# A Study on the Energy Balance within a Bubble Column Evaporator

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A bubble column evaporator (BCE) system was used to determine accurate and precise enthalpy of vaporization ($\Delta H_{vap}$) values for concentrated salt solutions. The method is based on the steady state energy balance developed in a bubble column evaporator. The BCE system offers a novel and simple approach for $\Delta H_{vap}$ measurements because it only requires measurement of the hydrostatic differential pressure across the column and the temperatures of the steady state column solution and the inlet gas. BCE systems also have been studied and developed for many other applications, such as thermal desalination, sterilization and evaporative cooling. The energy balance and utilization involved in these processes form the fundamental theory for BCE applications. In this work, besides precise determination of $\Delta H_{vap}$ values, a comparison has been made between the originally proposed energy balance equation and a new energy balance equation. Experimental measurements obtained at low and high inlet air temperature were used to calculate the corresponding $\Delta H_{vap}$ values. At low temperatures of inlet air (~333 K), the new equation gave the same level of error percent compared with literature $\Delta H_{vap}$ values; while for high inlet air temperatures (423-548 K) the closest $\Delta H_{vap}$ values were given by the original equation. Typical energy consumption levels for thermal desalination for producing pure water using the BCE process was also analyzed with different inlet air temperatures.