

Chiro-optical and solution properties of stimuli responsive amino acid-deriving polymers

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The design of chiral synthetic polymers capable of self-assembling into stable secondary structures represents an attracting approach with important biological implications [1], from selective subcellular localization to protein surface mimicry and recognition. In previous work, the first examples of a new class of stimuli-responsive bioinspired chiral polymers, namely polyamidoaminoacids (PAACs), were obtained by the polyaddition of L-, D- and D,L-arginine with N,N'-methylenebisacrylamide (ARGO7) [2]. L-ARGO7 proved highly citobiocompatible and preferentially localized in the perinuclear region of Balb/3T3 cells [3]. Circular dichroism (CD) and molecular dynamic modeling studies showed that L- and D-ARGO7 folded into rigid conformations reminiscent of the protein hairpin motif, which underwent rapid and reversible interconversions with pH [2]. In order to demonstrate that the observed behavior was a general one, a library of amphoteric PAACs were synthesized from different L-, D- and D,L- α -aminoacids. They were obtained in 92% yield by stepwise polyaddition with N,N'-methylenebisacrylamide in water at pH > 10 and 50 °C for 6 days. Acid-base and chiro-optical properties were evaluated to gain insights into their pH-dependent conformational behavior in water and establishing structure-properties correlations. The thermodynamic results for the deprotonation of the amine- and carboxyl groups never displayed a typical "polyelectrolyte" behavior. In water, the " α " values of PAACs in the Mark-Houwink-Sakurada equation ranged between 0.6 and 0.8, suggesting that they assumed coiled structures (Figure 1). CD spectra, recorded for all PAACs in the 3-12 pH interval, were consistent with the presence of pH-dependent ordered secondary structures (Figure 2). Future studies on cell internalization will assess the potential of PAACs for establishing chirality-dependent selective interactions with cell components.

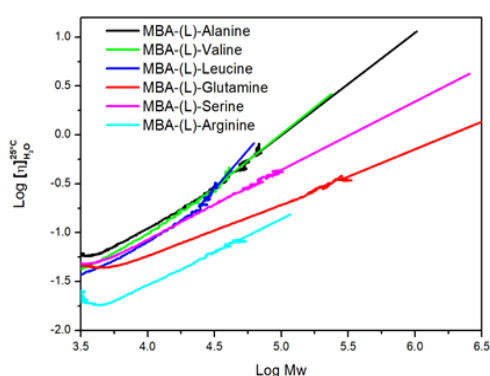


Figure 1. PAACs Mark-Houwink-Sakurada plots in TRIS buffer at pH 8.0.

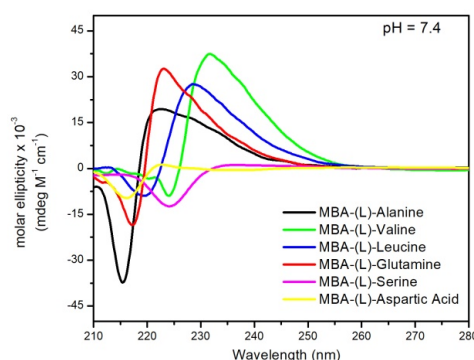


Figure 2. PAACs CD spectra recorded at pH 7.4.

References

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