浸液培養條件對黃金銀耳菌(Tremella mesenterica)形態、多醣體生成及其生物活性之影響 = Effect of culture conditions on ...

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摘 要

黃金銀耳菌(Tremella mesenterica Retz.: Fr.,)為一類酵母真菌(yeast-like fungus)，具有免疫刺激、抗輻射效應、降血糖、抗發炎、降膽固醇、抗過敏及保肝等生物活性，活性主要成分來自於多醣體。菌體生理狀態與細胞形態息息相關，應用光學顯微鏡結合影像處理技術的影像分析方法是可做為菌體形態監控的工具。浸液發酵培養具有生長一致、菌齡整齊、週期短、產量高、成本低及產物易提取精製等優點。發酵產程中培養基及培養環境會影響菌體的形態及生理狀態，進而影響發酵產物的產量、組成及生物活性。藥用真菌或其所產生多醣體或醣蛋白具有刺激非專一性免疫系統、活化免疫細胞、促進細胞激素分泌，經由刺激宿主的防禦機制而發揮抗腫瘤活性的能力。因此，本研究主要目的為探討不同浸液培養條件對黃金銀耳菌形態特性、多醣體生成及其生物活性之影響。 本論文分三部分: (一) 以影像分析方法對不同培養條件下的細胞形態特徵做具體的描述，並進一步分析形態特徵與生質量及胞外多醣體生成之關係； (二) 以不同碳源培養黃金銀耳菌生產胞外多醣體是否影響細胞激素刺激之效應；及 (三) 比較黃金銀耳浸液培養發酵產物之胞外多醣體(EPS)、胞內多醣體(IPS)及酒精萃出物(EE)對人類肺癌細胞株A549誘發細胞凋亡之效應。 結果顯示 (1) 液態培養黃金銀耳類酵母菌的形態受培養條件包括pH、溫度、氮源及碳氮比等因子所影響，然而並未發現上述等形態特徵與黃金銀耳菌生質量或其胞外多醣生成量的相關性。但在發酵產程中，發現伸長度小於2.5 ?悃的比率約大於90%以上即表示達到最高的生質量；而伸長度小於2.5 ?悃的比率低於80%以下，可發現胞外多醣體已達到最高值(2.38 g/L)。此外，觀察出芽率的變化曲線發現，出芽率的轉折點即為生質量的最高點（7.02 g/L），而後再出現第二個轉折點時即表示胞外多醣已達最高值。此結果顯示黃金銀耳菌形態特徵中伸長度及出芽率的變化與其生質量及胞外多醣體的產率具有相關性，可將伸長度及出芽率的變化作為監控生產黃金銀耳菌發酵產程的參考指標之一。 (2) 以不同碳源培養黃金銀耳菌生產胞外多醣體之結果，顯示培養基中以葡萄糖、甘露糖為碳源及與半合成培養基相較之下所得之生質量以葡萄糖(7.42 g/L)及半合成培養基(7.5 g/L)為最高，多醣體則以半合成培養基(7.68 g/L)為最高。在四種培養基中所得之多醣體，其單醣組成中是由甘露糖、木糖、半乳糖及葡萄糖以不同比例所組成，葡萄糖醛酸含量亦有差異。此外，以木糖及葡萄糖為碳源所得之胞外多醣體可明顯刺激巨噬細胞分泌較多的TNF-?恁BIL-6及NO。由於木糖及葡萄糖為碳源所生產之胞外多醣體之單醣組成中甘露糖比例較高，甘露糖可藉與巨噬細胞表面的受器結合來提高其免疫活性，培養基中木糖及葡萄糖為碳源時生產之黃金銀耳菌胞外多醣體有利於提高其免疫調節活性。 (3) 黃金銀耳浸液培養發酵產物之酒精萃出物(EE)可完全抑制肺癌細胞株A549之生長，而胞外多醣體(EPS)及胞內多醣體(IPS)並無此活性。以流式細胞儀分析細胞凋亡率結果發現，EE可誘導細胞凋亡，與對照組相較之下可達到32.8%的凋亡率。EE處理組可造成粒線體膜電位的變化、活性氧生成及凋亡蛋白?-3(caspase-3)的活化，顯示EE可藉由粒線體路徑誘導A549細胞凋亡來降低肺癌細胞株A549的存活率。

關鍵詞 : 銀耳屬、黃金銀耳、發酵、形態、影像分析、胞外多醣體、細胞激素、細胞凋亡

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