

以Acetobacter xylinum WU1生產細菌纖維素之最適培養條件及其抗菌應用之研究

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摘要

由革蘭陰性細菌Acetobacter xylinum WU1可分泌生產出細菌纖維(BC)，具有特殊的物理、化學和機械特性，包括高結晶度、高含水量、且主要是由奈米纖維絲組成的表面、有彈性、機械強度和生物相容性。細菌纖維具有特殊的物理化學特性，因此可應用在紙張和食品工業，同樣的也可應用在醫學領域上，如人工皮膚、血管替代物。

本研究主要是研究Acetobacter xylinum WU1在30 °C中，以靜置批次發酵下，探討不同培養條件包括碳源、氮源、pH、溫度、有機酸(檸檬酸、琥珀酸和醋酸)、酒精濃度(0-10%)、醋酸濃度(0-20%)、地瓜濃度(0-20 g/L)和曝氣量(0.5-2 L/min)。生產細菌纖維時，也會受到各種環境因子之影響，如pH和溫度，結果顯示pH 5.5與溫度為30 °C為最適合細菌纖維的生產條件。另一方面，實驗顯示在pH為5.5的5 L發酵槽條件下，當曝氣量控制在1.5 L/min、葡萄糖濃度為20 g/L時，細菌纖維最大乾重可達3.7 g/L。

在此亦探討細菌纖維經不同鹼液處理和各種不同乾燥方式處理後，細菌纖維物性結構的改變。處理前/處理後的細菌纖維特性都是以XRD (X-ray diffractometry)、FTIR (Fourier Transform Infrared spectroscopy)、FE-SEM (Field-emission scanning electron microscope)進行分析。此外，利用色差計(Hunter lab colour parameters)分析經不同鹼液處理後細菌纖維色澤上的變化。整體實驗顯示，凍乾後的薄膜會有較高的L值。另一方面，利用NaOH和Na₂CO₃鹼液處理細菌纖維時，也會有較高的L值，分別為101.8和97.1。凍乾後薄膜在XRD圖譜上顯示的相對強度波峰訊號較小。相反的，在空氣乾燥中的薄膜，其相對強度則明顯較高。由XRD的結果發現，經鹼液處理後並不會直接影響到細菌纖維的結晶度。

細菌纖維是一個受注目的傷口敷料材料，因為它可以提供傷口潮濕的環境以利復原。但細菌纖維本身不具抗菌力，為避免傷口感染，抗菌效用，利用將細菌纖維浸泡於AgNO₃溶液中，使奈米銀吸附於細菌纖維上。形成的奈米銀利用SEM觀察得知。乾燥後的奈米銀與細菌纖維複合物對Escherichia coli (格蘭氏陰性菌)與Bacillus subtilis (格蘭氏陽性菌)具有很強的抗菌力。

關鍵詞：Acetobacter xylinum、細菌纖維、奈米銀傷口敷料、抗菌力

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