Abstract

N–methylation of nucleic acids is one of the most important epigenetic mechanisms in organisms and viruses and it is observed in connection with physiological or pathological processes in human body. For example, the *N*–methylation of adenine to give N^6-methyladenine is associated with development of obesity or Alzheimer disease. These systems can be successfully studied by low-temperature NMR spectroscopy because the bond between a purine ring and its substituent has a significant double-bond character and, due to restricted rotation around this bond, two sets of signals are observed in low-temperature NMR spectra.

This diploma thesis is focused on research of *N*–methylated nucleobases' rotamer equilibria and the free-energy changes associated with the hydrogen-bonded base pair formation via simple and straightforward method based on NMR spectroscopy monitoring. We proved that the rotamer equilibria of *N*–methylated adenine derivatives are dependent on temperature, solvent and bonding partner concentration. We also obtained the geometry of formed intermolecular complexes of *N*–methylated adenine derivatives with thymine and the free-energy changes associated with their formations via newly developed method based on chemical shift changes dependent on bonding partner concentration. All obtained data were supported by DFT calculations.