the higher the oleoresin content, the more spicy it feels (Stoilova et al., 2007).

Figure 1. Red ginger plant.

The aroma and spicy taste of ginger rhizomes are very much influenced by the chemical composition contained, some of the factors that influence the chemical composition of red ginger rhizomes are soil conditions, age of harvest, methods of cultivation and ecosystems where plants are grown. Essential oil content is between 0.25 - 3.3% where this essential oil gives rise to a distinctive aroma of ginger.

METHODS

Application of vacuum evaporator and rotary crystallizer for instant red ginger beverage production aims to get ginger crystals quickly without reducing the existing content. In this experiment using red ginger as raw material evaporated under vacuum pressure and continued with crystallization process using a rotary christalizer.

The research flow is as follows:

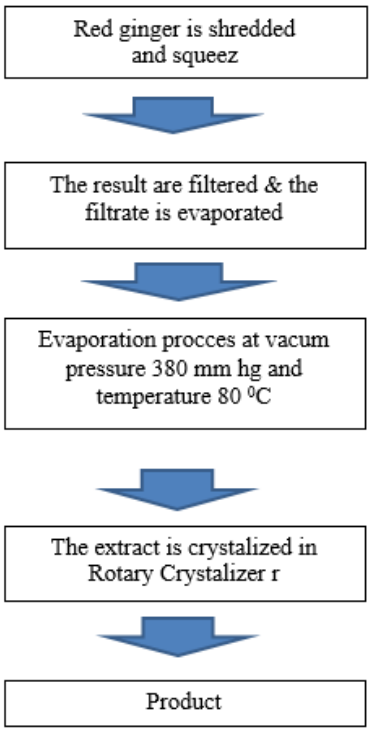

Figure 2. Block research diagram.

A series of experimental tools for the evaporation process using a vacuum pump consisting of an evaporator tank along with the heater, condensor and vacuum pump as follows.

Figure 3. Vacum Evaporator

In this experiment, red ginger which has been added with water is crushed and squeezed, adding water in a ratio of 1: 1 - 1.5 and then evaporated in a vacuum evaporator at a pressure that varies from 380 - 760 mmHg and the distillate is accommodated equal to the amount of water added to the comparison 1 : 1 that is as much as 2.200 cc. The extract is removed from the evaporator and then transferred in a rotary crystallizer and added enough sugar to dry to form crystals. The crystallization process is carried out at a certain speed and temperature to obtain the maximum number of crystals.

Figure 4. Rotation Crystalizer.

RESULT AND DISCUSSION

From the steam table (McCabe, 1986): for a vacuum pressure of 760 mm Hg obtained the boiling point of water = 212^0 F = 100^0 C. From the results of the experiment using a vacuum evaporator prototype with a raw material of 2000 cc of red ginger extract and the addition of water according to the comparison with the same time obtained the following results:

Table 1. Vacum pressure

No	Comparison	Pressure (mm Hg)	Water ev aporated (cc)	Temperature (^{0}C)
1.	1 : 1,1	760	2.200	100,0
2.	1 : 1,2	670	2.200	95,0
3.	1 : 1,3	560	2.200	88,0
4.	1 : 1,4	460	2.200	84,0
5.	1 : 1,5	380	2.200	80,0

Table 2. The timing of crystal

No	The amount of extract,cc	Time of drying (minute)
1.	2.000	20,0
2.	2.200	21,5
3.	2.400	22,2
4.	2.600	23,4
5.	2.800	25,0

Instant ginger is a powdered beverage product that can be directly consumed as a health drink, health drinks are drinks that contain nutrients that have a positive effect on body health (Encik & Martanto, 2016).

Theoretically from the steam table for a pressure of 760 mm Hg the water will boil at a temperature of 1000 C (Mc Cabe, 1986) but from the fact that there is in the evaporation of pure water using a prototype evaporator at vacuum pressure 760 mm Hg obtained boiling water at a temperature of 1020 C This is because the temperature control device is less accurate in receiving the heat supplied by the gas stove.

When using a red ginger extract heated in a vacuum pressure of 760 mm Hg the water will evaporate at 1040 C this is in accordance with the graph Duhring Line (McCabe, 1986) where the boiling point of a material will increase according to its level.

If the vacuum pressure from the vacuum pump is increased so that the room pressure increases vacum so that the boiling point of the red ginger extract will drop this in accordance with the rules of the boiling point that if the pressure gets vacant then the boiling point will also decrease. The boiling point reaches the lowest of 800C where the vacuum pressure is made at a pressure of 380 mm Hg and the temperature of the cooling water exits the condenser at 350 C.

Instant beverage products from red ginger raw materials can be made by crystallization where the formation of crystals as a microcapsulation process with the addition of sucrose (Permata & Sayuti, 2016).

In the crystallization process by varying the depth of air at the speed of red ginger and rotating speed of 75 rpm will affect the crystallization time where there will be a lot of air addition so the time needed to become longer but in the process of crystallizing the volume made is 2,200 cc then the time required to dry until crystals occur in 20 minutes.

Instant ginger is an instant powder where the way to consume it is very practical because it can be served quickly (Encik & Martanto, 2016).

CONCLUSION

When using an evaporator, the product produced has a small amount because the air boils at a temperature of 80 °C, while the time for being crystalline at 20 minutes is faster than using a stirred christalizer.

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