CHAPTER 6

Conclusions

This study has presented a new technique revolving around desalination process, using a renewable energy (solar energy) as a heat source. The results was summarized into two parts. Part 1 studied the effects of parameters on the system's performance. These parameters were initial salinity of the salt solution, reservoir level of the bubble pump and outlet temperature from solar collector. Mathematical models of the bubble pump and the whole system were established. Part 2 was the long term and economic analysis.

6.1 Effects of Parameters on the System

Three samples of salt solution with salinity of 3, 3.5 and 4% of water by weight were tested under Chiang Mai climatic condition. The reservoir level of salt solution in the bubble pump was changed between 60%, 80% and 100% from the bottom of the evaporator. It was evident from the results that the system with the reservoir level of 60% and initial salinity of 3% was the most efficient case which produced distilled water 13.54 ml/min or 0.81 l/h in average.

6.2 Correlations of Bubble Pump

The correlations between the mass flow rate of the distilled water (M_d), the reservoir level of saline water in the evaporator (H) ranging ranges from 162 to 270 mm, the temperature coming from the solar collector (T_o) ranging from 95 to 103°C, and the initial concentration of sea water (X_f) of 3, 3.5 and 4% were formed.

The modeling of bubble pump in the case of salinity of 3% with 91.66% of the experimental data is consistent with the simulation data within $\pm 10\%$ with the uncertainty of $\pm 7.02\%$ as given by:

$$M_d = (-353.83100 + 2.75650H - 0.00654H^2) + (3.61750 - 0.02694H + 0.00006H^2)T_o.$$

The modeling of bubble pump in the case of salinity of 3.5% with 83.33% of the experimental data is consistent with the simulation data within $\pm 10\%$ with the uncertainty of $\pm 13.64\%$ as given by:

$$M_d = (60.05200 - 1.63710H + 0.00434H^2) + (-0.59100 + 0.01749H - 0.00005H^2)T_o.$$

The modeling of bubble pump in the case of salinity of 4% with driving head of 162 mm (60%) has 87.5% of the experimental data is consistent with the simulation data within $\pm 10\%$ with the uncertainty of $\pm 7.72\%$ as given by:

$$M_d = 0.8669T_o - 77.082.$$

6.3 Economic Analysis

The lowest cost of the production from the solar thermal desalination of seawater by bubble pump technique was 4.32 baht per liter.The initial investment and the discount rate was the main cost of the system. The discount rate had more effect on the unit cost of distilled water than the cost of the solar collector.