

Vapour Pressure Determination of Pharmaceutical Powders

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The explicit determination of the vapour pressure and enthalpy of sublimation of pharmaceutical powders is of great scientific and practical interest to the pharmaceutical industry. In this work an isothermal Knudsen effusion apparatus, consisting of a small cell with an effusion orifice placed on a microbalance held within a vacuum chamber is used to determine the vapour pressure of pharmaceutical solids.

Small samples of benzoic acid, paracetamol (acetaminophen) form I along with ibuprofen (4-isobutyl- α -methyl-phenylacetic acid) were studied at temperatures between 40 and 74°C. Vapour pressures were then calculated from the effusion rate and the enthalpies of sublimation calculated from the data gathered at a range of temperatures.

Benzoic acid was found to have an enthalpy of sublimation of 88.5 kJ/mol which agrees well with literature values. Paracetamol was found to have vapour pressures ranging between 0.0671 Pa to 0.000022 Pa for the temperature range 74°C to 40°C, and an enthalpy of sublimation 238.85 kJ/mol. Ibuprofen had a vapour pressure ranging from 3.386 Pa to 0.00708 Pa for the temperature range 70.4°C to 25°C and an enthalpy of sublimation of 163 kJ/mol.

The vacuum Knudsen technique was found to be ideally suited to measure the vapour pressure and enthalpies of sublimation of pharmaceutical powders.