



Tropentag, October 7-9, 2008, Hohenheim

“Competition for Resources in a Changing World:
New Drive for Rural Development”

Study on Drying Cloves (*Syzygium aromaticum*) using Greenhouse Effect Solar Dryer Integrated by Biomass Energy

RITA KHATHIR¹, WOLFGANG LUECKE², EDI HARTULISTYOSO³, LEOPOLD OSCAR NELWAN³

¹*Syiah Kuala University, Agricultural Engineering, Indonesia*

²*Georg-August-Universität Göttingen, Institute of Agricultural Engineering, Germany*

³*Bogor Agricultural University, Agricultural Engineering, Indonesia*

Abstract

A study on drying cloves (*Syzygium aromaticum*) was conducted in Bogor, Indonesia, in November, 2008. The purpose of this study is to evaluate the performance of GHE-hybrid dryer applying greenhouse effect mechanism and biomass energy to improve drying air temperatures, and electricity to force the drying air. The GHE-hybrid dryer tested is a deep bed crop dryer represented by 10 series of thin layers covered by polycarbonate sheet. The dryer is supported by 2 axial fans and a biomass stove. The biomass stove is equipped by 99 baffles functioning as heat exchanger. For each drying batch of 1 cm thickness, the drying capacity is 144 kg of cloves. The temperature of drying air from the collector varied between 28 and 52°C and cloves could be dried in 42 hours (6 days) where drying process was run intermittence during the day. Drying chamber temperatures varied in average between 36 to 46°C. The different temperatures among 10 layers were from 3 to 12°C. Air velocity found in drying chamber was in range of 0.04 to 2.09 m s⁻¹ by average of 0.68 m s⁻¹. Thermal efficiency is found about 15 %, and drying efficiency is around 23 %. Based on the cloves initial moisture content of 71.32 %, the energy specific found was 16.79 MJ per kg of evaporated water. The energy input was dominated by the use of biomass energy (75 %) since the research was conducted during the beginning of rainy seasons. Solar energy contributed about 15 % and electricity shared about 10%. It was estimated that due to the variation of temperatures, air velocity, and humidity in the drying chamber the final moisture content wet basis varied highly from 0.2 % to 19.2 %.

Keywords: Biomass energy, cloves, solar dryer, greenhouse effect