2-Aminoisobutyric acid (Aib) is an achiral, \(\alpha\)-amino acid having two equivalent methyl groups attached to C\(_\alpha\). Extended Aib oligomers are known to preferentially adopt a 3\(_{10}\)-helical structure in the condensed phase. Here, we take a simplifying step and focus on the intrinsic folding propensities of Aib by looking at a single, capped Aib structure and then extending to longer oligomers in the gas phase, free from the influence of solvent molecules and cooled in a supersonic expansion. Resonant two-photon ionization and IR-UV holeburning will be used to record single-conformation UV spectra using the Z-cap as UV chromophore. Resonant ion-dip infrared (RIDIR) spectroscopy provides single-conformation IR spectra in the OH stretch, NH stretch, amide I and amide II regions. Two conformational isomers have been identified for the smallest unit in the study, Z-Aib-OH, and four conformational isomers were seen for Z-Aib-Aib-OH, with widely-varying IR spectral patterns. In addition to investigating the conformational dependence on oligomer length, this work also studies the steric and electrostatic impact of different capping groups, R-X where \(X = -\text{OH}, -\text{OMethyl}, \text{ and } -\text{OtButyl}\). These caps are considered here for the case of Z-Aib-Aib-X. Extension to larger Z-(Aib)\(_n\)-X oligomers will shed light on the extent to which the solution phase preference for 3\(_{10}\)-helix formation is retained in the gas phase, and when its onset first appears. When possible \(^{13}\)C isotopomers will be used to assist with the assignments and modulate the coupling between amide I fundamentals.

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