

A Thermodynamic Investigation of Reactions Catalyzed by D-Hydantoinase and N-Carbamoyl-D-Amino Acid Hydrolase

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The enzymes D-hydantoinase and N-carbamoyl-D-amino acid hydrolase are used for the commercial production of optically pure amino acids. These optically pure amino acids are, in turn, widely used to produce semi-synthetic antibiotics, pesticides, and peptide hormones. Interestingly, there do not appear to be any thermodynamic results in the literature for D-hydantoinase or N-carbamoyl-D-amino acid hydrolase catalyzed reactions. Accordingly, we have performed a thermodynamic investigation of some representative reactions that are catalyzed by these enzymes. This thermodynamic study was carried out by using a combination of microcalorimetry and h.p.l.c. to measure, where possible, values of the apparent equilibrium constants K' and calorimetric molar enthalpy changes $\Delta_r H_m^\circ$ for representative reactions. An equilibrium model was then used to calculate values of standard equilibrium constants K and standard molar enthalpy changes $\Delta_r H_m^\circ$ for reference reactions that are appropriate for the overall biochemical reactions that were studied. The results allow for the prediction of the position of equilibrium of the studied reactions over a wide range of temperature, pH, and ionic strength.