Thermodynamic Study of 8-Hydroxyquinoline by Adiabatic Calorimetry and Thermal Analysis

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8-hydroxyquinoline (abbreviated 8-HQ) (CAS registry number 148-24-3) is known as oxine and it is a bacterial inhibitor and precursor of a number of antimalarial and anticancer drugs [1]. The thermodynamic properties of 8-HQ are significant for producing the drug and clinical application. Some thermodynamic properties of this substance have been investigated such as the melting point [2] and the enthalpy of sublimation [3,4]. However, to our best knowledge, no report is found in the literature on heat capacity and enthalpy and entropy of fusion of 8-HQ.

Heat capacity is one of the fundamental thermodynamic properties of substances and closely related to the energetic structure, and is sensitive to the variations in other properties. Adiabatic calorimetry is one of accurate approaches to obtain the heat capacity, melting point and enthalpy and entropy of fusion of substances. In the present work, Calorimetric study and thermal analysis for 8-HQ were performed. The low-temperature heat capacity of this compound was measured with a precise automated adiabatic calorimeter over the temperature range from T = 78 K to T = 370 K. The melting point and molar enthalpy and entropy of fusion of this substance were determined to be (345.74±0.15) K, (13.93±0.11) kJ·mol^{-1} and (40.26±0.33) J·K^{-1}·mol^{-1}, respectively. The thermodynamic functions $[H_T - H_{298.15}]$ and $[S_T - S_{298.15}]$ were derived from the measured capacity data. The melting temperatures for the sample and the absolutely pure compound have been obtained from fractional melting experiments to be T = 345.601 K and T = 345.761 K, respectively, and the chemical purity of the sample was evaluated to be 0.9978 mol fraction according to the Van't Hoff equation. The thermal stability of the compound was further investigated by differential scanning calorimetry (DSC).

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