DNA and RNA Duplex Stability by ITC and DSC

B.E. Lang[C, S] and F.P. Schwarz
Center for Advanced Research in Biotechnology/National Institute of Standards and Technology, Rockville, MD, U.S.A.
brian.lang@nist.gov

DNA and RNA duplex stability is most often calculated using a Watson-Crick nearest-neighbor model to predict ΔG and ΔH. However, these models are based on extrapolation of UV melting of DNA duplexes, which are an indirect and somewhat imprecise method in determining the stability. We have measured the thermodynamic parameters of DNA duplex formation the DNA oligonucleotide 5'-ATGCTGATGC-3' and its complementary DNA and RNA strands, and compared them with the predicted thermodynamic parameters calculated from the nearest-neighbor model. From isothermal titration calorimetry (ITC), values for thermodynamic parameter and binding constants for the duplex formation have been measured as a function of temperature and pH. Using DSC we have determined the enthalpy of the conformational changes of various single strands DNA due to stacking interactions. These conformational changes contribute to extrapolated enthalpy of dissociation of the duplex DNA as measured by UV melting studies and must be taken into account in UV and DSC studies.