ADVANTAGES OF FAST SCANNING CALORIMETRY IN STUDYING THE THERMODYNAMICS OF PHASE TRANSITIONS IN PHARMACEUTICALS

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The study of the thermodynamic properties of pharmaceutical compounds is one of the most essential tasks in modern pharmaceuticals. The thermodynamic parameters of phase transitions significantly influence key physicochemical characteristics of compounds, such as solubility, stability, and bioavailability. However, a great number of pharmaceutical drugs is thermally unstable, which complicates their investigation.

To address this issue, a wide range of direct and indirect experimental methods have been proposed so far, as, for example, differential scanning calorimetry, solubility measurements, and solution calorimetry. In the context of thermally unstable compounds, fast scanning calorimetry is particularly interesting [1,2,3]. Due to the small sample size required for measurements, fast scanning calorimetry enables the study of the thermodynamic properties of compounds at high (up to 10000 K s^{-1}) scanning rates. This allows for the investigation of previously inaccessible thermodynamic parameters of substances by suppressing kinetically controlled processes, including decomposition, crystallization, and polymorphic transitions, and improving sample volatility for vapor pressure measurements.

In this work, we conducted a comprehensive study of the thermodynamic parameters of phase transitions for several pharmaceutical and model compounds using fast scanning calorimetry in combination with differential scanning calorimetry, solution calorimetry, and computational methods. As a result, a consistent set of thermodynamic data was obtained: the vapor pressure over the liquid and crystalline phases, the heat capacities of the ideal gas, liquid, and crystalline phases, and the enthalpies of fusion, vaporization, and sublimation over a wide temperature range.

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This work was supported by the Russian Science Foundation (project № 25-73-20073).