RINGKASAN

Pengeringan adalah metode untuk menurunkan kadar air dalam bahan. Pengering energi surya bekerja dengan menyerap energi dari iradiasi surya. Pengering energi surya tipe rak memiliki desain berbentuk persegi dengan beberapa rak di dalamnya sebagai tempat untuk meletakkan bahan yang akan dikeringkan dan dialiri udara. Udara yang digunakan untuk mengeringkan produk ditingkatkan suhunya melalui kolektor surya sebelum dialirkan pada ruang pengering (*chamber*). Namun, penyerapan energi surya kurang maksimal dan terjadinya fluktuasi suhu yang dapat menurunkan kualitas produk. Penelitian ini dilakukan dengan tujuan untuk menganalisis karakteristik bahan penyimpan pada kolektor surya dan pengering energi surya tipe rak dengan penambahan bahan penyimpan panas pada kolektor surya.

Penelitian ini dilakukan secara eksperimental dengan 3 perlakuan pada kolektor surya yaitu dengan kondisi tanpa bahan penyimpan panas (S_0), dengan penyimpan panas batu sungai (S_{rock}), dan dengan penyimpan panas pasir pantai (S_{sand}). Pengamatan dilakukan dengan meletakan pengering energi surya tipe rak di bawah energi surya dari pukul 08.00-16.00 WIB. Pengukuran dilakukan dalam interval 30 menit sekali, dengan variabel pengukuran yaitu, iradiasi surya, suhu lingkungan, suhu kolektor surya, suhu *chamber*, kelembaban relatif lingkungan, kelembaban relatif kolektor surya, kelembaban relatif *chamber*, efisiensi panas kolektor surya, efisiensi *chamber*, kecepatan aliran udara kolektor surya, dan kecepatan aliran udara *chamber*. Variabel-variabel tersebut dianalisis secara deskriptif.

Berdasarkan hasil penelitian dengan penambahan bahan penyimpan panas sensibel yang berupa batu sungai (S_{rock}) dan pasir pantai (S_{sand}) pada kolektor surya pengering energi surya tipe rak menunjukkan suhu tertinggi dan terendah batu sungai sebesar 47,0 °C dan 29,5 °C, serta rata-rata suhu batu sungai sebesar 38,5 °C. Sedangkan, suhu tertinggi dan terendah pasir pantai sebesar 33,1 °C dan 44,9 °C, serta suhu rata-rata pasir pantai 39,8 °C. Rata-rata peningkatan suhu pada fase *charging* pada batu sungai sebesar 1,9 °C dan pasir pantai 1,5 °C. Rata-rata penurunan suhu pada fase *discharging* pada batu sungai sebesar 3,0 °C dan pasir pantai 1,5 °C. Pengering energi surya tipe rak dipengaruhi oleh intensitas iradiasi surya, rata-rata intensitas iradiasi surya pada perlakuan S_0, S_{rock}, dan S_{sand} sebesar 394,6 W/m^2; 361,9 W/m^2; dan 353,0 W/m^2. Peningkatan rata-rata suhu kolektor surya dengan suhu lingkungan pada perlakuan S_0, S_{rock}, dan S_{sand} sebesar 1,7 °C; 2,2 °C; dan 2,5 °C. Sedangkan besarnya peningkatan rata-rata suhu *chamber* dengan suhu lingkungan sebesar 3,4 °C; 3,7 °C; dan 4,3 °C. Rata-rata kelembaban kolektor surya pada perlakuan S_0, S_{rock}, dan S_{sand} sebesar 54,1%, 59,3%, dan 60,6%, sedangkan untuk kelembaban rata-rata *chamber* sebesar 46,1%; 53,2%; dan 53,6%. Rata-rata efisiensi panas kolektor surya pada perlakuan S_0, S_{rock}, dan S_{sand} sebesar 19,2%; 32,3%; dan 29,0%, sedangkan efisiensi panas *chamber* sebesar 14,7%; 14,5%; dan 14,7%.

SUMMMARY

Drying is a method used to reduce the moisture content in materials. A solar energy dryer operates by absorbing energy from solar radiation. The tray solar energy dryer is designed in a square shape with several tray inside to place the materials to be dried, which are exposed to airflow. The air used for drying the product is heated through a solar collector before being directed into the drying chamber. However, the absorption of solar energy is often not optimal, and temperature fluctuations can occur, which may reduce product quality. This study was conducted to analyze the characteristics of heat storage materials in the solar air collector and the rack-type solar energy dryer by adding heat storage materials to the solar air collector.

The research was carried out experimentally with three treatments in the solar air collector: without heat storage material (S_0), with river stone heat storage (S_{rock}), and with beach sand heat storage (S_{sand}). Observations were made by placing the rack-type solar energy dryer under solar energy from 08.00 to 16.00 WIB. Measurements were taken at 30-minute intervals, with measured variables including solar iradiation, ambient temperature, collector temperature, chamber temperature, ambient relative humidity, collector relative humidity, chamber relative humidity, thermal efficiency of the solar air collector, and thermal efficiency of the drying chamber, air flow of solar air colletor, and air flow of drying chamber. These variables were analyzed descriptively.

Based on the results of the study, the addition of sensible heat storage materials in the form of river stones (S_{rock}) and beach sand (S_{sand}) in the solar air collector of the tray solar energy dryer showed the highest and lowest temperatures for river stones were 47,0 °C and 29,5 °C, with an average temperature of 38,5 °C. Meanwhile, the highest and lowest temperatures for beach sand were 44,9 °C and 33,1 °C, with an average temperature of 39,9 °C. The average temperature increase during the charging phase for river stones was 1,9 °C and for beach sand was 1,5 °C. The average temperature drop during the discharging phase for river stones was 3.0 °C and for beach sand was 1,5 °C. The performance of the tray solar dryer was influenced by the intensity of solar iradiation. The average solar iradiation intensity for treatments S_0, S_{rock}, and S_{sand} was 394,6 W/m²; 361,9 W/m²; and 353,0 W/m²; respectively. The average increase in collector temperature compared to ambient temperature for S_0, S_{rock}, and S_{sand} was 1.7 °C; 2.2 °C; and 2.5 °C; respectively. Meanwhile, the average increase in chamber temperature compared to ambient temperature was 3,4 °C; 3,7 °C; and 4,3 °C; respectively. The average relative humidity in the solar air collector for S_0, S_{rock}, and S_{sand} was 54,1%; 59,3%; and 60,6%; respectively, while the average relative humidity in the chamber was 46,1%; 53,2%; and 53,6%; respectively. The average thermal efficiency of the solar air collector for S_0, S_{rock}, and S_{sand} was 19,2%; 32,3%; and 29,0%; while the thermal efficiency of the drying chamber was 14,7%; 14,5%; and 14,7%; respectively.