

Short Communication

Design of fluidized bed dryer for small-scale sago starch processing

Abadi Jading, Paulus Payung, Edward Tethool, Reniana

Dept. of Agricultural Technology, Faculty of Agricultural and Agricultural Technology Papua State University, Indonesia.

Email: a_jading@yahoo.com

A version of this paper was originally presented at the 10th International Sago Symposium, Bogor, Indonesia, October 29-30, 2011.

Abstract

The main objective of this study was to design a sago starch dryer using a fluidized bed model for smallholder producers. Two components; furnace and heat exchanger were evaluated separately. It was found that the efficiency of the sago starch dryer was only 40%. Experiments on loaded condition were conducted with wet sago starch 20 kg. For operation with biomass energy alone, the drying duration and fuel consumption rates were about 4 hours. Moisture content of sago starch was reduced from 42.51% to 13.42% wet basis.

Keywords : energy conservation, biomass, moisture content, Indonesia.

Introduction

Drying wet sago starch is generally still done conventionally by direct drying in sunlight using simple equipment. The drying process is undertaken by laying out the starch and sago soaked in simple equipment, such as bucket and mats, then dried under direct sunlight. According to Tarigan and Ariningsih [1], drying sago starch is performed by the people in Papua is still conducted by using modest equipment, i.e., wet sago starch as much as 50-60 kg dried over a bucket for 6 hours until the moisture content reaches 14% starch. The limitations of mechanical drying equipment is one of the factors that causes people to still use the conventional drying process.

Sago starch drying process is conventionally not effective because it depends on the heat of the sun and is strongly influenced by weather conditions, thus a longer drying time. In addition, sago starch is composed of sticky solid particles and thus requires a longer drying time. According to Jading, *et al* [2], sago starch granules have a size of 5.0 to 57.5 μm , thus including the particles that can be fluidised in a cohesive group (group cohesive/C) according to the Geldart chart.

To overcome these problems, and the scarcity of mechanical dryers for sago starch, consideration was given using a fluidized bed dryer (FBD). Given the granule size, FBD was considered as an appropriate drying device for drying sago starch. FBD is the development of the dryer plug flow fluidized bed dryer air flow especially given the shape of the dried material. Drying air flow through the distribution plate intersects with the material flowing in a continuous bed dryer.

FBD has been widely used in the drying process and generally for materials that are smooth and smaller in size between 10-20 μ m, especially drugs or pharmaceuticals and food ingredients in powder form. In addition, FBD can help reduce material losses during the drying process. FBD has several advantages that the air contact produces better materials, better mixing process so that the drying process is faster than ovens or conventional dryers, easier handling of input of the product during the drying process, can minimize losses and the level of dryness results in a more uniform product. The objective of this study was to design a cross-flow fluidized bed dryer for sago starch as an alternative to traditional drying.

Materials and Methods

The experiment included designing, testing and analyzing the quality of the sago starch. The FBD design was based on a model developed by Jading, *et al* [2] and Sopanronnarit [3]. It consisted of drier parts of the bed dryer, plate distribution, blower, where revenues wet sago starch, sago starch and the dry output. Part of the dryer which has been further developed in this study is the distribution plate, bed dryer and furnace heating. Bed capacity of 50-100 kg of starch wet dryer per process.

Results and Discussion

The results of technical analysis and functional tests of drier, that the sago starch showed cross flow fluidized bed dryer model had a dimension of 2.0 m x 0.5 m x 1.80 (LxWxH), the drying capacity-effectiveness was 20 kg/h at drying temperature of 50 -70°C and the reduced moisture content from 42.51% to 13.42% wet basis can be seen in Figure 1. Test results of CFFB dryers without the use of sago starch can be seen in Table 1.



Figure 1. Sago starch dryer prototype model of fluidized bed for small scale.

Table 1. Test result of sago starch dryer FBD model.

Parameter	Magnitude of the measured values
Temperature in bed dryer	60°C
Temperature in stove biomass	560°C
Fuel consumption	10kg/h
Drying time	3 h

Testing the performance of the equipment was undertaken using wet sago starch as much as 50 kg, 42.5% initial moisture content, granule shape round, oval (oval), and oval cut with a size of 5-57 µm. According to Knight in Haryanto and Pangloli [4], sago starch granules are shaped somewhat truncated ellipse, with a size of 20-60 microns, gelatin temperature range 60 - 72°C and water content of 16.63%. Based on the physical properties of sago starch is then included in the group or C group size limit between 30-100 µm according to Geldart's classification chart. The results of performance testing of fluidized bed dryer indicates that the equipment is able to lower the moisture content to 13.42%, this is in accordance with the requirements of SNI 01-3729-1995 for sago starch. The chemical composition of sago starch produced no change compared with traditional drying. In addition the resulting dry starch viscosity is very good.

Conclusion

Cross flow fluidized bed dryer is capable of drying the sago starch more quickly, evenly and is not influenced by weather, making it very suitable for small-scale drying 50-100 kg.

Acknowledgments

The authors gratefully acknowledge the financial support for this project provided by the grant STRANAS by the General Director for Higher Education 2009.

References

1. Tarigan, H. and Ariningsih, E. (2007). Agro-Industry Development Opportunities and Constraints in Jayapura District: Sago. Proceedings of the National Seminar. Bogor.
2. Jading, A., Payung, P., Tethool, E. and Gultom, S. (2009). Designing and Testing Sago Starch Dryers Fluidized Bed Model Powered solar and Biomass, Seminar Paper Research Results. *UNIPA*, Manokwari, December, 2-4, 2009: Universitas Negeri Papua.
3. Sopanronnarit, S. (1999). Fluidised-bed Paddy Dryer. *Science Asia*, 25:51-56.
4. Haryanto, B. and Pangloli, P. (1992). Potential and Utilization of Sago. Jogjakarta: Kanisius.