

Thesis Title	Loop Thermosyphon as an Energy Saver for Heat Pump Dryer		
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ABSTRACT

The main focus of this thesis is the application of a loop thermosyphon (LTS) as an energy saver for a heat pump dryer (HPD) system. The method involved design and development of mathematical models. The mathematical models considered a conventional heat pump dryer (without loop thermosyphon), the loop thermosyphon model and the heat pump dryer with loop thermosyphon as an energy saver. An experimental unit was constructed to compare results and verify the model. The economics of a loop thermosyphon for use in heat pump dryer was also analyzed.

Mathematical models were developed which including a of heat pump dryer model used to predict the heat transfer characteristics of the system. The amount of longan in one batch was 120 kg, the suitable condition and the specification of the heat pump dryer were airflow rate of 450 m³/h, the condenser of 8 kW, the evaporator of 5.25 kW and the compressor of 2.75 kW. It was found that the results of experimental closely matched the results from the model. So, it can be concluded that the heat pump dryer without loop thermosyphon model can be used to predict the heat transfer characteristic of heat pump dryer at any condition. The model can also predict

the limitations of operation of the heat pump and the limitations of the drying process. The minimum specific energy consumption was calculated for design and construction of the loop thermosyphon. Numerical simulation of the loop thermosyphon was used to simulate all of the sizes of the loop thermosyphon. For this research, the size of the loop thermosyphon used based on design was 5.25 kW. From the result, it can be concluded that the loop thermosyphon model can be used to design the loop thermosyphon and predict the maximum effectiveness of the loop thermosyphon. The loop thermosyphon is a device that when used heat pump dryer saves energy. The results show that the loop thermosyphon can reduce the specific energy consumption from 12 to 20%, depending on the operating conditions. Application of the loop thermosyphon in the heat pump dryer is beneficial, because the economic analysis shows that the pay back period is about 3 years and the internal rate of return (IRR) is about 30%. These results were obtained by operating the heat pump dryer at an airflow rate of two to four times of the optimum value. For this research is 450 m³/h. If operated at optimum value of airflow, the value of energy saving will be more, the pay back period could be less than 3 years and the IRR will be higher than 30%.