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Bulk Amounts of Linear and Cyclic Polypeptides on Our Hand within a Short Time

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Abstract : Polypeptides with defined peptide sequences illustrate the power of remarkable applications in drug delivery, tissue engineering, sensing and catalysis. Especially the cyclic polypeptides, the distinctive topological architecture imparts many characteristic properties comparing to linear polypeptides. Here, a facile and highly efficient strategy for the synthesis of linear and cyclic polypeptides is reported using N-heterocyclic carbenes (NHCs)-mediated ring-opening polymerization (ROP) of α-amino acid N-carboxyanhydrides (NCA) in the presence or absence of primary amine initiator. The polymerization proceeds rapidly in a quasi-living manner, allowing access to linear and cyclic polypeptides of well-defined chain length and narrow polydispersity, as evidenced by nuclear magnetic resonance spectrum (1H NMR and 13C NMR spectra) and size exclusion chromatography (SEC) analysis. The cyclic architecture of the polypeptides was further verified by matrix-assisted laser desorption ionization-time of flight (MALDI-TOF) mass spectra (MALDI-TOF MS) and electrospray ionization (ESI) mass spectra, as well as viscosity studies. This approach can also simplify workup procedures and make bulk scale synthesis possible, which thereby opens avenues for practical uses in diverse areas, opening up the new generation of polypeptide synthesis.

Keywords : α-amino acid N-carboxyanhydrides, living polymerization, polypeptides, N-heterocyclic carbenes, ring-opening polymerization
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