URIDINE NUCLEOSIDE THIATION: GAS-PHASE STRUCTURES AND ENERGETICS

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The naturally occurring thiated uridine nucleosides, 4-thiouridine (s^4Urd) and 2-thiouridine (s^2Urd), play important roles in the function and analysis of a variety of RNAs. 2-Thiouridine and its C5 modified analogues are commonly found in tRNAs and are believed to play an important role in codon recognition possibly due to their different structure, which has been shown by NMR to be predominantly C3′-endo. 2-Thiouridine may also play an important role in facilitating nonenzymatic RNA replication and transcription. 4-Thiouridine is a commonly used photoactivatable crosslinker that is often used to study RNA-RNA and RNA-protein cross-linking behavior. Differences in the base pairing between uracil and 4-thiouracil with adenine and guanine are an important factor in their role as a cross linker. The photoactivity of s^4Urd may also aid in preventing near-UV lethality in cells. An understanding of their intrinsic structure in the gas-phase may help further elucidate the roles these modified nucleosides play in the regulation of RNAs.

In this work, infrared multiple photon dissociation (IRMPD) action spectra of the protonated forms of s^2Urd and s^4Urd were collected in the IR fingerprint region. Structural information is determined by comparison with theoretical linear IR spectra generated from density functional theory calculations using molecular modeling to generate low-energy candidate structures. Present results are compared with analogous results for the protonated forms of uridine and 2′-deoxyuridine as well as solution phase NMR data and crystal structures.