生物可降解性牙用/骨用聚乳酸高分子摻合物的製備與鑑定

Preparation and Characterization of Biodegradable PLA Polymeric Blends for Dental and Orthopedic application

中文摘要

本研究目的是進行體內可吸收性高分子複合材料的改質，以期更適於口腔顎面外科、整形外科及骨科之應用。以二氯甲烷為共同的溶劑，分別溶解基質–聚左乳酸(PLLA)、第二添加物–聚左右乳酸(PDLLA)或聚己內酯(PCL)及界面活性劑–聚乙烯氧化聚合物–聚丙烯氧化聚合物(PEOPPO)，將此三種成分進行不同比例的摻合，其中 PLLA 和 PDLLA 的重量百分比為 100/0、80/20、60/40、50/50、40/60、20/80 及 0/100。實驗上利用熱重分析儀、微差掃描式熱分析儀(DSC)、紅外線光譜測定儀、膠體滲透層析儀、掃描式電子顯微鏡及材料機械性質測定儀來量測結晶熔點、玻璃轉化溫度、相的表現及機械特性。由 DSC 結果發現，沒有添加界面劑之 PLLA/PDLLA 摻合物有兩個玻璃轉化溫度的趨勢，而在添加界面劑後的摻合物其玻璃轉化溫度會隨著 PLLA 成分的減少而降低，且呈線性的轉移。在機械性質的比較上，未添加界面活性劑前 PLLA/PDLLA 摻合物最佳強度的摻合比例為 40/60，而適當的界面活性劑濃度為 2% ，此時 PLLA/PDLLA 摻合物最佳強度的摻合比例為 50/50。PLLA 添加 PCL 後，伸長量(elongation)增加最多，但強度變弱。觀察摻合物斷面型態，發現硬而韌的材料具有絲絮狀不光滑之斷面。綜合本研究的結果發現，以摻合的方式加入界面活性劑進行高分子材料的改質可找到一最佳的組成分且具較優的機械性質。

英文摘要

The purpose of this study is to improve the properties of bioresorbable materials for particular applications in dental and orthopedic surgery. Blends of biodegradable poly-L-lactic acid (PLLA), poly- DL-lactic acid (PDLLA) or polycaprolactone (PCL) , and a third component, the surfactant PEO-PPO, were prepared by blending these three polymers at various ratios using dichloromethane as a solvent. The weight percentages of PLLA/PDLLA (or PCL) blends were 100/0, 80/20, 60/40, 50/50, 40/60, 20/80 and 0/100, respectively. Physical and morphological properties such as crystalline melting point, glass transition point, phase behaviors, degradation behavior and mechanical properties were characterized by thermogravimetric analysis, differential scanning calorimetry, infrared spectroscopy, gel permeation chromatography, scanning electron microscopy and dynamic mechanical analysis. DSC data indicate that PLLA/PDLLA blends without PEOPPO have two Tgs. With the addition of PEOPPO, there is a linear shifting of Tg as a function of composition showing a lesser percentage of PLLA, and a lower glass transition temperature indicating better miscibility has been achieved. DMA data show the best composition of PLLA/PDLLA blends without PEOPPO is 40/60, and the best concentration of PEOPPO is 2%. The 50/50 PLLA/PDLLA/2%PEOPPO blend has better mechanical properties. Elongation of PLLA increases while adding PCL, but the strength decreases at the same time. SEM observation shows that harder and tougher materials have rougher fracture surface morphology.