Modification of Poly-Valerolactone Through Hydrogen Bonding

Most of today's plastics are not biodegradable because they have backbones made of carbon chains or aromatic rings. Biodegradable plastics, such as polyhydroxyalkanoates (PHA), incorporate oxygens into the backbones. This leads to poor mechanical properties, however, such as brittleness. In order to improve the tensile strength of the polymer, the intermolecular forces must be increased. Kevlar is a great example for how hydrogen bonding increases the strength of a polymer. My research project will be modifying a PHA by incorporating hydrogen bonds to make the polymer strands interact in a more ordered, regular array. The higher degree of order will lead to a stronger and more efficient plastic to be used as an alternative to petroleum-based plastics. I will be adding masked aniline functional groups to the $\alpha$ position of $\delta$-valerolactone and then using acid-catalyzed ring opening polymerization to polymerize the lactone. Unmasking the aniline will produce a hydrogen bond donor/acceptor $\alpha$ to the ester of the polymer backbone. I will study how the new hydrogen bonding system affects the melting point, crystallinity, and tensile strength of the polymer.

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