

Tuchapol Thachasri 2006: Design of the Turmeric (*Curcuma longa* Linn.) Dryer.

Master of Engineering (Agricultural Engineering), Major Field: Agricultural Engineering,

Department of Agricultural Engineering. Thesis Advisor:

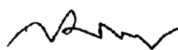
Assistant Professor Somyot Chirnakorn, Ph.D. 171 pages.

ISBN 974-16-1794-1

In this research, a heat pump dryer for turmeric was designed, built, tested the performance and evaluated the drying cost. Main parts consist of a drying chamber of 0.394 m^3 volume containing eight trays (weight of product 20 -30 kg) with 2.5 m^2 working area, a heat pump unit at capacity of 1 ton of refrigeration. The operation of the system is designed as a close loop system with drying temperature at 60°C , air mass flow rate of 0.316 kg/s and bypassing air of 69 %. Six kg of 0.3-0.4 cm thick sliced turmeric with an average initial moisture content of 856.85 to 2208.17 %db were dried to an average final moisture content about 9.08 %db. The suitable production of ground turmeric was found from curing turmeric in boiling water for 30-60 minutes, slicing and then drying at 60°C . The drying time was 9 hours, which was less than the drying time of fresh sliced turmeric for 14 hours. Coulor of ground turmeric was shown as L (brightness) at 36.31, a (red) at 20.46, and b (yellow) at 23.47 and curcumin content was 5.34 percentage. The result gave the highest average drying rate (DR) at 0.585 kg/h , moisture extraction rate (MER) at 0.421 kg/h and specific moisture extraction rate (SMER) at 0.364 kg/h . The lowest average specific energy consumption (SEC) was 9.915 MJ/kg . The coefficient of performance ($\text{COP}_{\text{hp(used)}}$) from 0.874 to 1.952 were obtained from the internal condenser actual load. Meanwhile the $\text{COP}_{\text{hp(sys)}}$ from 3.108 to 3.160 were found established for the total system because of the rejection of excess heat to the ambient by the external condenser. From the economical analysis of this experiment, it was found that the total cost of drying was 3.35 Baht per kg of water evaporated which comprised of 1.27 Baht fixed cost, 1.66 Baht energy cost, and 0.42 Baht maintenance cost. The payback period was 0.98 years and the internal rate of return was 1%.

Tuchapol Thachasri

Student's signature



Thesis Advisor's signature

16 / 05 / 2006