OFFICIAL ABSTRACT and CERTIFICATION

Synthesis and Temperature-dependent Phase Behavior of a Dendritic Dipeptide

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Liquid crystals (LCs) are unique molecules that combine the fluidity of liquids and the molecular order of solids. Dendrons, which have liquid crystalline properties, are often grafted onto peptides to create hybrids with the ability to withstand hostile environments in the LC phase and a large potential for applications in medicine, energy, and nanotechnology. While peptide-dendron monomers can be manipulated for their structure and function, the resulting hydrogen bonding and London dispersion forces (LDFs) can determine whether and when an LC forms. To further investigate the role of electrostatic forces on LC formation in hybrids with short dendrons, a novel dendritic lysine-alanine was synthesized and characterized. A leaving group was attached to a dendritic benzamide through esterification in order to ensure the successful attachment of lysine to the dendron. After attaching the dendron to lysine through trans-amidation, alanine was grafted onto the dendron-lysine through peptide-coupling, and the final product was confirmed through 1H NMR. Polarized optical microscopy (POM) and differential scanning calorimetry (DSC) experiments revealed that isotropization from the solid phase occurred at 102°C. An additional peak at a lower temperature was seen in the DSC data, but lack of fluidity during POM experiments led to inconclusive results regarding LC formation. Data from previous studies suggested that extensive hydrogen bonding may prevent an LC formation; however, minimizing potential H-bonding sites in this experiment did not result in a definitive LC phase, suggesting that the appropriate balance between LDFs in the dendrons and H-bonding in the peptide has not been achieved.

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