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### Review of close loop heat pump dryers for food drying

P.N.R.J. Amunugoda,<sup>1\*</sup>G.D.D.R. Jayasinghe,<sup>1</sup> and G. R. Dunuwila<sup>2</sup>

<sup>1</sup>*Food Technology Section, Industrial Technology Institute, 363, BaudhalokaMawatha, Colombo07.*

<sup>2</sup>*Thermex Lanka (Pvt Ltd), 156/75, Negombo Road, Peliyagoda.*

Sri Lanka has experienced an increase in the number of different dryers for commercial food dehydration. The objective of this study was to review the overall performance of heat pump dryers (HPD), and to survey and test the performance of locally introduced HPD for end user recommendation and improvements. We reviewed studies on heat pump drying and compared the methods therein with the most common methods of drying in overseas food drying industries, and in Sri Lanka. In a closed loop HPD, the heat pump retrieves the heat in the exhausted air to heat the air entering the dryer, while it removes the moisture in the exhausted air; it delivers more heat than the work input to the compressor and achieves high energy efficiency. The system has the optional ability to dry thermally sensitive food materials at near ambient temperature by configuration of the compressor capacity, and drying under an Oxygen free environment by using inert gas, thus under aseptic processing by air filtering, and sterilizing the drying chamber with the load before operating the dryer using the correct dosage of Ozone gas. Results of comparison of HPD with the most common traditional drying methods for food drying and survey based results obtain using 10 closed type heat pump dryers operating in Sri Lanka for fruits, vegetables, coconut and tea showed that heat pump dryer is better than traditional hot air drying methods. A closed type heat pump dryer experimentally investigated for mushroom, jackfruit, pineapple, banana, papaya, curry leaf, pepper, and cloves showed significance quality and operational cost improvement compared to kerosene oil and electrical hot air dehydration, and was competitive with vacuum drying and freeze drying for overall performance. Incorporation of this technically feasible and environment friendly HPD into dehydrated food value and supply chain in Sri Lanka is recommended with policy support, as the technology is less understood and there is further improvement avenues of the system to obtain overall benefits for the end users.

**Key words:** drying system, energy recovery, closed loop heat pump dryer.

neville@iti.lk

+ 94112797346 / +94718475734