SYNTHESIS AND CHARACTERISATION OF AN EXTENDED SERIES OF BIODEGRADABLE CYCLOALIPHATIC POLYESTERS

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INTRODUCTION: We report the synthesis and characterisation of an extended series of biodegradable cycloaliphatic polyesters for medical purposes. These polymers are based on cis- and trans-1,4-cyclohexanedicarboxylic acid, cis- and trans-1,4-cyclohexanediol and straight chain aliphatic diols and diacids with different chain lengths. The results demonstrate the possibility of controlling polymer morphology through the cis/trans composition of the 1,4-cyclohexane moiety. The trans isomer increases the regularity of the polymer chain and hence modifies the crystalline morphology, the most obvious indication of which is an increase in melting point.

METHODS: Cis and trans isomers of 1,4-cyclohexane-dicarboxylic acid or 1,4-cyclohexanediol were separated from commercially supplied mixtures by derivatisation and recrystallisation or solvent extraction. Diacids were converted with thionyl chloride into the more reactive acid chlorides. Polycondensations were then performed in the melt, and the polymers recovered and purified by dissolution and precipitation. Polymers were characterised by NMR, X-ray diffraction and thermal analysis.

RESULTS:

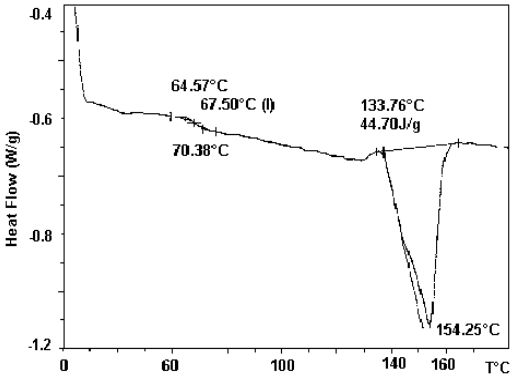

Fig. 1 Differential scanning calorimetry curve for poly(butyl-1,4-cyclohexanoate); 100% trans isomer, showing high melting point (154°C).

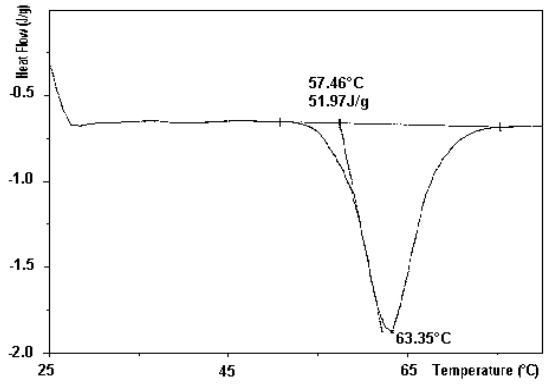

Fig. 2 Differential scanning calorimetry curve for poly(butyl-1,4-cyclohexanoate), 100% cis isomer, showing low melting point (63°C). Heat of fusion is essentially unchanged.

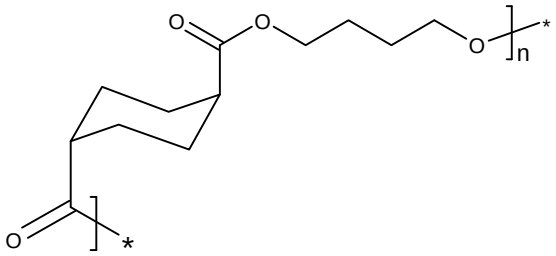

Fig. 3. Poly(butyl-1,4-cyclohexanoate), trans isomer.

DISCUSSION & CONCLUSIONS: The crystalline morphology of these polyesters is controlled by the cis/trans content of the cyclohexane moiety. Control of morphology offers the opportunity for the optimisation of mechanical properties and biodegradation lifetime.

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