Development of Poly(Ester–Carbonate)s Comprising Aromatic Mesogens and Aliphatic Oligocarbonates with Hydrophilic Side-Chains

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Condensation polymers containing rigid-rod aromatic structures can exhibit high thermal and high mechanical properties. Main-chain liquid-crystalline polyesters and polyamides are also included in this family of polymers.[1] They are known to show high melting points and high mechanical strength resulting from molecular orientation.[1] However, their high chemical stability may not be compatible with degradation in the natural environment.

Aliphatic polyesters and polycarbonates such as polylactides (PLAs) and poly(trimethylene carbonate) (PTMC) have drawn increasing attention as biodegradable polymers that can be applied to both biomedical devices and sustainable materials.[2] In addition, much effort has been made to develop PLA and PTMC analogs with functional side groups in the last few decades. Nevertheless, few aliphatic condensation polymers with high thermal and mechanical stabilities have been studied.

Herein, we designed poly(ester–carbonate)s **1** comprising aromatic three-ring mesogens and aliphatic oligocarbonates with ether side-chains to combine the thermal and mechanical stabilities and bio-functionality. The aromatic/aliphatic poly(ester–carbonate)s **1** were obtained by two-step polymerizations. The aliphatic oligocarbonates were first synthesized by ring-opening polymerization of a corresponding cyclic carbonate initiated by a bis(hydroxy)-functionalized mesogen. The oligocarbonate diols were then reacted with adipoyl chloride for chain extension by polycondensation. Polymers with more than 1×10^5 in the weight-average molecular weights were obtained. The composition of the aromatic mesogens was controlled, ranging 6–17 wt%, by the length of the aliphatic oligocarbonates. We found that polymer **1** showed a considerable increase in Young's moduli from the aliphatic polycarbonate with ether side-chains.

1) T. Kato *et al.*, *Polym. J.* **2018**, *50*, 149-166. 2) K. Fukushima, *Biomater. Sci.*, **2016**, *4*, 9-24.