

使用頂空固相微萃取結合 GC-MS 和 GC-O 測定海藻透過微生物發酵後

香氣化合物之影響

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- 一、前言
- 二、監測海藻發酵過程中的微生物計數
- 三、頂空固相微萃取條件之優化
- 四、不同微生物發酵海藻後揮發性化合物含量之影響
- 五、結論

摘要

海藻具有獨特的氣味，因此人們開始研究海藻中的揮發性化合物，這些揮發物會影響到海藻作為飲食產品的香氣和風味。微生物在發酵過程中會透過多種酵素代謝途徑來降解基質的大分子，以提供小分子等前驅物，這些前驅物可以進一步的進行生化反應，從而產生帶有特殊氣味的揮發性化合物以調節產品香氣。故本研究挑選常用於食品發酵菌株 (*Bacillus subtilis*, *Saccharomyces cerevisiae*, *Lactobacillus acidophilus*, *Lactobacillus delbrueckii* subsp. *bulgaricus* 及 *Lactobacillus casei*) 接種於海藻中，以 Headspace solid-phase microextraction (HS-SPME) 結合 Gas Chromatography-Mass Spectrometry (GC-MS) 探討海藻發酵後揮發性化合物之變化，並透過 GC-Olfactometry (GC-O) 結合 Aroma extraction dilution analysis (AEDA) 從海藻中篩選出最具氣味活性的化合物。本實驗選用 SPME 塗覆纖維的材質為 50/30 μm DVB/CAR/PDMS 來進行 HS-SPME 優化石蓴的萃取條件，結果顯示將纖維暴露於 60°C 下萃取 30 分鐘具有最高的萃取效率，故採用此條件進行後續的分析實驗。在未發酵與發酵後的石蓴培養物之頂部空間中總共鑑定出 52 種揮發性化合物，包括酮、醛、醇、酸、酯、碳氫化合物、呋喃、吡嗪、含硫化合物和酚。與未發酵組別相比，*B. subtilis* 發酵後產生許多其他的酮類，尤其是 2-戊酮和 2-庚酮最豐富，其濃度分別為 164.64 和 436.59 $\mu\text{g/L}$ ，並檢測出 2,5-二甲基吡嗪、含硫化合物及苯酚的存在，且降低許多醛類，以減少海藻中較負面的氣味，*S. cerevisiae* 發酵後除了產生乙醇外，還檢測到許多其他高級醇，而在三株乳酸菌發酵後則產生其他的酸類化合物，例如己酸和苯甲酸。綜合上述結果可得知，將不同微生物接種至石蓴進行發酵，可導致其揮發性成分發生改變，代表微生物發酵具有生成香氣化合物或降低海藻異味之潛力。

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