

#### 4.8 Testing the performance of the loop thermosyphon

The thermal performance method, which was used in this thesis is “ Effectiveness (Eff.) - Number of transfer Units (NTU).”

The analysis of heat exchanger performance in terms of the Eff – NTU relation is given in Equation. 4.57.

$$\text{Eff.} = (1 - e^{-(\text{NTU})}) \quad (4.57)$$

This equation is used for all heat exchanger of counter current flow.

#### 4.9 Assumptions Made in the theoretical Model

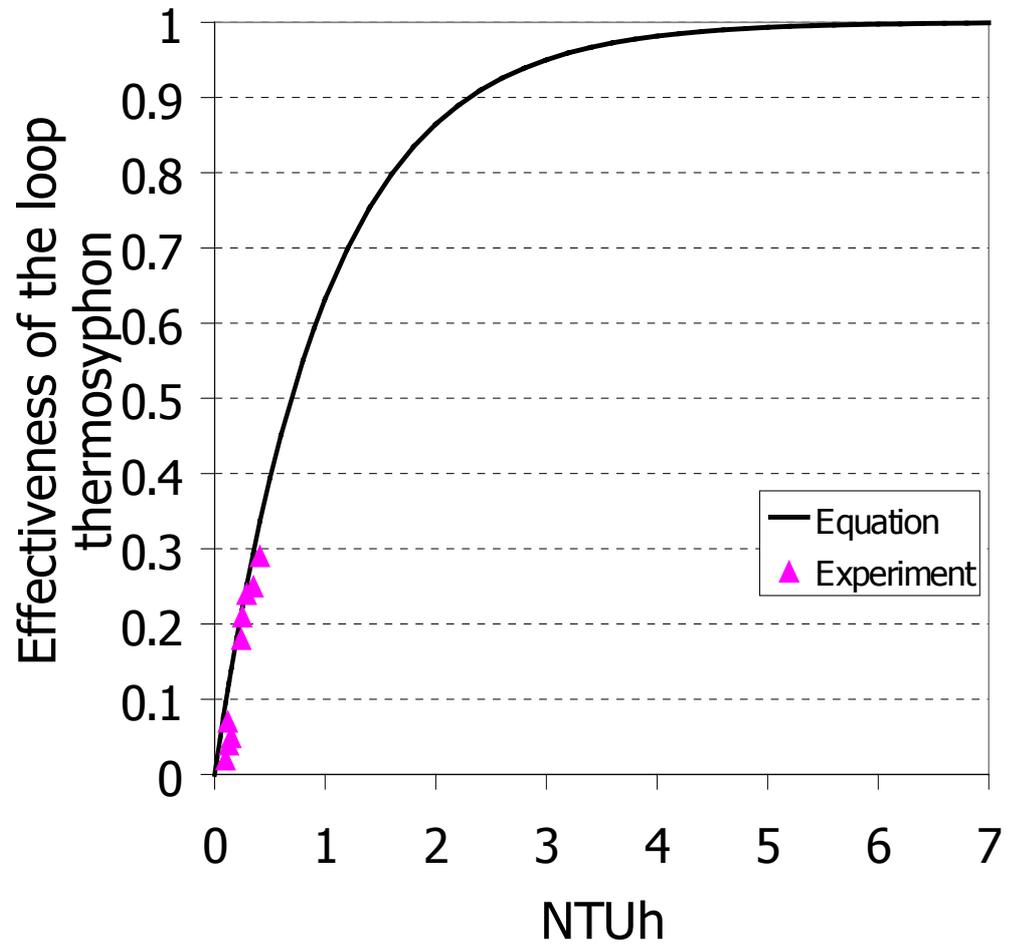
4.9.1 The heat exchanger operates under steady- state conditions

4.9.2 The overall heat transfer coefficient is constant throughout the heat exchanger.

4.9.3 Fluid temperatures and velocities are uniform across the channel.

After construction of the loop thermosyphon and before application on the heat pump dryer, performance testing of the loop thermosyphon was done using Effectiveness – NTU method.

Figure 4.7 shows effectiveness of the loop thermosyphon and NTU<sub>h</sub>. It can be seen that the NTU<sub>h</sub> increase from 0 to 7 when the effectiveness increases from 0 to 0.999. The solid line is the value from the equation and the value from the experiment is the points. It can be seen that the results are quite well in agreement. The maximum effectiveness from experiment of 0.25, which happen at the airflow rate of 450 m<sup>3</sup>/hr. This value is the minimum limit of heat pump operation and drying process in this research. When the effectiveness increase the NTU<sub>h</sub> increase. The NTU<sub>h</sub> increases by increases heat transfer area or reduces airflow rate. If the effectiveness approaches 1 the value of NTU<sub>h</sub> was infinity. This can occur when the heat transfer area was infinity or the temperature of airflow rate approach zero and the temperature of air enter heat exchanger equal the temperature of working fluid.



**Figure 4.7** Effectiveness of the loop thermosyphon and NTU<sub>h</sub>