

2026第六屆醱酵技術研討會
2026 Fermentation Technology Workshop



活動時間：
中華民國一一五年三月十九日星期四
上午九點至下午四點

活動地點：
臺灣大學食科所演講廳四樓 (台北市羅斯福路4段1號)

研討會內容時間表

Agenda

時段	負責單位/講者及主題		主持人
09:10 ~ 09:40	報到		
09:40 ~ 10:00	貴賓致詞大合照		
10:00 ~ 10:40	時段一	海大食科系 黃崇雄教授 - Potential applications of solid-state fermented substrate of <i>Cordyceps militaris</i> in immunomodulation and anti-inflammation 北蟲草固態發酵培養基於免疫調節與抗發炎之應用潛力	鄭光成 特聘教授
10:40 ~ 11:00	Break 1		
11:00 ~ 11:40	時段二	台大食科所鄭光成教授研究室-洪悅豪博士 - 發酵策略於生質燃料生產：以乙醇為例	
11:40 ~ 12:00	時段三	major science 產品專員 徐維春 - From Requirements to Reality: ms Customization Experience Sharing 需求到實踐：ms 客製化經驗分享(包含植物外泌體)	周珮雯 副教授
12:00 ~ 12:20		major science 產品專員 褚柏涵 - 從基礎研究到生物製程的全方位實驗室設備整合	
12:20 ~ 13:20	午餐		
13:20 ~ 14:00	時段四	台大生化科技系 李昆達教授兼系主任 - Synthetic biology of 1,12-Dodecanediol in engineered <i>Escherichia coli</i>	周珮雯 副教授
14:00 ~ 14:40	時段五	輔大食科系 楊瑀堯 教授 - 超音波在乳酸菌發酵過程中之應用	
14:40 ~ 15:00	Break 2		
15:00 ~ 15:20	時段六	時機允晟 曾季清 - 生技製程自動化	
15:20 ~ 15:40		進階 儀器產品 鄭凱丰主任 - Cellometer X2高倍率自動化計數器專為酵母菌和細菌設計	

主辦單位保有最終修改、變更、活動解釋及取消本活動之權利。若有相關異動將會公告於官網，恕不另行通知。

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發酵研討會主持人

鄭光成 特聘教授 (2025/8~)

臺大食科所與生技所合聘

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學歷:

博士 美國賓州州立大學農業生物工程學系 (2010)

碩士 國立臺灣大學微生物與生化學研究所 (2005)

學士 國立臺灣大學農業化學系農產製造組 (2001)

主要經歷:

台灣農業化學會現任理事長

美國 Rutgers 大學食品科學系訪問學者 (2016/6~8)

台灣乳酸菌協會現任秘書長

國際精準健康協會現任秘書長

服務與榮譽:

國際食品科學院 (IAFoST Fellow) 院士

台灣食科學會現任常務理事

台灣食品保護協會現任常務理事

台灣農業化學會第 106 年度學術獎獲獎人

台灣保健食品學會 2022 傑出學術研究獎獲獎人

台灣食品科技學會 2019 食品學術研究榮譽獎獲獎人

ELSEVIER Top 2% 全球頂尖研究學者 (2020~2025)

中研院第 11 屆楊祥發院士傑出農業科學年輕優秀學者獎獲獎人

臺大生農學院 2023 院級勵進青年學術講座

臺大勵進青年學術講座

實驗室研究主題

▣ 藥用菇類發酵與生理活性探討:

藥用菇類為泛指能於菌絲體、子實體等產生對人體健康有益，或對疾病有抑制或治療作用的一級或次級代謝物之真菌，目前藥用菇類為中草藥的新藥及保健食品開發的一大研究指標，過去許多研究著重於靈芝及台灣牛樟芝等藥用菇類的次級代謝物之生物活性做開發，而本研究室目前針對不同靈芝，例如台灣紫芝及重傘靈芝，其菌絲體之液態發酵生產靈芝多醣與靈芝酸及生物活性研究為主軸。如抗癌、抗氧化及美白功效等。

▣ 釀酒酵母育種與酒類發酵:

自有人類文明記載以來，各種酒類與人群日常生活存在密切關係。紅酒具有多種保健成分，其中白藜蘆醇 (resveratrol) 的臨床觀察更備受矚目，包括減少心臟病與中風、預防動脈硬化、抗腫瘤、抗發炎、預防第二型糖尿病、預防神經系統退化等。本實驗室之開發重點即為酒類 (紅酒、地酒與啤酒) 與共發酵製程開發與產香酵母菌育種。

▣ 生醫敷料開發與應用:

近年來，生物醫材研發著重在提高生物活性、生物降解性、生物可吸收性及無細胞毒性。此外，傷口促癒效果、無痛治療等特性亦是選擇材料重點。本實驗室利用細菌發酵所生產的細菌性纖維素，如 foaming BC。可透過加工修飾，提升抑菌能力，或使其負載藥物釋放至傷口進而促癒。藉由這幾種特性開發出適用於不同傷口照護所需的新式敷材，或是醫美級面膜產品。

▣ 銀髮保健食品開發:

根據統計，現在的台灣人，平均 6 個人照顧一個老人，在 2025 年，台灣已經迎來超高齡社會。因此，可預期且將倍數成長的銀髮族人口，讓銀髮族食品需求及商機展露，成為近年國內外關注的趨勢議題。本研究團隊積極開發以發酵台灣本土素材，如台灣藜、樹豆等對於銀髮族健康有助益之植物性發酵產品，並進行後續營養效能評估與活性分子鑑定。

▣ 生物反應器設計與開發:

生物反應器為微生物醱酵生產之重要工具，不同微生物所需之生長環境亦有不同。針對特定微生物進行生物反應器之設計與開法，為生物工程領域之重要子題。本研究室亦針對不同微生物如黴菌、酵母菌與細菌等工業微生物之生產，進行生物反應器開發與設計，以期提高產能與利用效率。並針對不同之微生物生產系統，進行生物模擬與評估，以追求實驗數據之正確性與可預測性。

重要發表 (2024~2026)

1. Lin, SP, Yi, TK, Kao, YF, Tu, MC, Hsieh, CC, Shen, SC, Chou, YC, Lu, JJ, Santoso, SP, Chai, HJ, **Cheng, KC***. 2026. Dextran-altered foaming bacterial cellulose with Botryocladia leptopoda extract in a wound-dressing application. *International Journal of Biological Macromolecules*. 348:150838.
2. Lu, JJ[§], **Cheng, KC[§]**, Khumsupan, D, Hsieh, CC, Hsieh, CW, Santoso, SP, Angkawijaya, AE, Kuo, HC*. 2026. Proteomic profiling of *Monascus*-fermented djulis (*Chenopodium formosanum*) identifies ACE-inhibitory peptides through integrated *in silico* and *in vitro* approaches. *Food Chemistry*, 500:147474.
3. Khumsupan, D, Lin, SC, Huang, YC, Chen, CM, Chi, HW, Jantama, K, Lin, HW*, **Cheng, KC***. 2025. Creating a robust and reusable cell immobilization system for bioethanol production by thermotolerant yeast using 3D printing and soybean waste. *Industrial Crops & Products*, 224:120434.
4. Lin, SP, Hong, L, Hsieh, CC, Lin, YH, Chou, YC, Santoso, SP, Hsieh, CW, Tsai, TY, **Cheng, KC***. 2024. In situ modification of foaming bacterial cellulose with chitosan and its application to active food packaging. *International Journal of Biological Macromolecules*. 279(3), 135114
5. Huang, YC, Khumsupan, D, Lin, SP, Santoso, SP, Hsu, HY, **Cheng, KC***. 2024. Production of Bacterial cellulose (BC)/nisin composite with enhanced antibacterial and mechanical properties through co-cultivation of *Komagataeibacter xylinum* and *Lactococcus lactis* subsp. *Lactis*. *International Journal of Biological Macromolecules*. 258(2):128977.

Visit our lab!!!



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經歷:

美國東南密蘇里州立大學心理與諮商學系 副教授 (2019~2022/2)

美國東南密蘇里州立大學心理與諮商學系 助理教授 (2014~2019)

榮譽:

112 學年度臺灣大學全英語授課教學傑出獎

2025 臺灣開放教育卓越獎優選

研究主題:

一、正向青少年發展

本研究室以正向青少年發展為核心，探討影響青少年與成年初顯期發展軌跡的因素，並發展具文化敏感度之預防與介入策略，以促進個體之健康適應與正向發展。

1. 青少年風險行為

透過臺灣與美國跨文化比較研究，研究聚焦於親職教養如何透過青少年的決策歷程與風險利益評估機制，進而影響其健康風險行為，並據此建構父母控制與風險行為之理論模型。近年亦結合機器學習方法辨識高風險族群特徵，以制定符合不同發展階段需求的介入策略。

2. 成年初顯期發展

本研究室另一研究主軸聚焦於成年初顯期之發展歷程，探討身份探索、幸福感、歸屬需求與成人標準認定等議題，並進行臺灣樣本之資料蒐集與跨國比較分析。研究強調教育情境與文化脈絡對發展歷程之影響，深化對成年初顯期多樣發展型態之理解。

3. 預防與介入方案

在實務應用層面，研究室推動以實證為基礎之學校介入方案，參與國立臺灣大學中國信託慈善基金會兒少暨家庭研究中心之相關計畫。透過 PILOT 生活技能訓練課程，強化兒少自尊、壓力調適、決策能力與社會技巧。藉由前後測設計，評估課程對兒少幸福感、復原力與霸凌行為之影響，以促進理論、研究與實務之整合。

二、EMI 教育

結合心理學專業與英語授課 (EMI) 教學，本研究室建構以學習科學為基礎之 EMI 實證研究架構，探討雙語高等教育情境下之學生學習機制與成效。

1. EMI 學習成效

為提升 EMI 教育品質，本研究室執行教育部大專校院學生雙語化學習計畫，評估大學基礎學科 EMI 課程之學習成果。研究涵蓋學科知識掌握、學習參與、自我效

能、軟實力發展與未來學習意向等多面向指標，建立 EMI 成效評估模型，並提供課程優化之實證依據，以支持臺灣「2030 雙語政策」的教育發展。

2. 跨領域教學創新與 PBL 實證

本研究室亦參與跨院合作計畫，將心理學理論與教學設計應用於食品科學領域，探討問題導向學習 (PBL) 與協作學習模式於 STEM 課程中的應用成效，促進高等教育教學創新與產學接軌。

臺大食品科技研究所

食科所成立於 1976 年，為臺大生物資源暨農學院中第一個未設大學部之獨立研究所。70 年代國內食品工業尚處萌芽階段，對於食品科技人才之需求極為殷切。有鑑於此，當時在美國羅格斯大學食品科學系任教，且擔任我國經濟部食品科技顧問之張駟祥教授等人乃提出建議，由臺大向教育部申請設置「食品科技研究所」，在經濟部、農委會及食品產業界等之支持下，本所因而獲准成立。本所現任所長為羅翊禎教授。

本所為一獨立研究所，所有教學研究均集中於獨立的四層樓建築，包括「食品科技館」與「食品研發大樓」兩部分，總樓板面積為 3,441 平方米。

1. 獨立研究單位 11 個，每一單位包括教師研究室、實驗室與研究生研究室或個人儀器室的空間。
2. 兩間共同核心儀器室：一為食品物性分析儀器室，建置有三部質地輪廓分析儀、一部動態流變分析儀、兩部示差熱掃描分析儀、色差儀、粒徑分析儀、界面電位分析儀(Zeta Potential Analyzer)、膜通透性分析儀等；另一為食品化學實驗室，建置有兩套高效能液相層析儀、三套氣相層析儀、毛細管電泳分析儀、螢光波譜分析儀等。
3. 共同實驗室七間：(1)化學分析室；(2)細胞培養室；(3)免疫分析室；(4)動物房；(5)動物犧牲室；(6)發酵實驗室；(7)液相層析質譜儀室。
4. 五間教室和討論室：教室均具有完善的現代 E 化(電子控制)設備。
5. 實習工廠

本所設置之宗旨為「培育我國食品工業及教育研究機構所需之高級食品科技人才」。當前的任務包括：

→ 教學：

以培養具有保健營養知識之食品科技人才為教育目標。碩士班的教育目標是「培育我國在食品科學與技術領域所需之學術研究與產品開發人才」；博士班的教育目標是「培育我國在食品科學與技術領域所需之學術研究與產品研發之高級人才」。

→ 研究：

注重創新，進行具應用價值之基礎研究或具理論基礎之應用研究。

→ 服務：

對本所國際聲譽有助益之學術活動，以及公益性服務。優先順序為：有益於人群或國家者，有益於整體食品相關產業者，有益於機構單位或個別公司企業者。

臺大生物科技研究所

本所於 95 年 8 月 1 日正式成立，並於 95 學年度招收博士班學生，於 103 學年度招生碩士班學生。目前共有 9 位正式教師，皆具有博士學位。本所發展方向與重點：本所博士班的發展方向與重點在於培育我國「挑戰二〇〇八國家發展重點計畫」中所需之「生物科技」人才，此等人才在我國未來之發展重點包括「生物資訊」、「奈米生物醫學」、「組織工程與再生醫學」、「替代能源」及「基因體與蛋白質體學」等領域中將擔綱起關鍵之角色，而本所最主要的特色，除在於延攬國際傑出師資來台授課及研究，形成國際一流生物科技研究團隊，協助我生技產業發展外，亦將藉由本所之增設而進一步統合本校各學院有關生物科技的教學與研究資源，配合本校『生物技術研究中心』所開設的核心課程，集結成一個跨院系的龐大力量；再加入引入法律學院與管理學院的課程訓練，強化學生對生技產業的經營與管理能力，以便將來能夠實際投入生技產業界。同時，因為生技產業致勝的關鍵在於高科技研發，將以培養高級研究人力為積極目標，期能把握科技產業成功的最基本源頭。本所現任所長為劉啟德教授。

教育目標與宗旨

專業知識的養成：培育學生具備紮實的生物科技的專業知識。

科技整合理念與研發精神的養成：培育學生獨立思考，主動發掘、分析、探討及解決問題，具備良好的表達能力，重視團隊合作。

生物科技倫理的認知：培養學生專業倫理的素養，體認身為國家科技人才所肩負的社會責任。

產業與國際視野的擴展：因應全球生物科技發展趨勢，培育學生具備前瞻性恢弘的國際觀，體認身為地球公民的社會責任。

核心能力

核心能力一：細胞與組織之再生科技學理知識與實務操作能力

核心能力二：生物科技核心技術操作能力

核心能力三：高等分子生物學與基因調控核心知識

核心能力四：生物科技倫理

核心能力五：創新思考及問題解決能力

核心能力六：團隊溝通與合作能力

核心能力七：領導與跨領域整合能力

核心能力八：國際觀

核心能力九：終身自我學習

教育部教學實踐研究計畫

教學實踐研究係指教師為提升教學品質，促進大專校院學生學習成效，透過教育現場提出問題，並藉由課程設計、教材教法、或引入教具、科技媒體運用等方式，採取適當之研究方法及評量工具檢證成效之歷程。

<https://tpr.moe.edu.tw/index>



臺灣農業化學會 組織與會員



「台灣農業化學會—Agricultural Chemical Society of Taiwan」

成立於 1963 年 5 月 1 日，原名為「中國農業化學會—The Chinese Agricultural Chemical Society」，於 2003 年 6 月更名為目前名稱，為國內最早向內政部登記立案的非營利學術性社團之一。本學會涵蓋學術範圍包括微生物、食品科學、生化與營養及土壤環境與植物營養等領域，以聯絡國內外專業人士共同增進我國農業化學之貢獻及發揚學術研究為宗旨。目前會員人數有 500 餘位，其中永久會員 259 位，普通會員 200 餘位及團體會員 10 單位。本學會現任理事長為臺大食科所鄭光成特聘教授。

任務

本學會之任務定為：(1)提倡農業化學研究、(2)舉辦農業化學演講及討論、(3)搜集國內外有關農業化學圖書供學術界及實業界之參考、(4)發行學術刊物，以及(5)辦理其他有關農業化學事項。

學會期刊

臺灣農業化學與食品科學 (Taiwanese Journal of Agriculture Chemistry and Food Science) 學術期刊是由台灣農業化學會與台灣食品科學技術學會共同發行，內容以刊載台灣農業化學會與台灣食品科學技術學會兩學會會員之研究論文，舉凡與農業化學、生物化學、分子生物學、生物技術、微生物學、發酵化學、土壤與環境保護、污染土壤整治與復育、食品科學以及食品營養學等相關之研究報告或論著，且從未在國內外雜誌發表或投稿者均為本刊徵稿之對象。「臺灣農業化學與食品科學」學術期刊內容俱為國內外一流研究機構及大學院校研究人員的研究心血，並或有國外大學及研究機構著名學者之論著，堪稱一內容豐富且具高學術水準之刊物。本刊隨時接受作者投稿，稿件收件登錄後，由編輯委員或總編輯邀請符合該稿件領域之專家學者二人進行審查，並經修訂及復審通過與仔細的文字編輯校訂後，方能刊印於期刊上。「臺灣農業化學與食品科學」期刊為國內最具盛名的學術研究期刊之一，其刊載之學術論文內容創新，編排印刷精美，是從事相關研究的學者與其他專家分享研究成果及最具參考價值的學術期刊。現任期刊總編輯為臺大生技所所長劉啟德教授。

本會預計於 2026 年 6 月 24 日(三) 於台大校總區博雅館舉辦年度會員大會暨研討會，歡迎各界先進報名參加。

學會網址: <http://www.agrichem.org.tw/>



臺灣食品保護協會

沿革

台灣食品保護協會 (Taiwan Association for Food Protection, TAFP) 之台灣在地組織，於民國 100 年 10 月 28 日向內政部申請籌組，經內政部民國 100 年 12 月 19 日台內社字第 1000242821 號函准同意辦理籌組事宜。本會現任理事長為黑松企業董事長張斌堂先生。

協會宗旨

台灣食品保護協會為國際食品保護協會 (International Association for Food Protection, IAFP) 之第 48 號國際分會。國際食品保護協會成立於 1911 年，成立目的在於提供會員與國際同步的食品安全最新相關資訊、先進的食品安全相關科學技術、提升全球國際食品安全適用之食品製造與供應方法及有效食品安全預防措施之水準，並作為與國際食品安全組織重要之溝通橋樑。目前 IAFP 會員遍佈全球超過 50 個國家，透過網路、教學計畫、期刊雜誌等多元化運作達成維護食品安全的宗旨。

IAFP 國際分會更進一步提升臺灣食品安全

民國 100 年也適逢 IAFP 創立百年，在 IAFP 的百週年慶與來自全球 2500 多位與會者的見證下，台灣食品保護協會接受 IAFP 主席 Dr. Jaykus 授予國際組織分會證書 (Charter)。在台大食科所沈立言教授、周正俊教授、公衛系陳家揚教授，海洋大學潘崇良教授、輔大蔡宗佑助理教授和衛生福利部食品藥物管理署黃翠萍技正的努力與美國友人的協助下，讓台灣在對於雙方都具有特殊意義的時間點獲得國際組織分會資格認可，取得第 48 號 IAFP 國際分會的資格，實屬不易與榮耀！期盼藉此提升台灣的食品安全並取得最新的國際食品安全資訊，除了為國人把關食品安全，更能協助食品產業了解國際規範，對台灣的經濟發展將有莫大的助益！

會徽意涵

台灣食品保護協會會徽，在國際食品保護協會 (IAFP) LOGO 當中，加入台灣圖形，代表台灣食品保護協會為國際食品保護協會之台灣分會之意涵。



台灣乳酸菌協會

人類對於健康，除了注重醫療科技的進步使身體恢復健康、壽命延長之外；現代人對健康的觀念，則更進一步提昇到如何透過飲食來達到自體保養、免於求醫用藥而活的健康為積極目標。因著此概念的普及，使健康食品在這幾年蔚為風潮，而在衛生署健康食品認證的食品中，乳酸菌就佔了近一半，因此在現代人的心目中，乳酸菌幾乎成了"健康"的代名詞。而亞洲乳酸菌產業市場雖頗具規模，然而學術研究卻落後歐美各國，為此自 2000 年起，在幾位學界與業界之乳酸菌同好召集下，我國與日本、韓國等開始策劃並於 2002 年在日本東京正式成立亞洲乳酸菌協會(Asian Federation of Societies for Lactic Acid Bacteria, 簡稱 AFSLAB)。而在參與策劃 AFSLAB 的同時，也積極策劃成立台灣乳酸菌協會(Taiwan Association for Lactic Acid Bacteria, 簡稱 TALAB)，訂定「學術研究、國際交流、消費者教育、產業振興」為協會宗旨，希望結合產官學研，群策群力，除了謀求學術研究向下紮根，振興乳酸菌產業，更希望社會大眾因而同享乳酸菌保健的功效！現任理事長為國立海洋大學蔡國珍特聘教授。

學會工作

- ◇ 推動乳酸菌之研究發展、資訊交流與產業應用。
- ◇ 推動消費者教育，拓展乳酸菌相關產品市場。
- ◇ 參加國際乳酸菌相關會議，並經常與國內外乳酸菌相關組織聯繫與交流。
- ◇ 舉辦學術演講及研討會。
- ◇ 建議有關乳酸菌產業政策、標準及法規等相關事項。
- ◇ 辦理其他與本協會章程宗旨相關之事項。



台灣乳酸菌協會
<http://www.talab.org.tw>

國際精準健康學會 (International Society for Precision Health, ISPH)

一、創立宗旨與願景

國際精準健康學會 (ISPH) 是一個致力於推動全球精準健康研究與應用的專業國際學術組織。學會的願景是建立一個「科學與創新緊密連結」的世界，讓精準健康技術成為提升全球全人類福祉的核心。

在現任理事長王進崑教授 (Dr. Chin-Kun Wang) 的帶領下，ISPH 響應聯合國永續發展目標 (SDGs)，致力於將傳統的醫療模式從「病後治療」轉向「預測與預防」。學會強調透過大數據、人工智慧 (AI) 以及對個體差異 (如基因、微生物組、生活方式) 的深入理解，提供個人化的健康建議。本會現任理事長為中山醫大王進崑教授。

二、核心領域與組織架構

ISPH 匯集了來自全球超過 10 個國家的頂尖科學家與專家，設有 13 個專業委員會 (Councils)，涵蓋四大核心範疇：

1. **營養與食品科學 (Nutrition & Food Science)**：專注於精準營養、功能性食品及植物生醫研究。
2. **醫學與疾病干預 (Medicine & Disease Intervention)**：包含癌症研究、互補醫學及藥學科學。
3. **身心健康與微生物 (Body-Mind & Microbiota)**：探討腸道菌群、神經科學及健康促進的關聯。
4. **科技與教育 (Tech & Education)**：推動大數據分析、分子生物技術及跨領域人才教育。
- 5.

三、創新應用：9Health 智慧健康平台

為落實精準健康科技的實務應用，ISPH 推廣由崇德基金會支持、中山醫學大學與逢甲大學共同研發的「9Health 智慧健康平台」。該平台結合 AI 影像辨識與個人化數據分析，使用者僅需透過 LINE 介面即可進行餐食熱量估算與營養分析，是學會將學術轉化為全民健康工具的具體成果。

四、國際交流與學術盛事

ISPH 定期舉辦國際研討會與網路專題講座 (Webinars)，為全球學者、政策制定者與產業界提供交流平台。

2026 年年會：預計於國立宜蘭大學盛大召開，持續深化疾病預防與大數據應用的國際對話。



台灣保健食品學會 (Health Food Society of Taiwan, THFS)

一、成立背景與宗旨

台灣保健食品學會成立於 1999 年(民國 88 年)，是台灣最具代表性的保健食品學術組織。學會集合了來自食品科學、營養學、醫學、藥學及生技領域的專家學者，致力於建立一個結合「產、官、學、研」的專業平台。本會現任理事長為臺大食科所潘敏雄特聘教授。

本會創立的核心宗旨在於：以嚴謹的科學方法投入保健食品的安全性、毒理評估及生理機能性研究，並積極協助政府與業者落實《健康食品管理法》，推動具備科學實證功效的產品開發，進而提升國民的健康福祉。

二、核心任務與服務項目

學會透過多元化的運作，推動台灣保健食品產業的升級與國際化，主要任務包括：

1. **學術研究推廣**：鼓勵以分子生物學、臨床實驗等科學手段研究保健食品的生理功效，提升國內研發水準。
2. **法規與諮詢服務**：彙整國內外保健食品之法規、管理與市場趨勢，提供給會員、政府單位及產業界作為決策參考。
3. **產業轉型輔導**：協助業者建立正確的科學觀念，從傳統食品加工轉向高附加價值的機能性素材開發。
4. **專業資訊流通**：定期發行學會會訊與通訊，並透過數位平台即時分享全球最新的保健新知與研討會資訊。

面對高齡化社會與精準醫療的趨勢，台灣保健食品學會積極推動從「全民健保」延伸到「全民保健」的概念。學會不僅關注食品安全與標示合規，更致力於推廣「食補勝於藥補」的正確預防醫學觀念，並透過人工智慧與數位科技的輔導，協助台灣保健食品產業在國際供應鏈中佔據關鍵地位。



台灣食品科技學會 (Taiwan Association of Food Science and Technology)

一、歷史傳承與成立宗旨

台灣食品科技學會成立於 1971 年(民國 60 年)，至今已超過半個世紀，是台灣食品科學與技術領域規模最大、歷史最悠久的學術團體。學會以「聯絡國內外食品科學技術人士，共同致力於食品科學技術之研究、應用與發展」為核心宗旨。在歷任理事長與專家的耕耘下，學會成功整合了農學、生化、化學、機械及營養等跨領域人才，成為推動台灣食品工業現代化與科學化的領航者。現任理事長為翁聰賢先生。

二、組織核心職能與專業委員會

學會透過高度專業化的組織架構，針對不同產業需求提供服務，目前設有多個專門委員會：

1. **學術研究推動**：主辦「食品科學」與「食品技術」的學術獎項，並定期發行《台灣食品科學》等專業期刊，維持學術研究的高度競爭力。
2. **產業服務與諮詢**：協助政府單位進行法規研擬(如食安管理、標示基準)，並受託進行食品品質鑑定與產學技術媒合。
3. **人才培育與認證**：辦理「食品工程師」、「食品分析檢驗人員」等各類專業職能培訓，並協助舉辦技能檢定，為產業輸送高品質的技術人才。
4. **資訊傳播**：透過官方網站與電子報，即時發布國內外食安動態、先進製程技術及市場分析。

三、國際連結與全球影響力

作為台灣食品科技的國際窗口，CIFST 積極參與國際組織活動：

- **國際食品科學技術聯盟 (IUFoST)**：本會為其資深會員，透過參與全球年會，將台灣的食品研發成果推向世界舞台。

四、年度大會與社會責任

每年的「台灣食品科技學會年會」是國內食品界的指標性盛事，齊聚數百位專家學者與產業精英。會中除發表最新論文外，亦會頒發「成就獎」、「技術開發獎」等，表彰對產業轉型有卓越貢獻的個人或企業。

在面對食安挑戰時，學會亦扮演關鍵的第三方智庫角色，提供科學客觀的解釋與建議，協助社會大眾建立正確的食品安全認知。





好菌嘉年華-微生物發酵技術的各種應用

Potential applications of solid-state fermented substrate of *Cordyceps militaris* in immunomodulation and anti-inflammation

Chung-Hsiung Huang

(黃崇雄)

March 19, 2026

1

Cordyceps militaris

- *Cordyceps militaris* is a entomopathogenic fungus, and can be cultivated in a variety of media including silkworm pupae, **grain**, or liquid nutrition.
- The main bioactive ingredients of *C. militaris* include polysaccharides, cordycepin, and adenosine.



(Nan *et al.*, 2001; Mao *et al.*, 2005; Das *et al.*, 2010)

2

Solid-state fermentation of *C. militaris*

- Fermented solid-state substrate is far cheaper than fruiting bodies and needs to be developed into higher-value products.



(Provided by MeansGood Agri-biotechnology Co., Ltd.)

3

Composition of fermented substrate

- Carbohydrates: 66.3%
- Protein: 16.6%
- Lipid: 11.5%
- Moisture: 3.5%
- Ash: 2.1%
- Polysaccharides: 35.5%
- Cordycepin 1.1%
- Adenosine 0.02%



(Provided by MeansGood Agri-biotechnology Co., Ltd.)

4

C. militaris polysaccharides

- *C. militaris* polysaccharides is mainly composed of glucose, galactose and mannose.
- > 30% β -glucan
- *C. militaris* polysaccharides are known to have antiviral, antioxidative, **anti-inflammatory**, antitumor, neuroprotective, antihypertensive, and **immunomodulatory** biological effects.

(Sims *et al.*, 2011; Lee *et al.*, 2017; Rodrigues *et al.*, 2020)

5

Food allergy



- Type I hypersensitivity
- Food allergy is a common disease, accounting for about **2-8% of the world's population**, about 8% of children, and about 2-4% of adults.
- The symptoms include gastrointestinal discomfort, diarrhea, and may even cause anaphylactic shock.
- Food allergens are found in dairy products, eggs, peanuts, nuts, seafood and soybeans.

(Mendonca *et al.*, 2023)

6

Gut microbiota

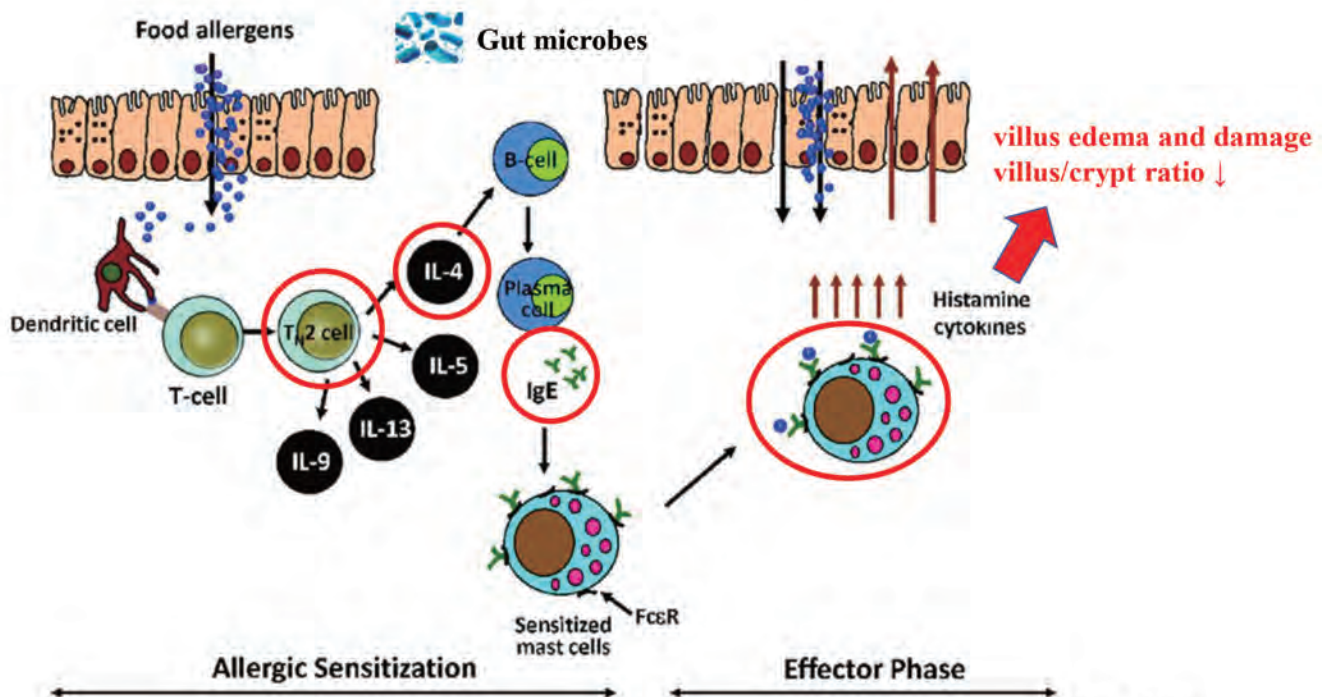
- Evidence from human and animal studies shows that **gut dysbiosis** is closely related to the pathogenesis of **food allergy**.
- The gut microbiota plays an important role in preventing allergies by balancing and inducing **tolerogenic immune function**.



(Campbell *et al.*, 2020)

7

Mechanism of food allergy



(Lee, 2016) 8

Rationale & objective (1)

- *C. militaris*-fermented grain substrate is typically treated as waste or used as animal feed.
 - Bioactive compounds with immunomodulatory potential.
 - Valorization → **sustainable development** and **waste reduction**.
 - **Food allergy** is a growing health concern requiring novel functional interventions.
- To evaluate the **anti-allergic effects** of water and ethanol extracts from *C. militaris*-fermented grain substrate using a murine model.

9

Preparation of fermented-substrate extracts

Preparation of water extract (WE)

20 g fermented grain substrate powder +
400 mL pure water

↓

Heat at 121°C for 15 min

↓

Cool and centrifuge (12,500 \times g, 30 min)

↓

Collect supernatant

↓

3 volumes of ethanol for precipitation 24 h

↓

Centrifuge (12,500 \times g, 20 min)

↓

Collect precipitate and lyophilize → WE

Preparation of ethanol extract (EE)

50 g fermented grain substrate powder

↓

Add 95% ethanol (1:10, w/v)

↓

Soak at room temperature with shaking
for 18 h

↓

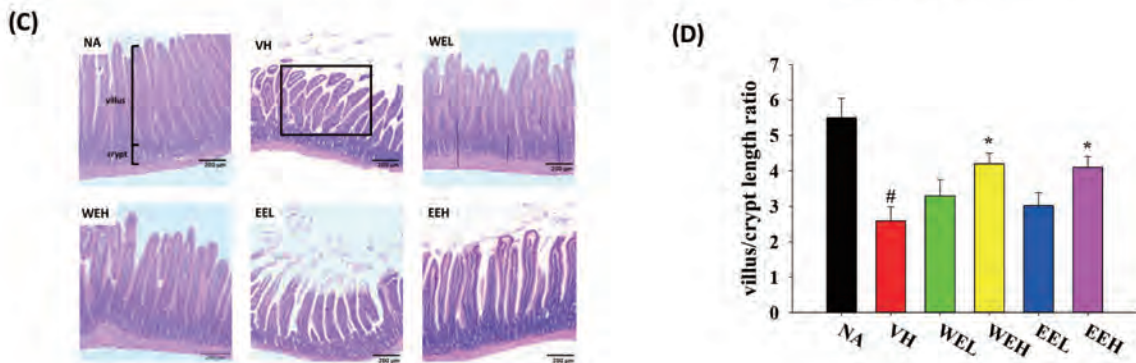
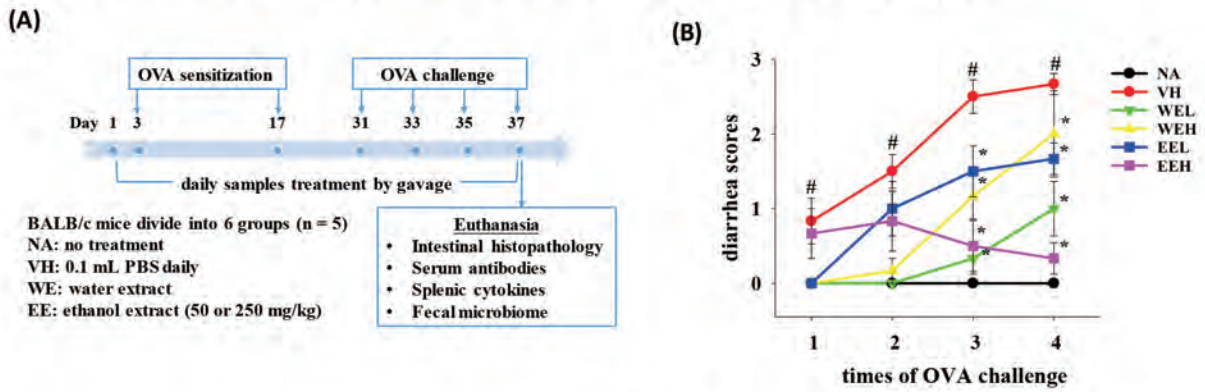
Collect suspension

↓

Lyophilize → EE

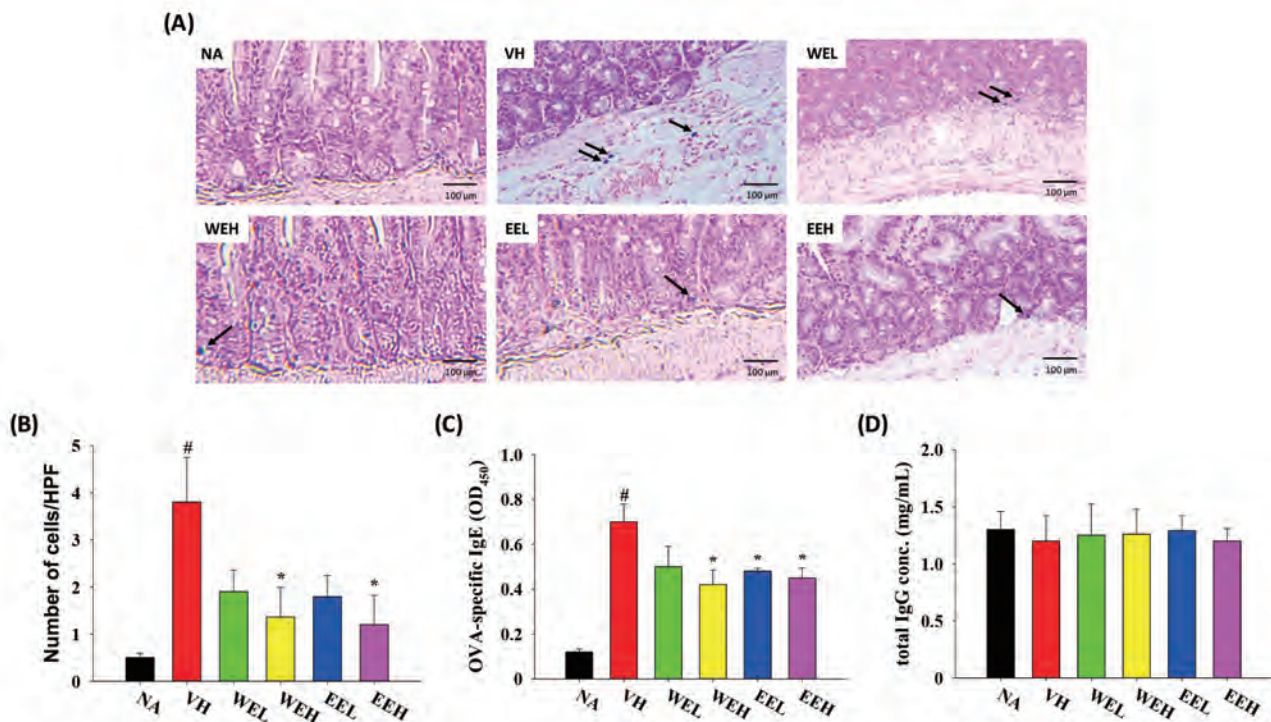
(Liu *et al.*, 2023) 10

Animal experiment & diarrhea scores



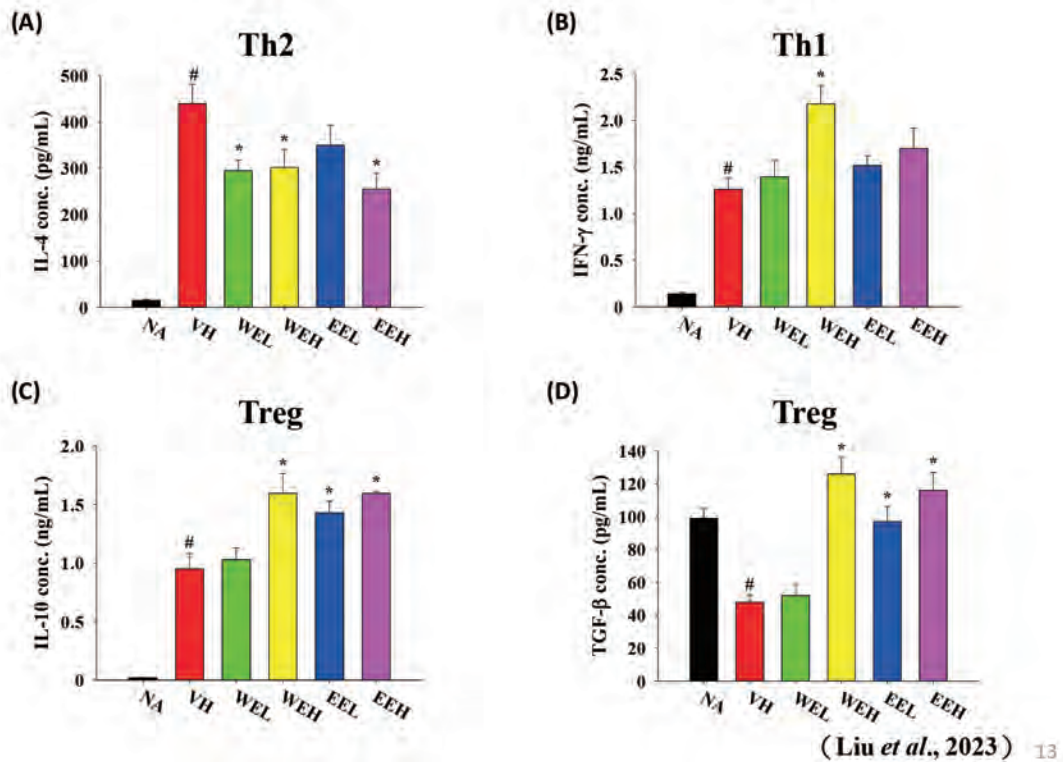
(Liu et al., 2023) 11

Intestinal mast cell & serum antibody production

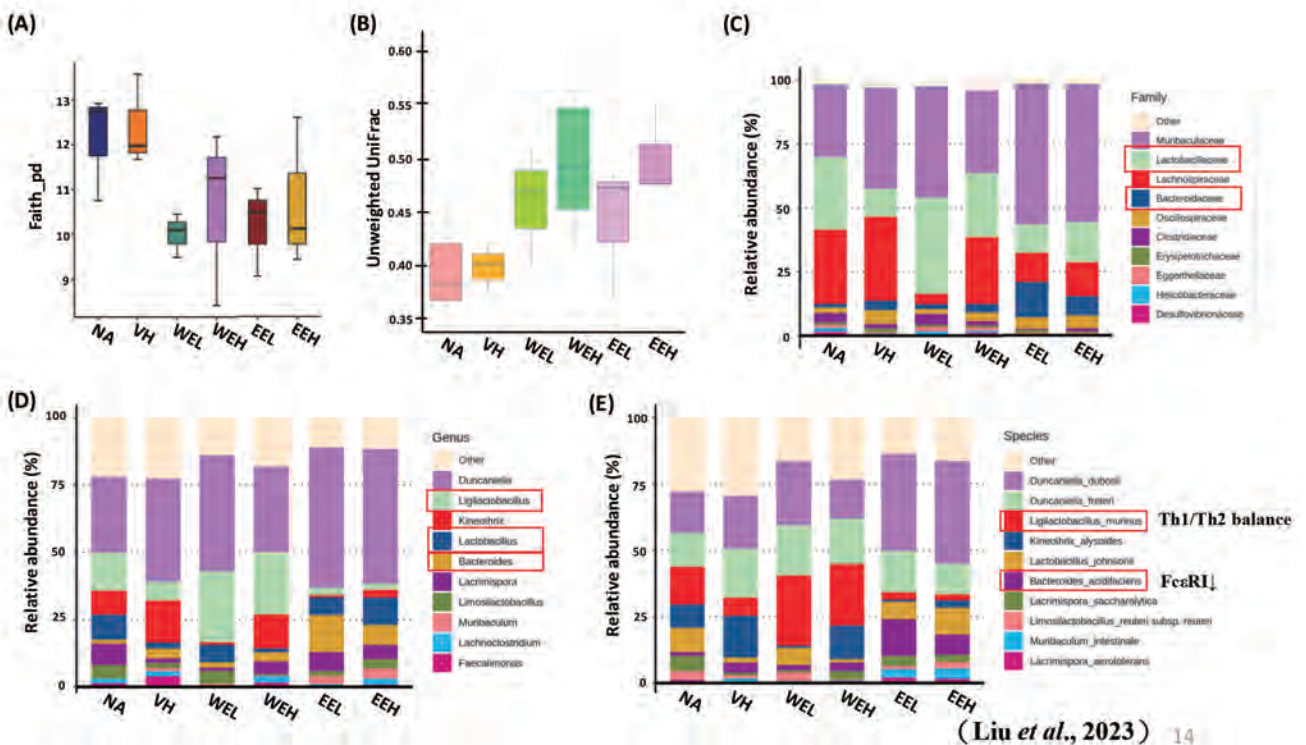


(Liu et al., 2023) 12

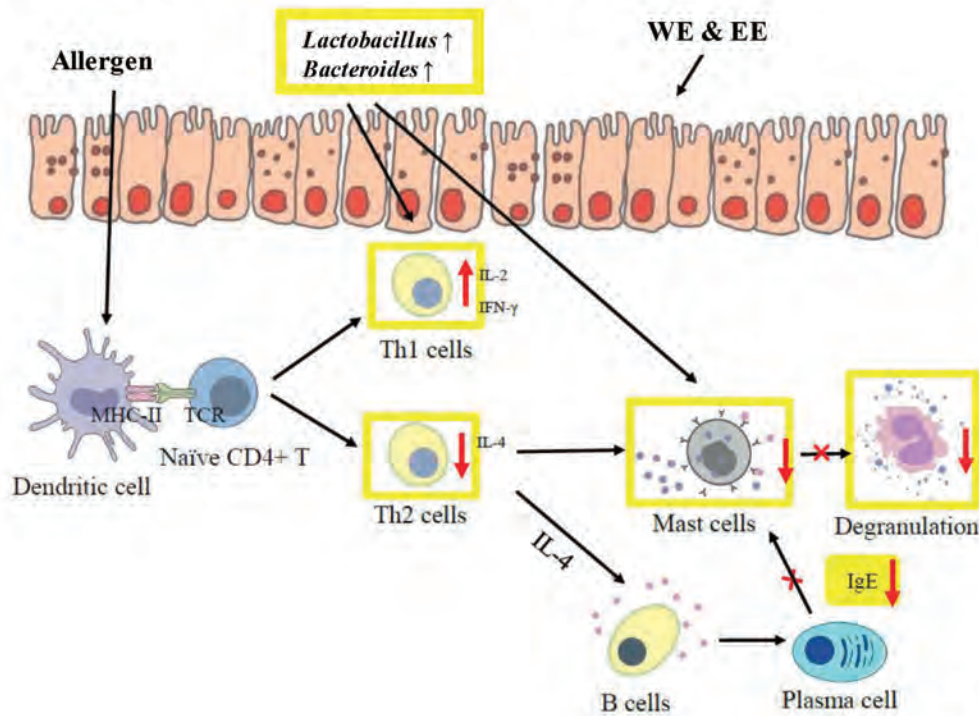
Cytokine production from OVA-stimulated SPLC



Full-length 16S rRNA gene analysis of fecal microbiota



Summary & conclusion (1)



(Liu et al., 2023) 15

Vaginal candidiasis

- Vaginal candidiasis, mainly caused by *Candida albicans*, affects 75% of women and causes inflammation and related symptoms.
- Reduced *Lactobacillus* from vaginal dysbiosis impairs natural *anti-Candida* defenses that inhibit growth and hyphal formation.



Candida (fungus)



Thick, white, odorless discharge



Vaginal Itchiness



Vaginal Redness

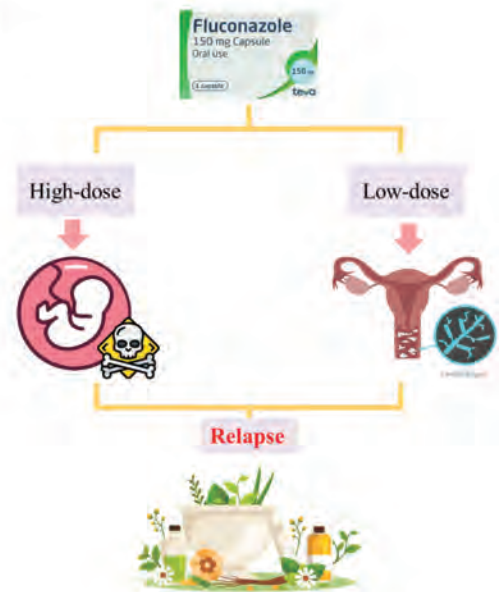
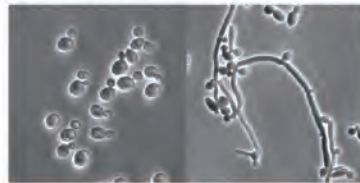


Pain When Urinating

(Sobel, 2007; Yano et al., 2019; Yano et al., 2019) 16

Candida albicans

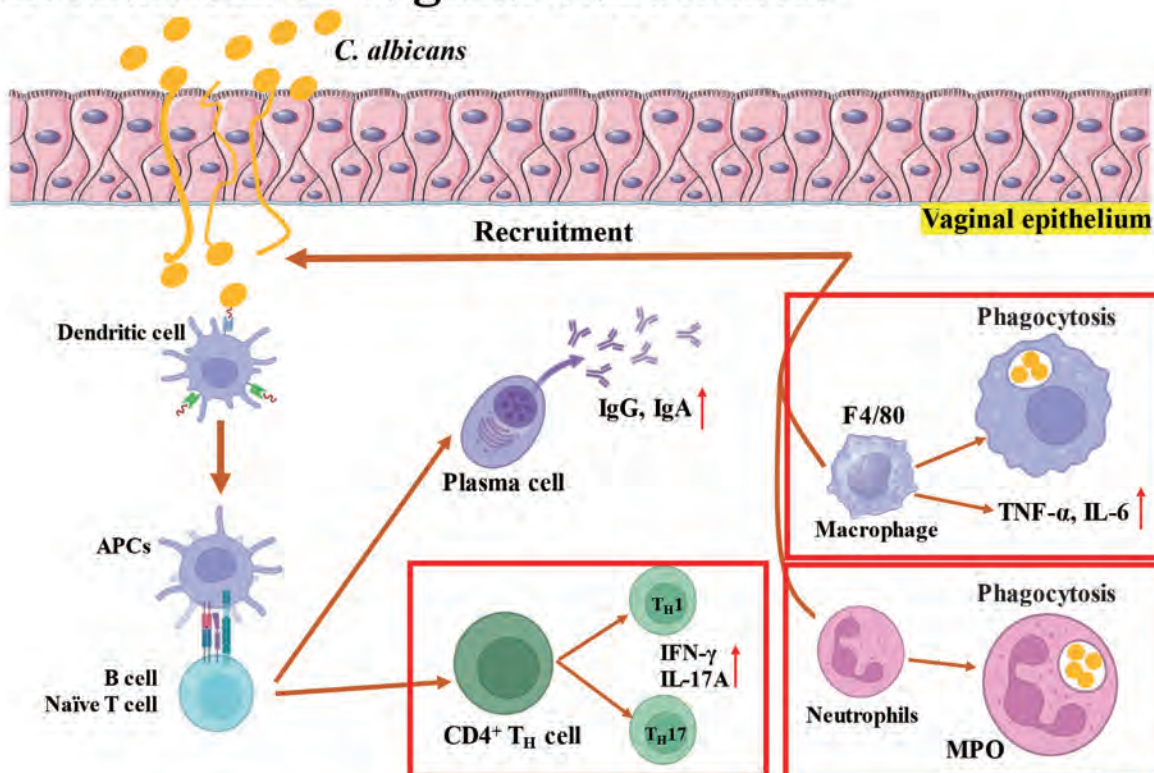
- *C. albicans* is an opportunistic pathogen that resides at the mucosa of oral cavity, GI tract, and genitourinary tract.
- **Virulence factors** are key to *C. albicans* pathogenicity, particularly **dimorphism** and the formation of **biofilms**.
- A increase in reports of **azole resistance**.



(Kashem *et al.*, 2015; Duchaussoy *et al.*, 2015)

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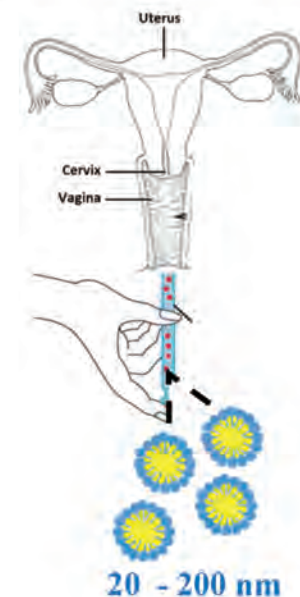
Mechanism of vaginal candidiasis



(Tong *et al.*, 2017) 18

Intravaginal delivery & nanoemulsion

- Ivag.: **localized** delivery, reduced systemic side effects, bypasses first-pass metabolism, convenience
- Nanoemulsion: **oil, water, surfactants**. Transparent & **stable**. Improve solubility, absorption, **bioavailability**, etc.
- Sesame oil: anti-inflammatory & potential anti-microbial effects



(Ho *et al.*, 2021; Huang *et al.*, 2020; Pandey *et al.*, 2017; Kotta *et al.*, 2012; Kanu *et al.*, 2010)

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Rationale & objective (2)

- *C. militaris*-fermented grain substrate is underutilized and lacks high-value applications
- *C. militaris* polysaccharides and sesame oil show anti-inflammatory and antimicrobial potentials
- Current antifungal treatments for *C. albicans* have side effects and risk of drug resistance
- To develop a *C. militaris* polysaccharide-based intravaginal nanoemulsion and evaluate its efficacy against vaginal candidiasis.

20

Polysaccharides-rich extract

C. militaris-fermented grain substrate

- ↓ Hot water extraction (121°C, 15 min)
- ↓ Centrifugation (12500 *x g*, 4°C, 15 min)

Supernatant

- ↓ 6 x volume Ethanol precipitation (25°C, 24 h)
- ↓ Centrifugation (12500 *x g*, 4°C, 15 min)

Precipitate

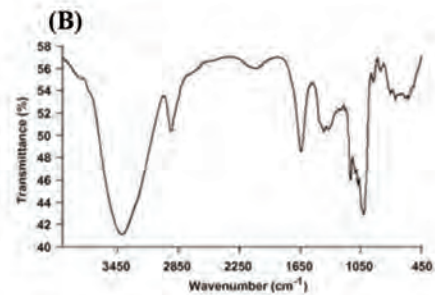
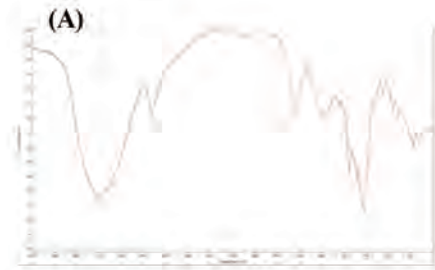
- ↓ Freeze-dried (24 h)

Crude polysaccharides

- ↓ Ultrafiltration system (>10 kDa)

Purified polysaccharides

(molecular weight: 578 kDa)







FTIR spectrum of the (A) extract and (B) β -glucan

(Lu *et al.*, 2023) 21

Preparation of *C. militaris* polysaccharides emulsion and nanoemulsion

- Formulation components
 - 400 μ L *C. militaris* extract (5 mg/mL in PBS)
 - 470 μ L pure sesame oil
 - 60 μ L Tween80[®]
 - 85 μ L Span85[®]
- Preparation procedure
 - Homogenization: 23,000 rpm, 4°C, 3 min \rightarrow emulsion (E & EC)
 - Sonication: 43 kHz, 4°C, 30 min \rightarrow nanoemulsion (NE & NC)

Table Characterization of the emulsion and nanoemulsion samples.

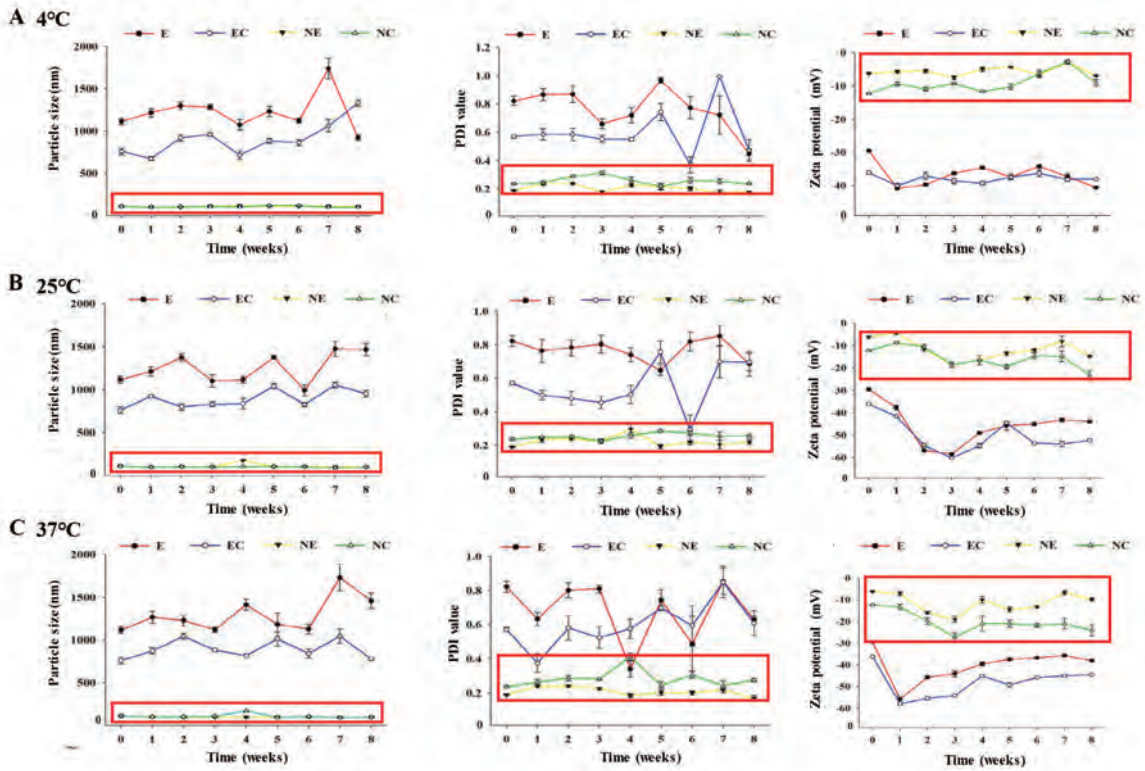
Characterization	E 	EC 	NE 	NC 
Particle size (nm)	1115.12 \pm 38.05	758.96 \pm 38.37	111.76 \pm 0.74	110.82 \pm 1.74
PDI value	0.822 \pm 0.032	0.571 \pm 0.012	0.189 \pm 0.02	0.235 \pm 0.01
Zeta potential (mV)	-29.53 \pm 0.26	-36.13 \pm 0.38	-6.20 \pm 0.11	-12.33 \pm 0.12

Each value is mean \pm standard error (n = 3)

E: emulsion; EC: *C. militaris* polysaccharide-containing emulsion; N: nanoemulsion; NC: *C. militaris* polysaccharide-containing nanoemulsion

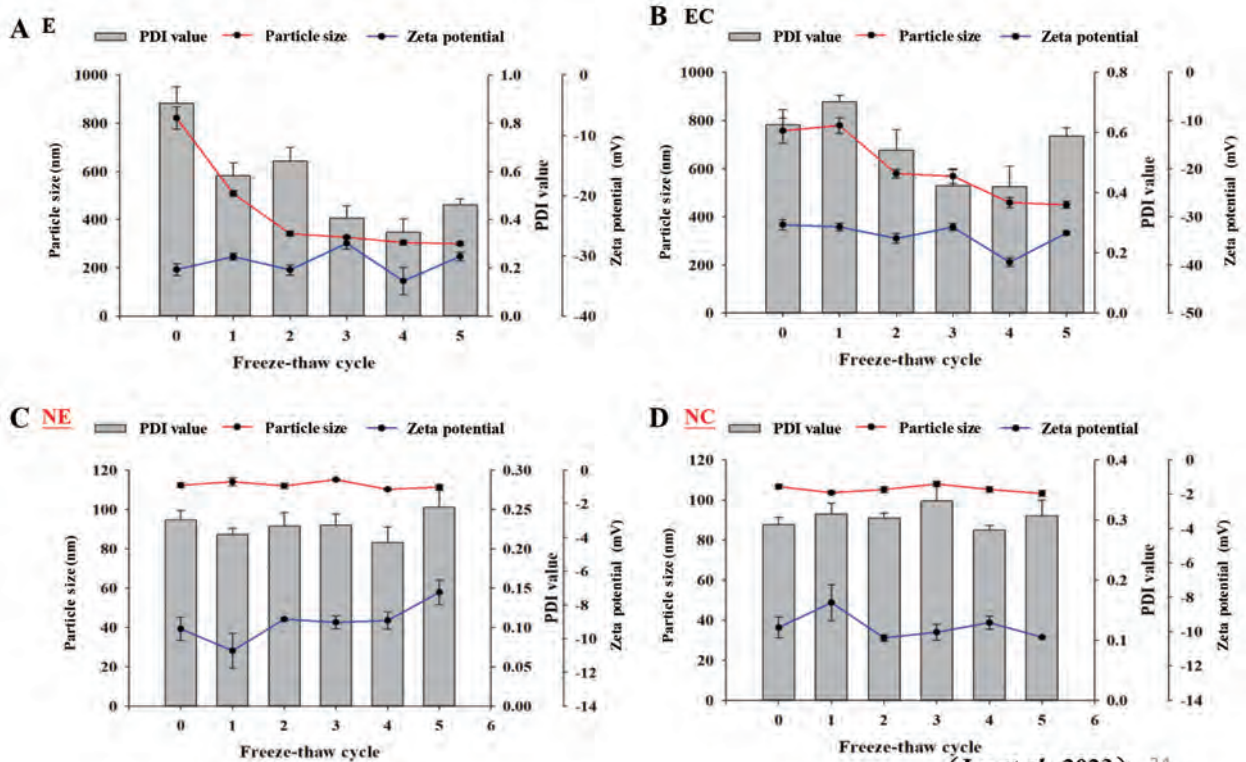
(Lu *et al.*, 2023) 22

Storage stability analysis



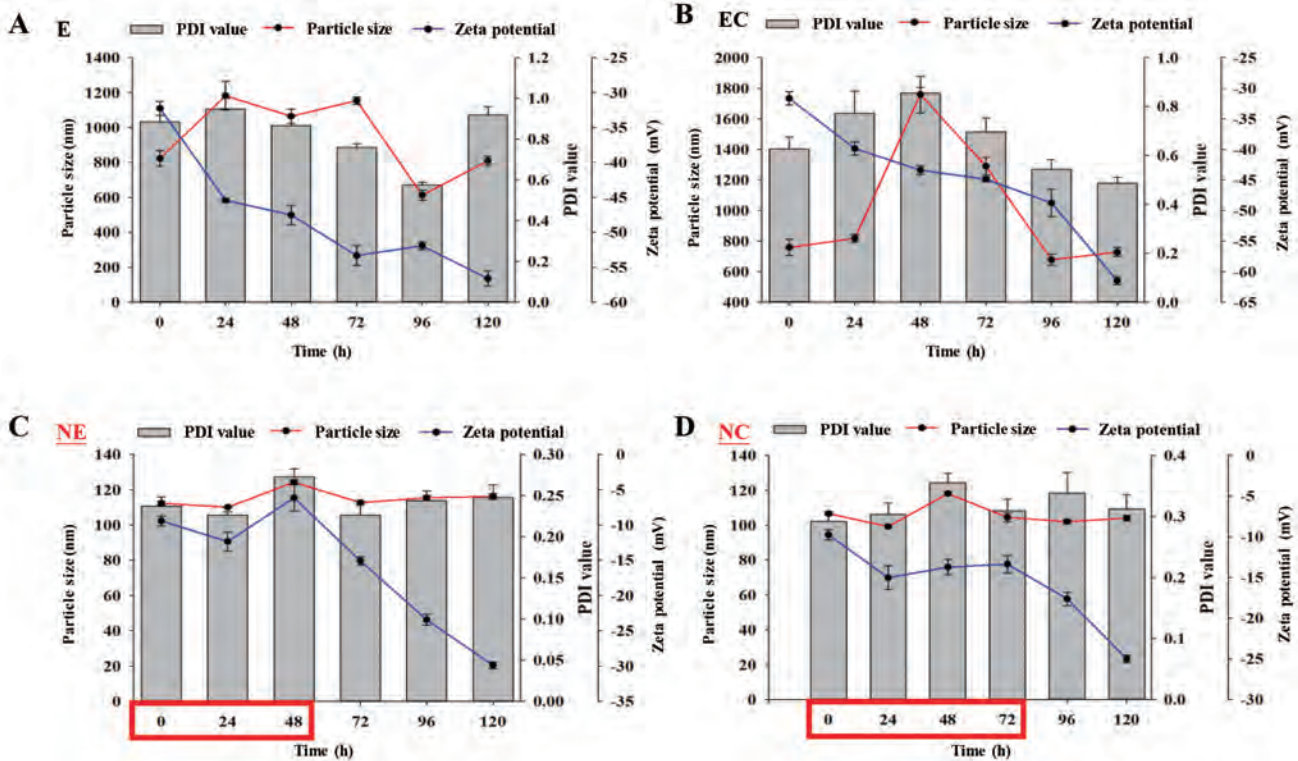
23

Freeze-thaw stability analysis



24

Storage stability analysis at pH 4

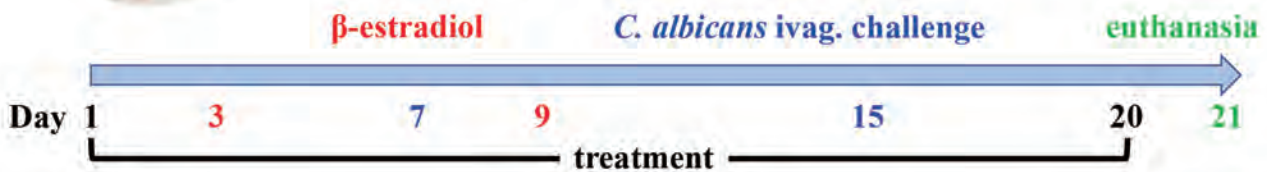


(Lu et al., 2023) 25

Animal experiment



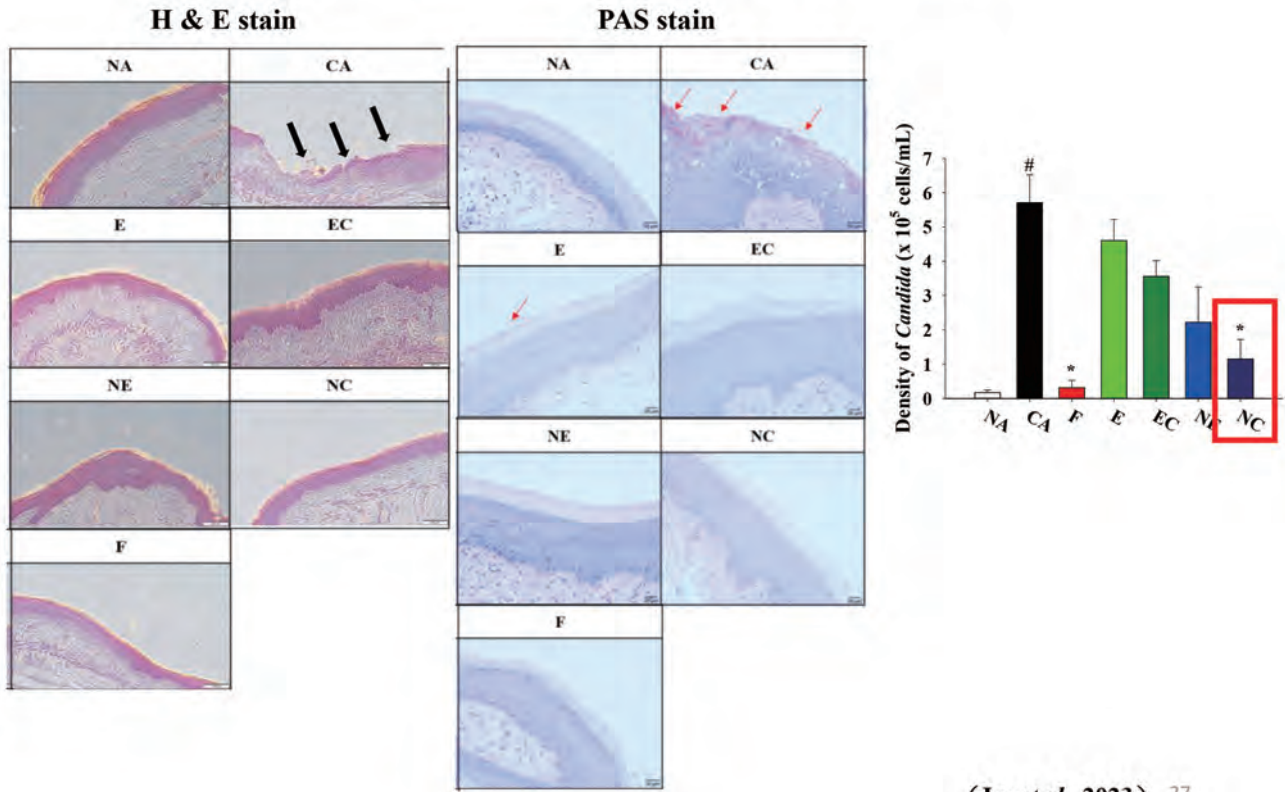
6-week old BALB/c mice (n=6)



Group	Treatment
Normal control: NA	No infection & no treatment
Infection control: CA	Challenged with <i>C. albicans</i> (10^5 cells) and ivag. treated with sterile PBS (20 μ L)
Positive Control: F	Challenged and orally treated with fluconazole (100 mg/kg/day)
Treatment groups: E/EC/NE/NC	Challenged and ivag. treated with E, EC, NE or NC daily

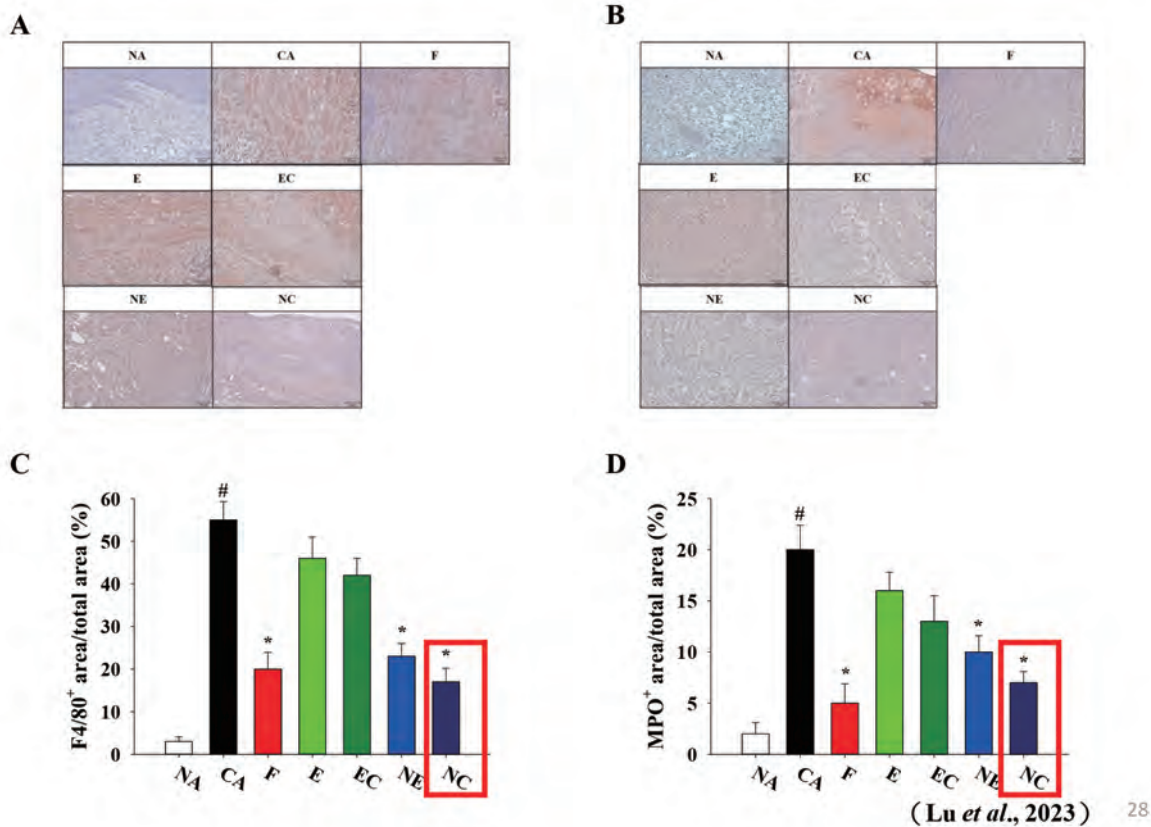
(Lu et al., 2023) 26

Pathological change of vaginal tissue



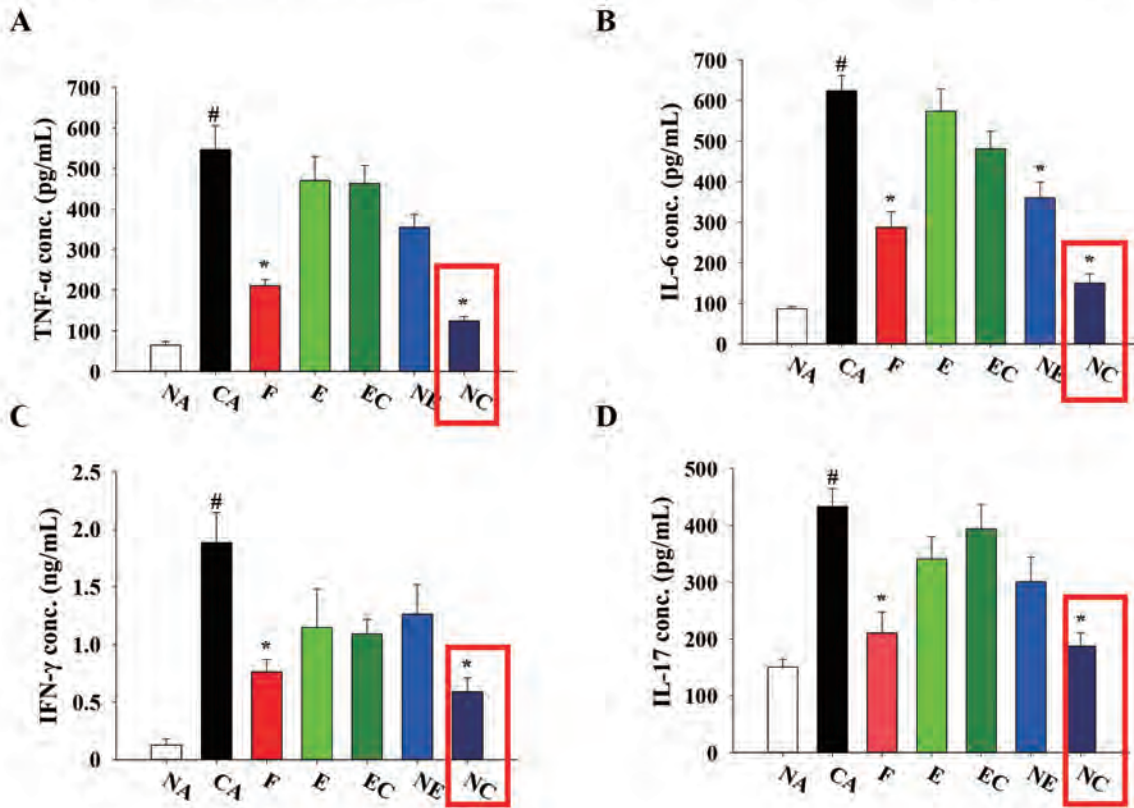
(Lu et al., 2023) 27

Expression of F4/80 & MPO at the vaginal mucosa



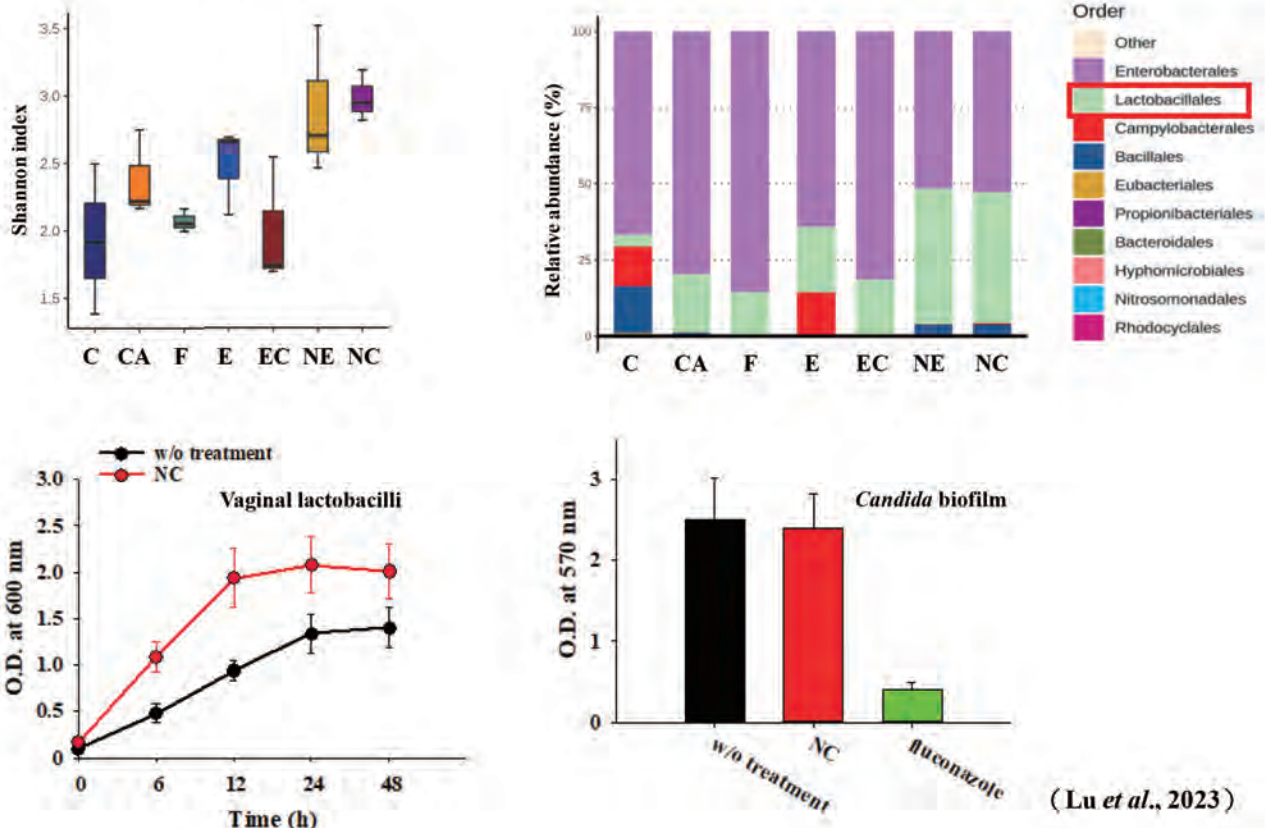
(Lu et al., 2023) 28

Cytokines secreted by HK-CA-stimulated SPLC



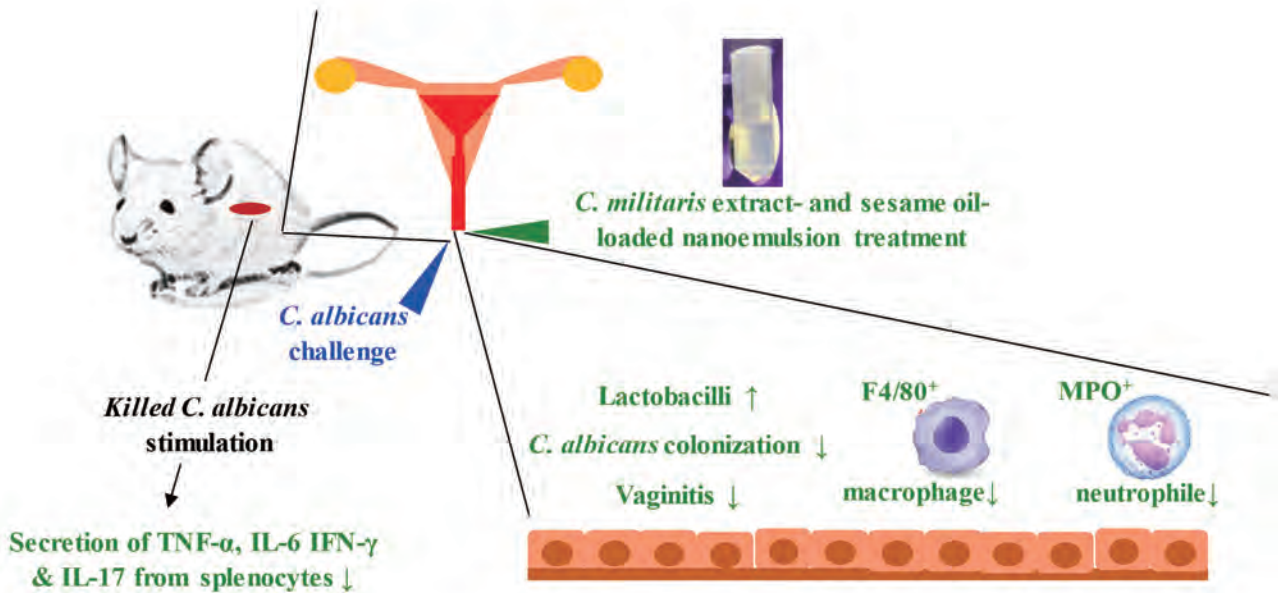
(Lu et al., 2023) 29

Analysis of vaginal microbiota



(Lu et al., 2023)

Summary & conclusion (2)

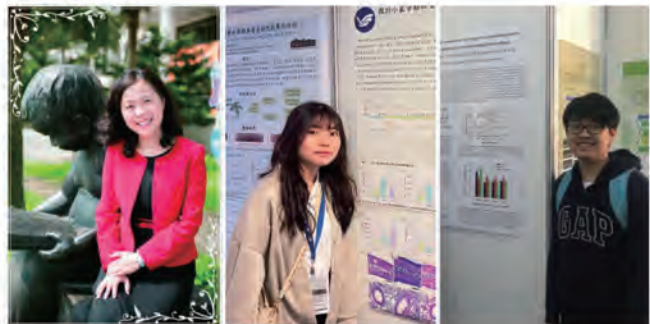


(Liu *et al.*, 2023) 31

Acknowledgement

➤ NTOU FS

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- Rong-Yi Huang (黃容怡)
Heliyon, 2023 Dec 5;9(12):e23315
- Hsueh-Yu Lu (呂學聿)
Biomed Pharmacother. 2023 Nov;167:115506



➤ MeansGood Agri-biotechnology Co., Ltd.

- Mr. Tseng

Thank you for listening



2026 第六屆發酵技術研討會

發酵策略於生質燃料生產： 以乙醇為例

Presenter: Dr. Yueh-Hao Ronny Hung (洪悅豪 博士)

Advisor: Distinguished Professor Kuan-Chen Cheng (鄭光成 特聘教授)

March 19, 2026

Dr. Yueh-Hao Ronny Hung

What are biofuels?



Fuels that are generated directly or indirectly from **organic matter (biomass)** including plant materials and animal wastes

e.g. ethanol, methanol, biodiesel

image: Flaticon.com

Biomass



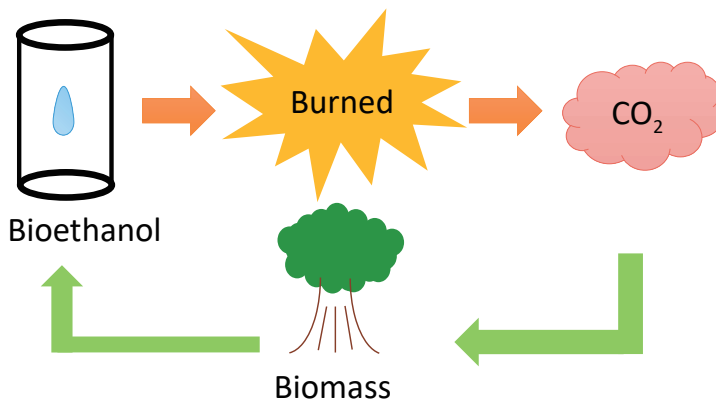
Material derived from a living or recently living organism such as plant material or animal waste



image: hiclipart.com

3

Carbon Neutralization



• Benefits in:

- Reducing greenhouse gas emissions
- Saving fossil fuel depletion
- Diversifying energy sources

(Borrion et al., 2012, *Biomass and Bioenergy*, 47)

Fig. Bioethanol carbon cycle.

4

Biofuel vs. Fossil Fuel

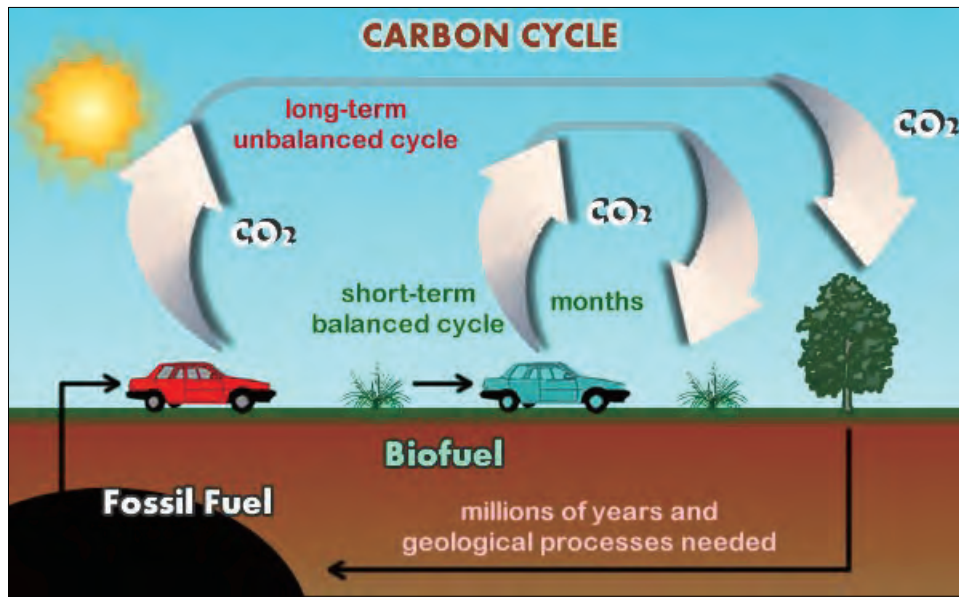
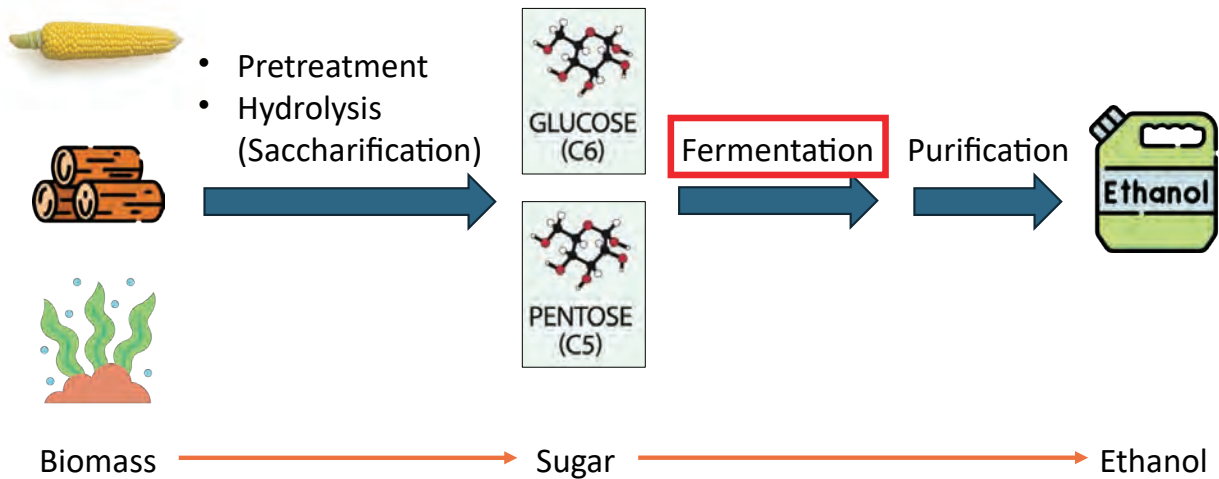


image: Sustainable Futures Institute, Michigan Technological University

5

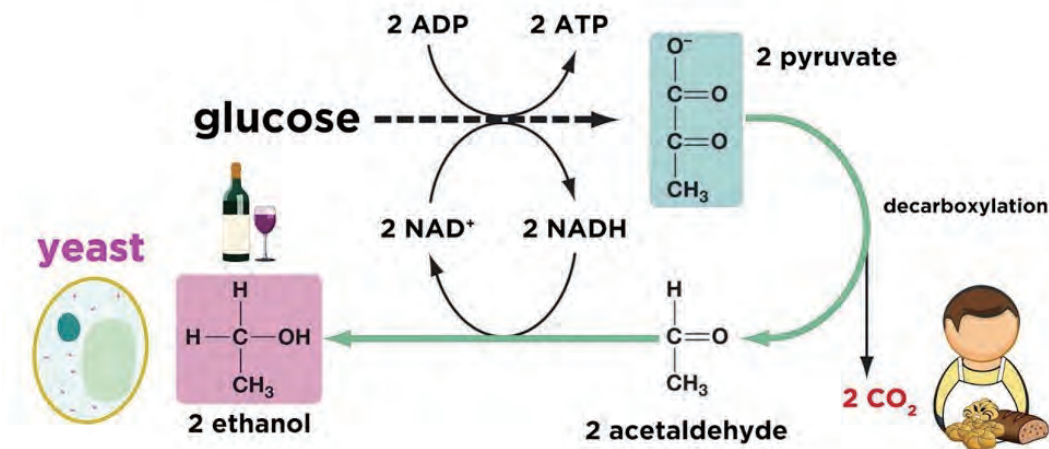
General design for bioethanol production



icon: Flaticon.com
image: Unsplash.com

6

Alcohol Fermentation



<https://www.kegg.jp/pathway/map00010>

7

Bioethanol Fermentation

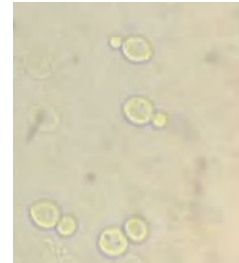
Fermentation configurations

Fermentation modes

8

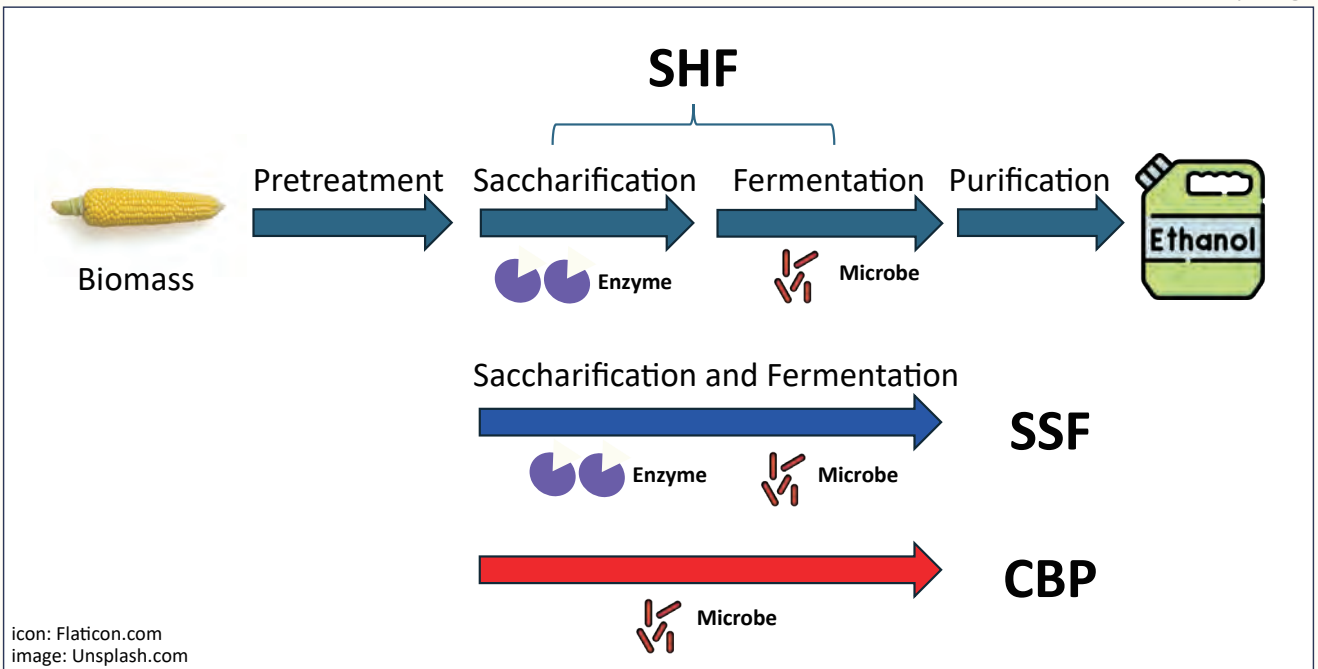
Fermentation configurations

Approaches of bioprocess



Fundamental fermentation configurations

- **Separate** hydrolysis and fermentation (SHF)
- **Simultaneous** saccharification and fermentation (SSF)
- Consolidated bioprocessing (CBP)



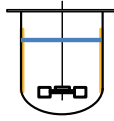
Fermentation modes

Modes of Substrate Delivery

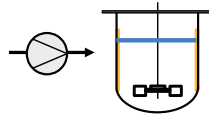
The diagram shows a stirred-tank fermenter with a central vertical shaft and two horizontal blades. A blue horizontal line indicates the liquid level, and a square symbol at the bottom of the shaft represents the impeller.

Fundamental fermentation modes

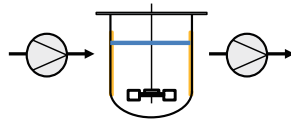
- Batch



- Fed-batch



- Continuous



13

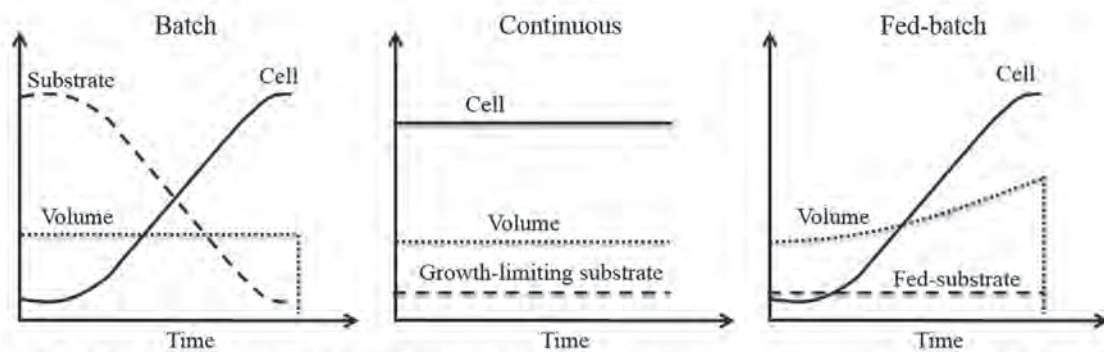


FIGURE 6.5 Typical variations in working volume and cell and substrate concentrations under various operation modes.

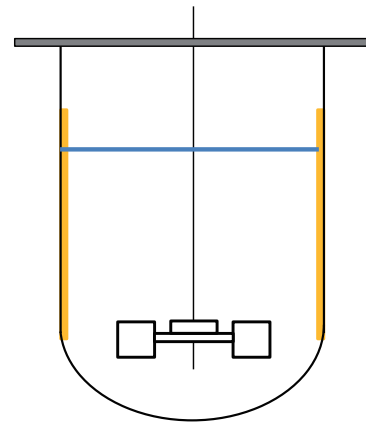
(Fernandes *et al.*, 2017. In *Current Developments in Biotechnology and Bioengineering*, pp. 153-185)

14

Batch fermentation

Characteristics:

- Unsteady state operation
 - Transient conditions
- (+) most common
 (+) high product concentration
 (+) low risk of contamination
- (-) long downtime
 (-) space requirements
 (-) manpower requirements



15

16

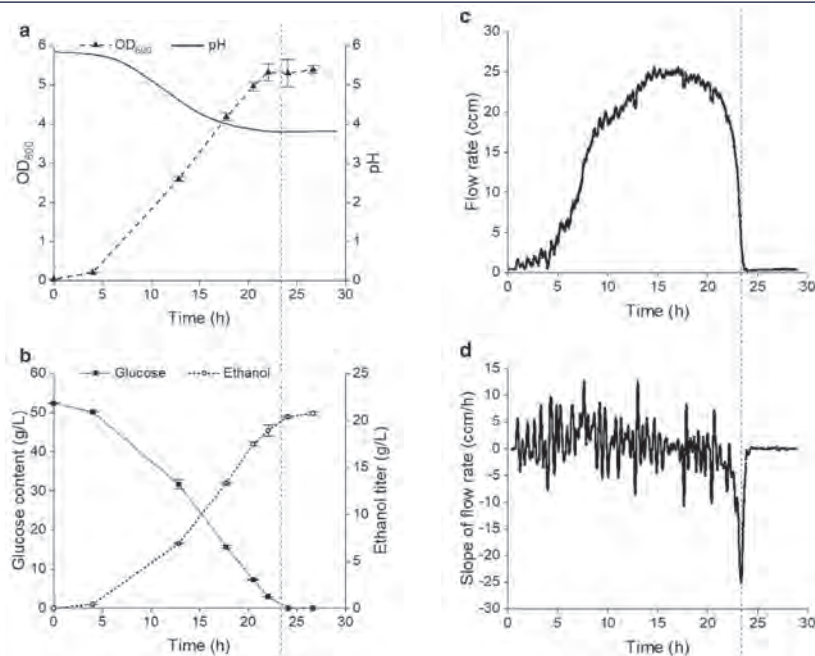


Fig. Batch fermentation of *S. cerevisiae*.

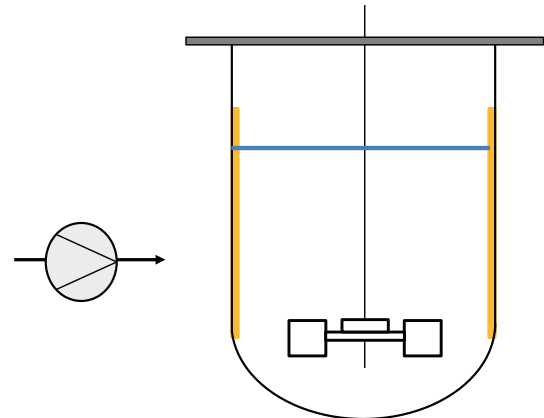
(Wang et al., 2020. *Biotechnology for biofuels*, 13)

Fed-batch fermentation

- Need feeding strategies
- Transient conditions

- (+) high cell density
- (+) high product concentration
- (+) low substrate inhibition

- (-) manpower/downtime
- (-) heterogeneous properties
- (-) require control systems



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18

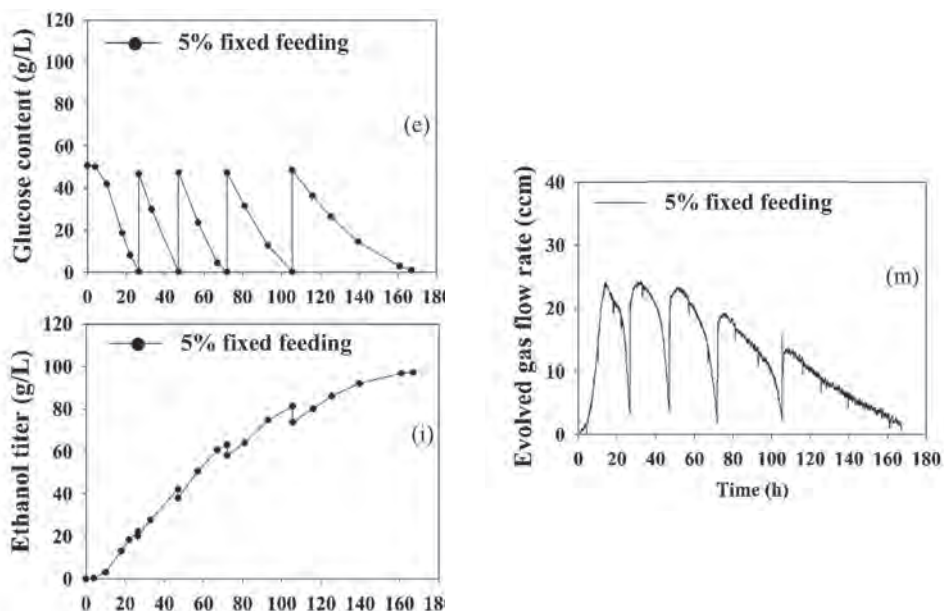


Fig. Fed-batch fermentation of *S. cerevisiae*. (Hung et al., 2023. *Bioengineered*, 14)

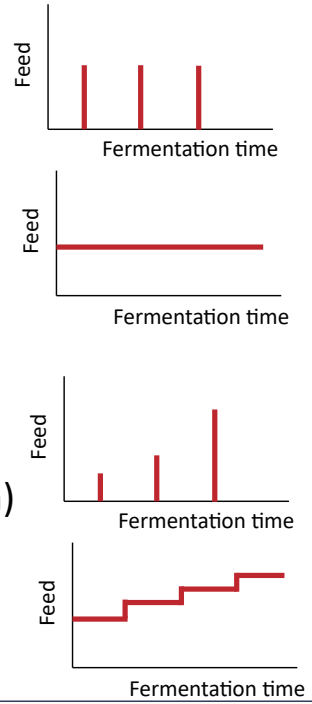
Fed-batch: Feeding strategies

Without Feedback Control

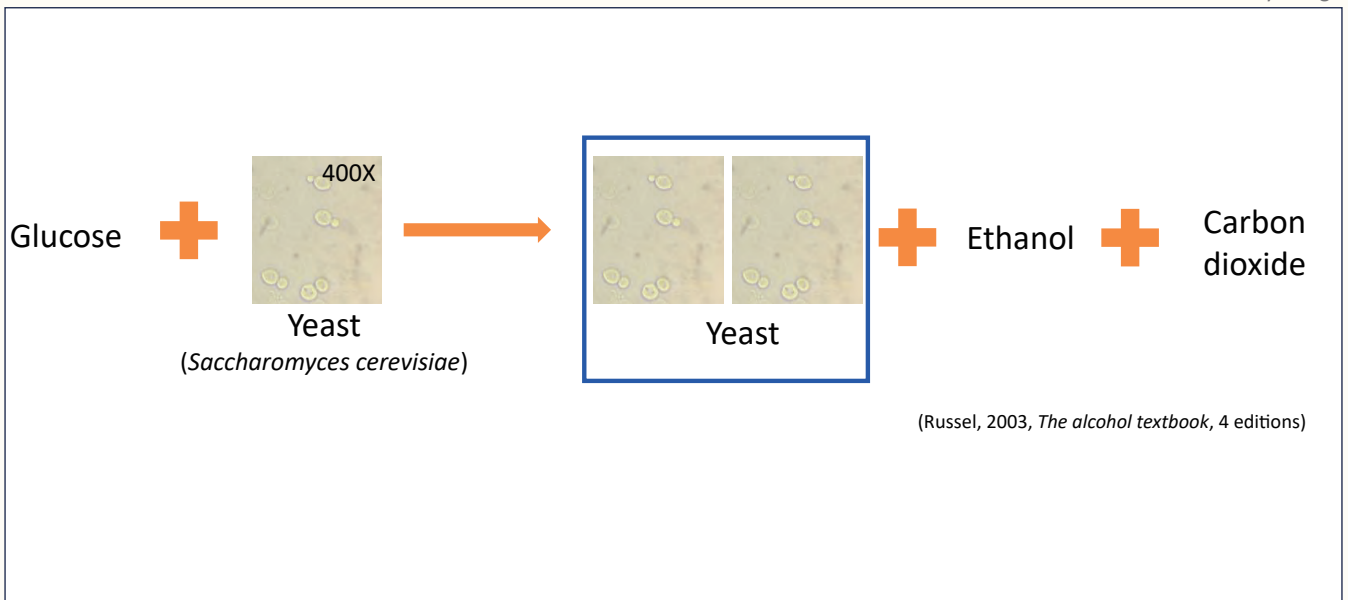
- Intermittent/Pulse feeding
- Constant feeding
- Exponentially feeding
- Optimized feeding (mathematical models)

With Feedback Control

- Direct feedback control (e.g. sugar concentration)
- Indirect feedback control (e.g. CO₂ evolution)

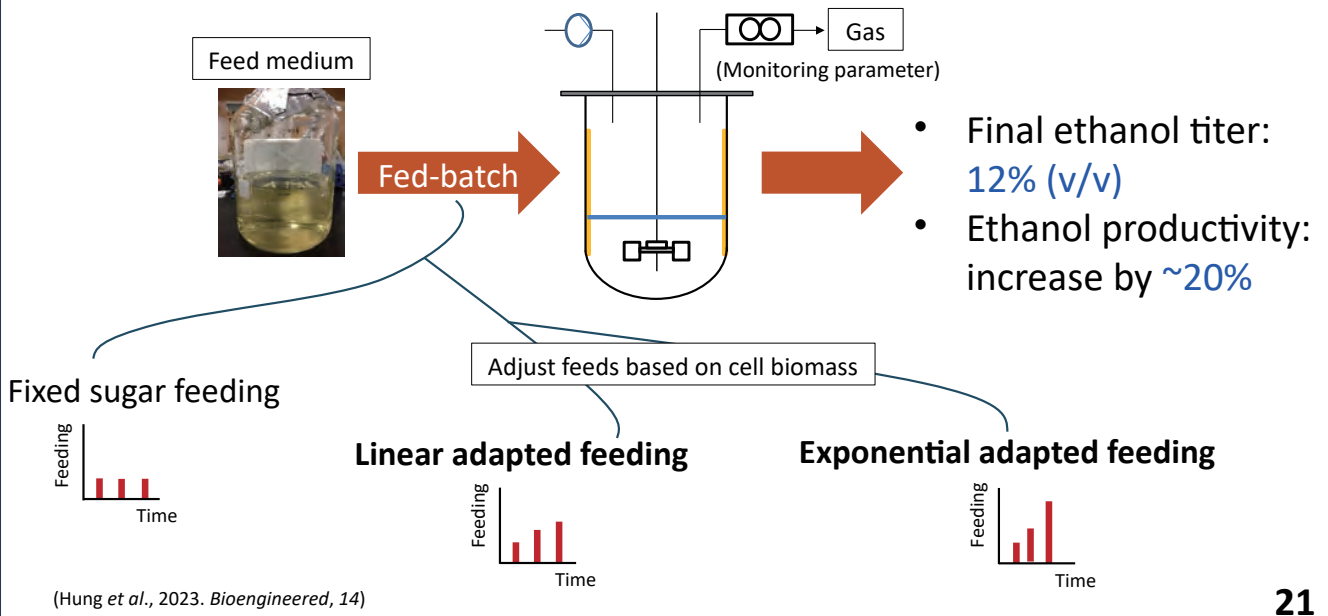


19

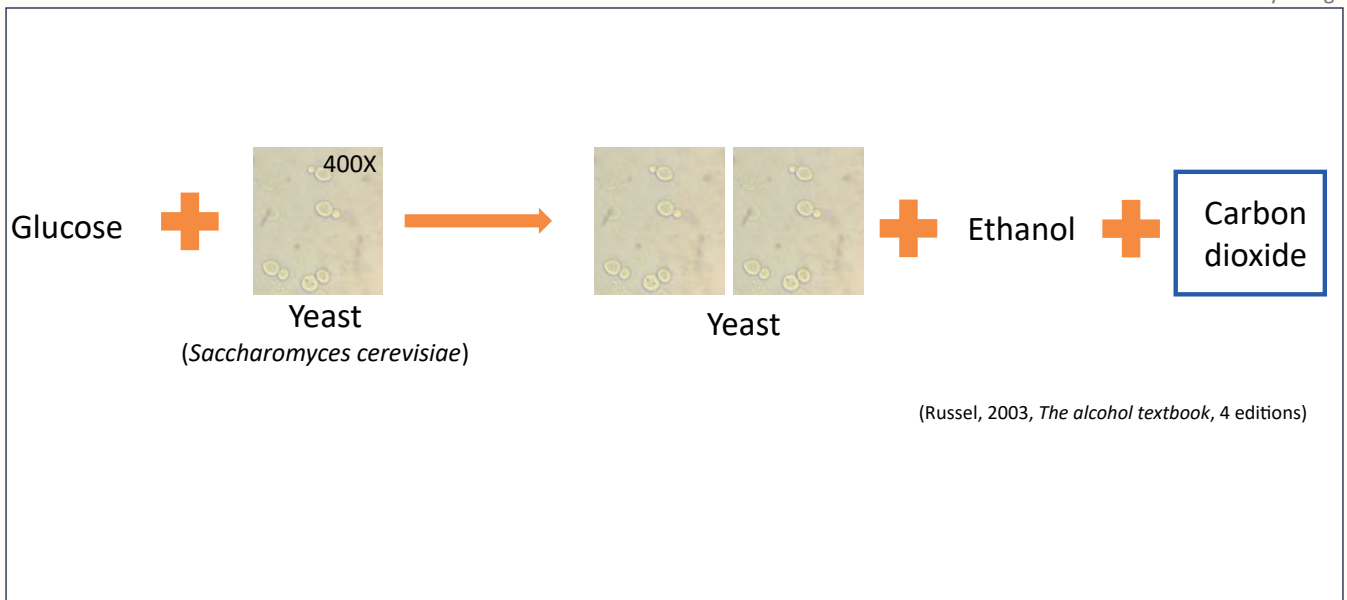


20

Pulsed adapted feeding strategies



21



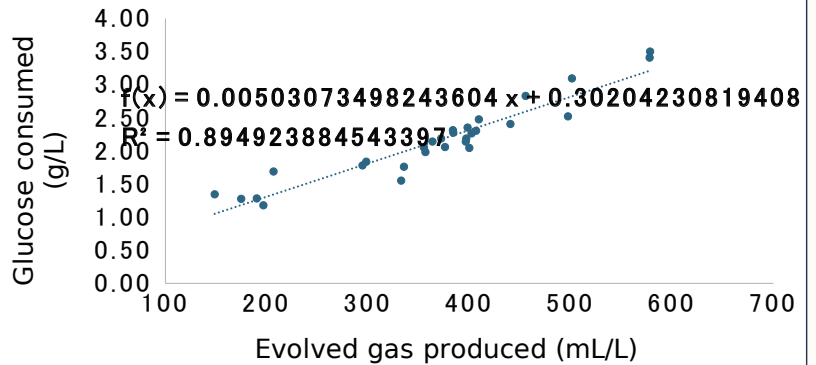
22

Continuous adapted feeding strategy

(i) Estimate glucose consumption

Adapted feeding operations:

(a) Use evolved gas production to estimate glucose consumption per reactor working volume



Gas flow meter

(Hung et al., 2025. *Applied Microbiology and Biotechnology*, 109)

23

Continuous adapted feeding strategy

24

(ii) Adjust glucose feed rate

Adapted feeding operations:

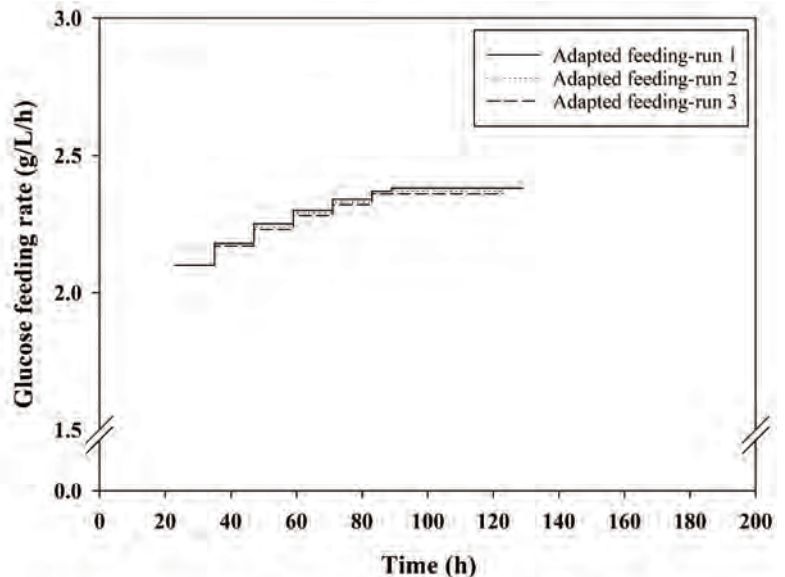
(a) Use evolved gas production to estimate glucose consumption



(b) Adjust the glucose feed rate based on increased gas production ratio



(c) Until 200 g/L glucose is fed
(input: the same as the fixed feeding)

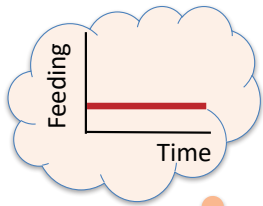


(Hung et al., 2025. *Applied Microbiology and Biotechnology*, 109)

24

Continuous adapted feeding strategy

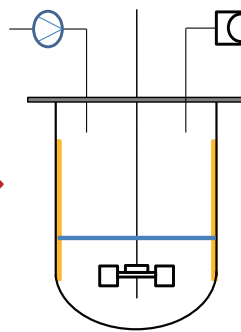
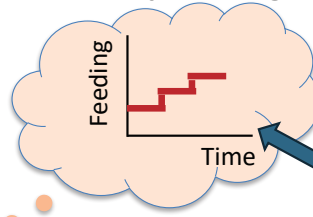
Fixed sugar feeding



Feed medium



Gas-adapted sugar feeding

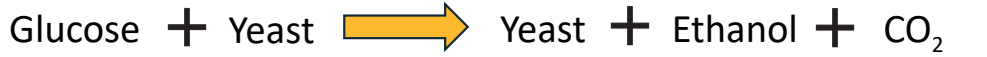


- Final ethanol titer: 11% (v/v)
 - Ethanol productivity: increase by 21%
- (Monitoring parameter)

(Hung et al., 2025. *Applied Microbiology and Biotechnology*, 109)



(Russel, 2003, *The alcohol textbook*, 4 editions)

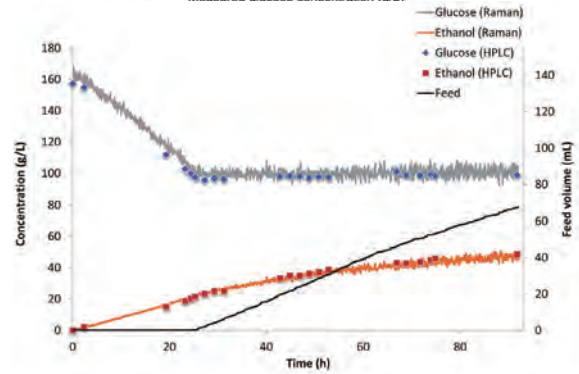
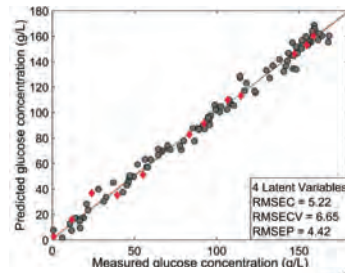
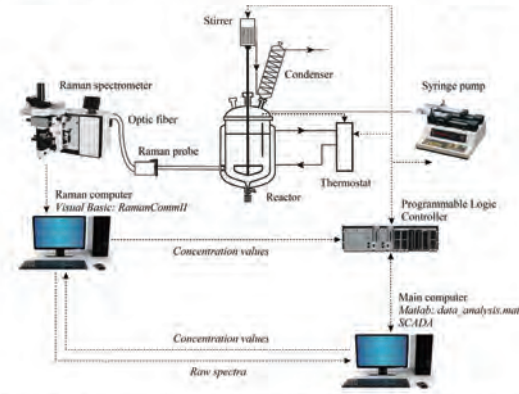


RESEARCH ARTICLE



Inline noninvasive Raman monitoring and feedback control of glucose concentration during ethanol fermentation

Edit Hirsch¹ | Hajnalka Pataki² | Júlia Domján¹ | Attila Farkas¹ | Panna Vass¹ | Csaba Fehér² | Zsolt Barta^{2,3} | Zsombor K. Nagy² | György J. Marosi¹ | István Csontos¹



(Hirsch et al., 2019. *Biotechnology Progress*. 35)

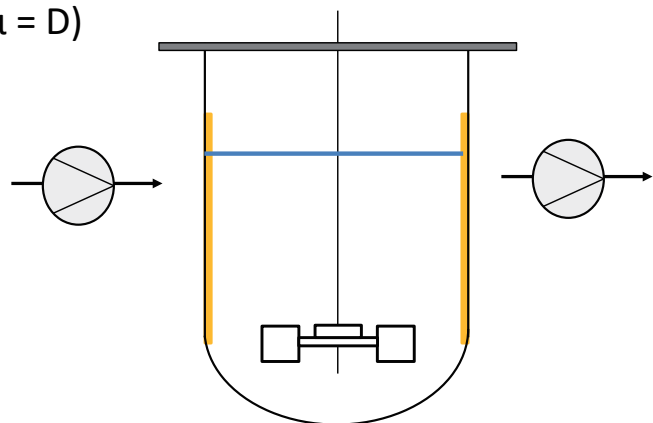
Continuous fermentation

Characteristics:

- Steady state operation
- Growth rate = dilution rate ($\mu = D$)
- Chemostat/Turbidostat

- (+) high throughput
- (+) less downtime
- (+) less product inhibition

- (-) low product concentration
- (-) high risk of contamination
- (-) microbial selection

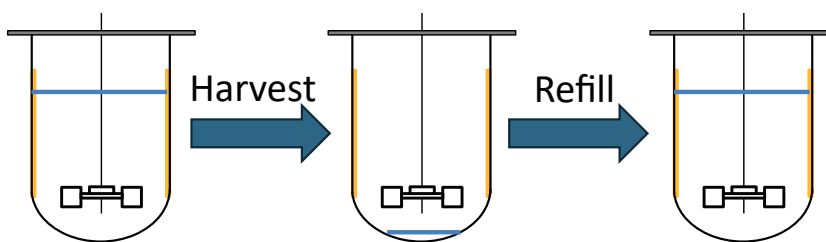


Comparison of fermentation modes

	Batch	Fed-batch	Continuous
Operations	<ul style="list-style-type: none"> Fixed volume of medium 	<ul style="list-style-type: none"> Nutrients-in 	<ul style="list-style-type: none"> Nutrients-in and medium-out continuously
Advantages	<ul style="list-style-type: none"> Low risk of contamination Good benchmark 	<ul style="list-style-type: none"> High ethanol titer Low substrate inhibition 	<ul style="list-style-type: none"> High ethanol productivity Low substrate inhibition
Limitations	<ul style="list-style-type: none"> Substrate inhibition Long downtime 	<ul style="list-style-type: none"> Product inhibition Required precise control strategies 	<ul style="list-style-type: none"> Low ethanol titer High risk of contamination Required precise control strategies

29

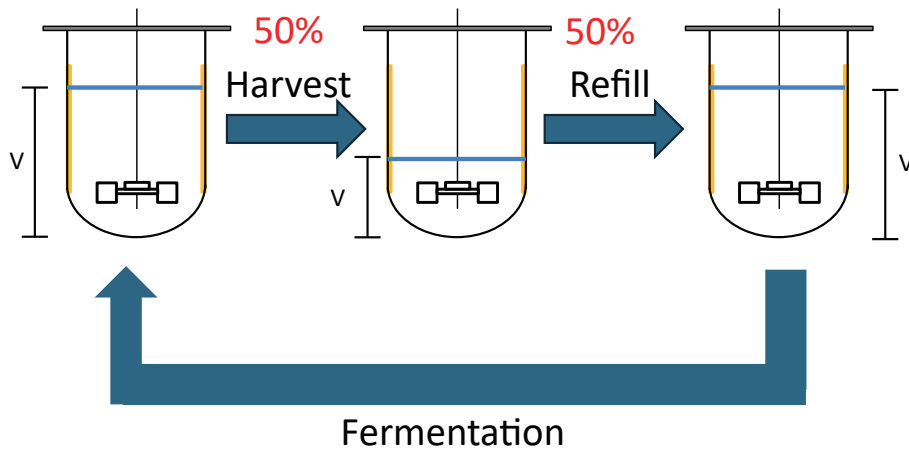
Other fermentation modes: semi-continuous



Repeated-batch fermentation

30

Self-cycling fermentation (50:50)



31

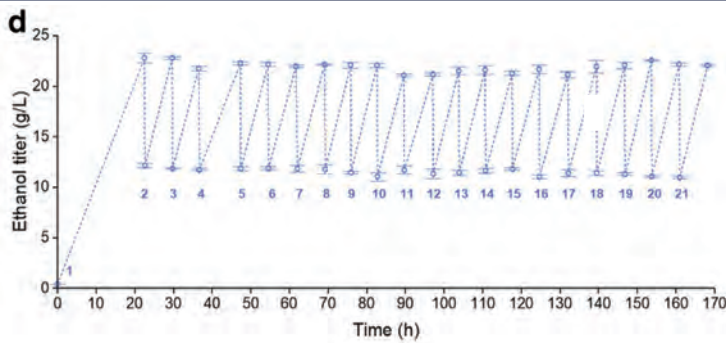


Fig. Ethanol titer in SCF.

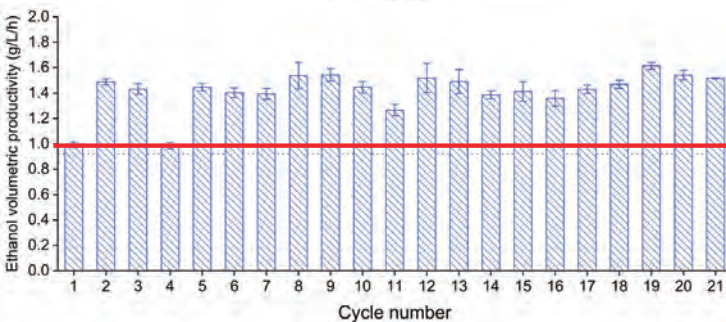


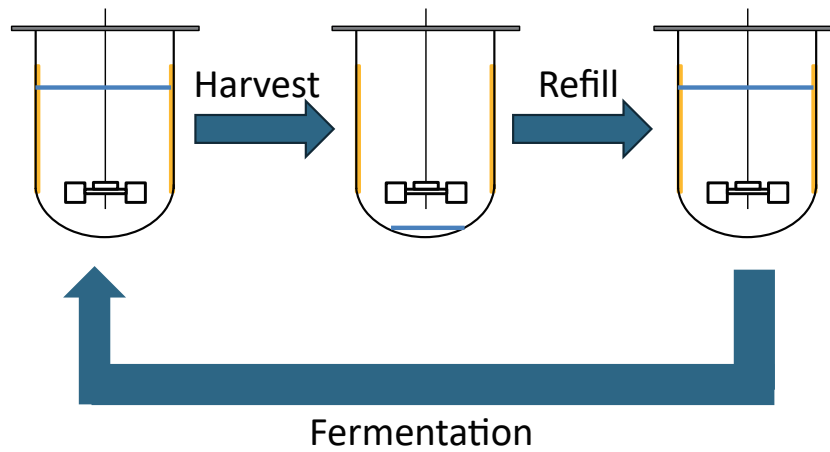
Fig. Ethanol volumetric productivity in SCF.

- Improved productivity by 37–75%

(Wang et al., 2020, *Biotechnology for Biofuels*)

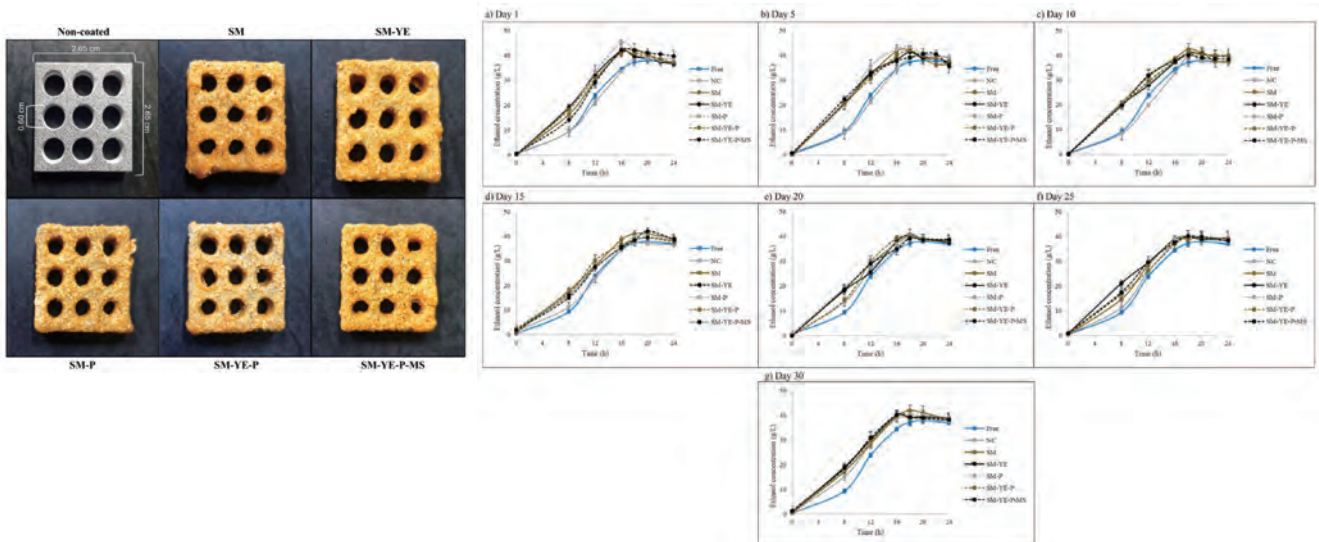
32

Repeated-batch fermentation



33

Cell immobilization

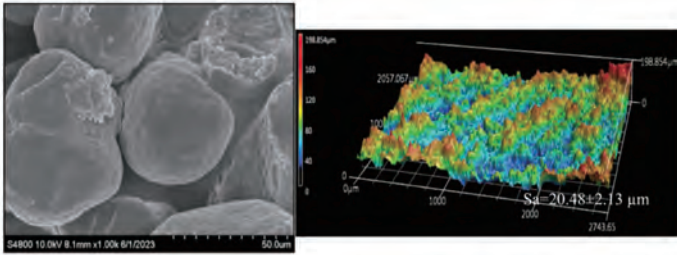


(Khumsupan et al., 2025. *Industrial Crops and Products*, 224)

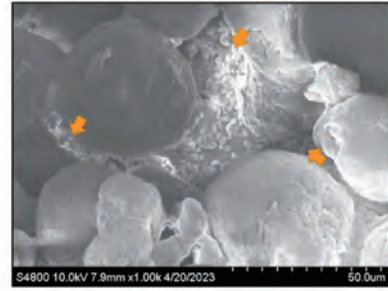
34

Agro-wastes • Increase the surface roughness and hold more cells

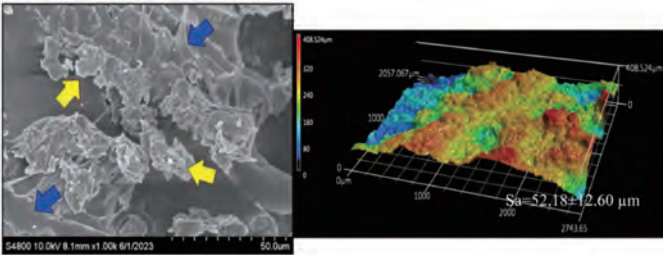
(a) Non-coated



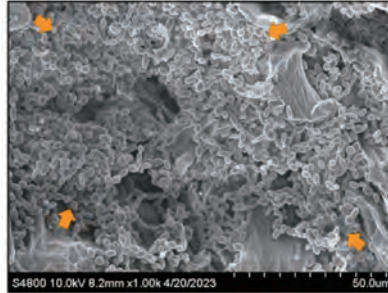
a) NC



(b) SM

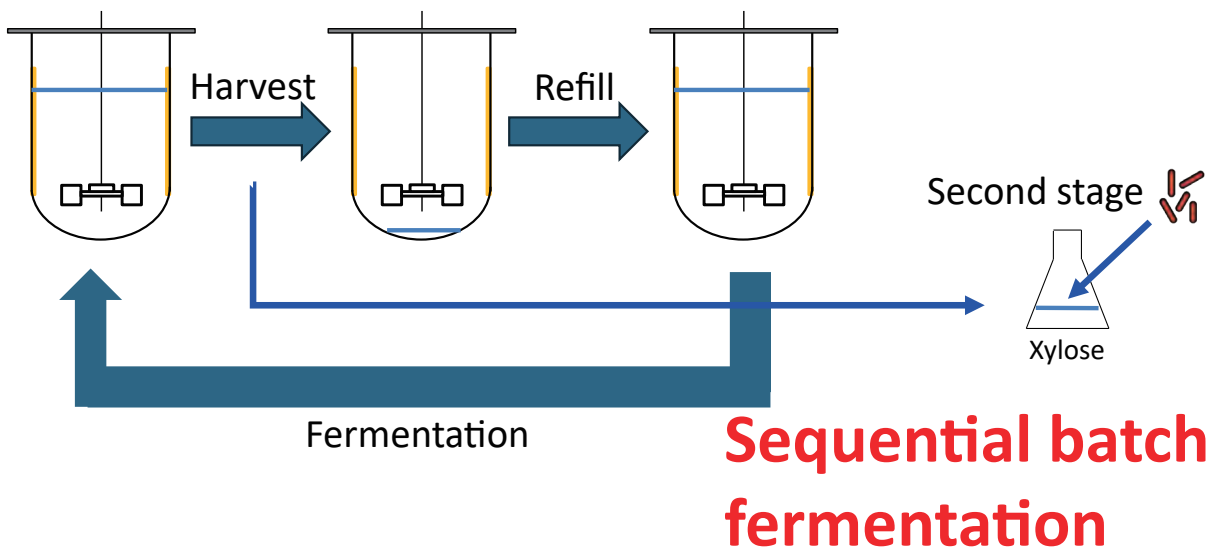


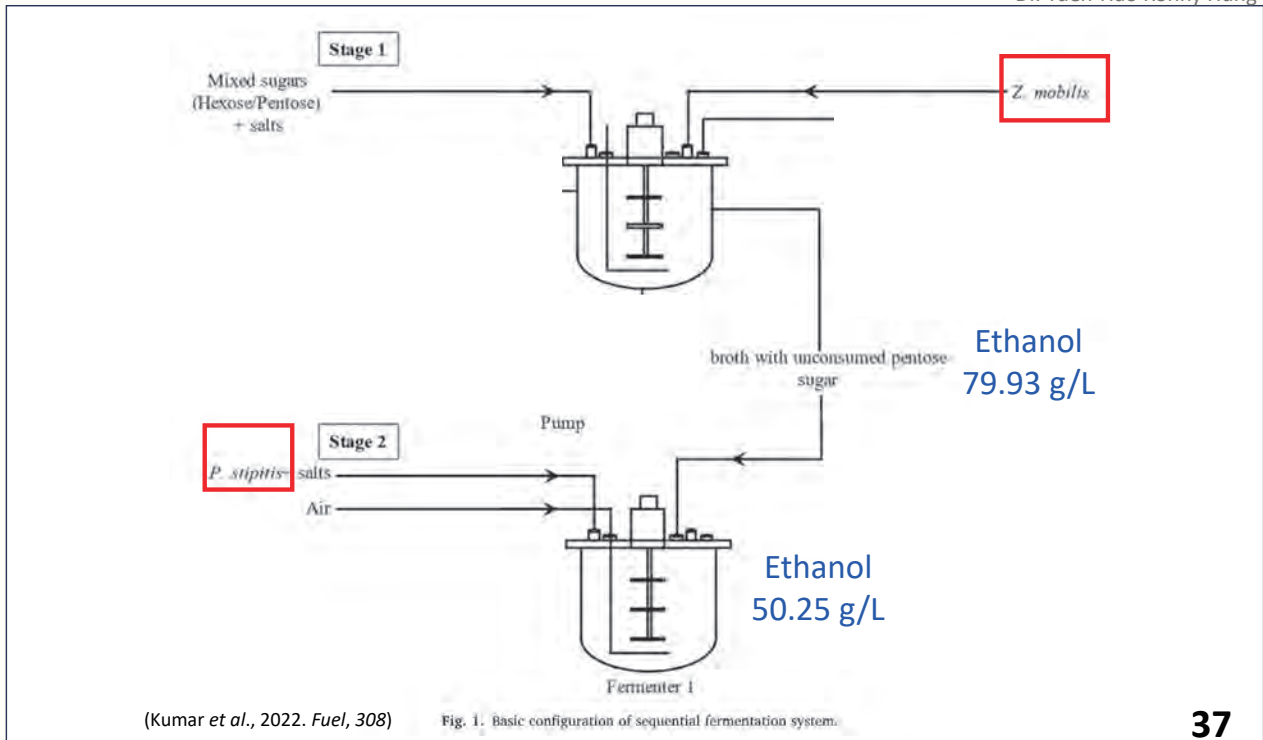
b) SM



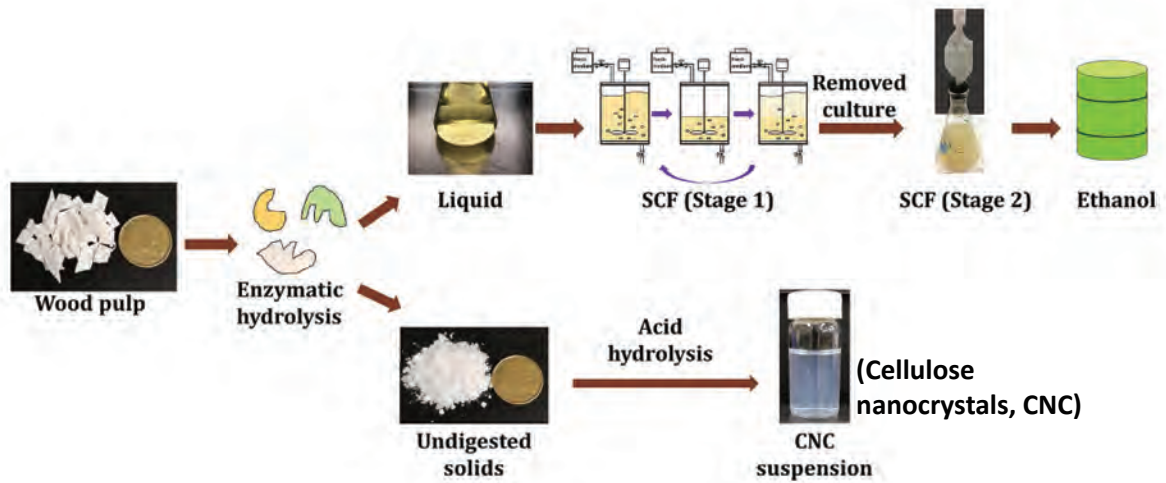
(Khumsupan et al., 2025. *Industrial Crops and Products*, 224)

What can we do for the harvested medium?





Biorefinery process



(Wang et al., 2021. Bioresource Technology, 330)

Take home message...

- Bioethanol production contributes to carbon neutralization. **Feedstocks matter.**
- **Fermentation configuration and mode** are critical variables for bioethanol production.
- Can we **create additional value** from existing bioethanol production processes?

39

References

40

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Acknowledgements

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台灣大學生物科技研究所
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台灣食品保護協會
台灣乳酸菌協會
國際精準健康學會
台灣保健食品學會
台灣食品科技學會



From Requirements to Reality

ms Customization Experience Sharing



19th of Mar. 2026
Zoe Hsu

Presenter Name
 major science
Innovative Life Sciences Tools

Agenda

01 Who We Are
major science

02 Customization
Experience Sharing

03 Product Portfolio

01

Who We Are



About major science

Founded in **1994**, Major Science is a professional manufacturer specializing in the design, production, and sales of life science laboratory instruments. We provide reliable solutions and services to research institutions and biotechnology companies worldwide.

What We Do

Winpact Series: Bioreactors and fermenters designed to support microbial and cell culture research..

Laboratory Equipment: Electrophoresis systems, dry baths, temperature-controlled water baths, shakers, and peristaltic pumps.

Innovation & Customization: Providing modular and scalable solutions to meet diverse research needs.



Our team

From R&D and production to logistics and technical support, Major Science manages every stage of an instrument's life cycle.

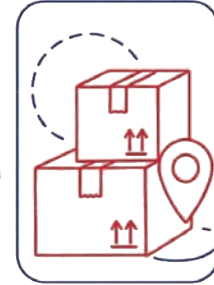
From the moment it's designed to its final day in service, we ensure performance, reliability, and lasting value.



RESEARCH & DEVELOPMENT



MANUFACTURE



WAREHOUSE

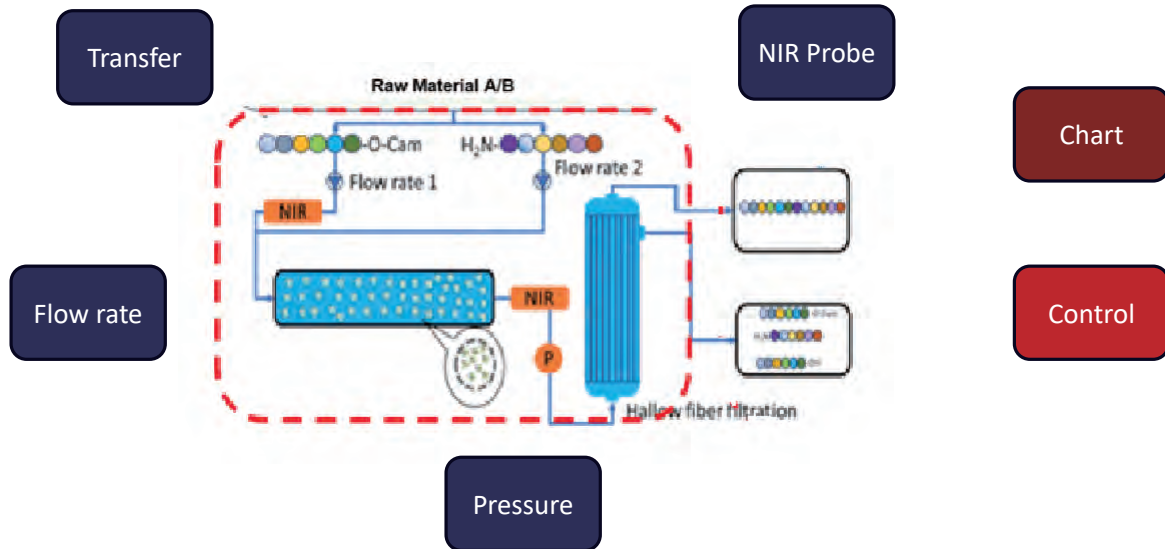


TECHNICAL SUPPORT

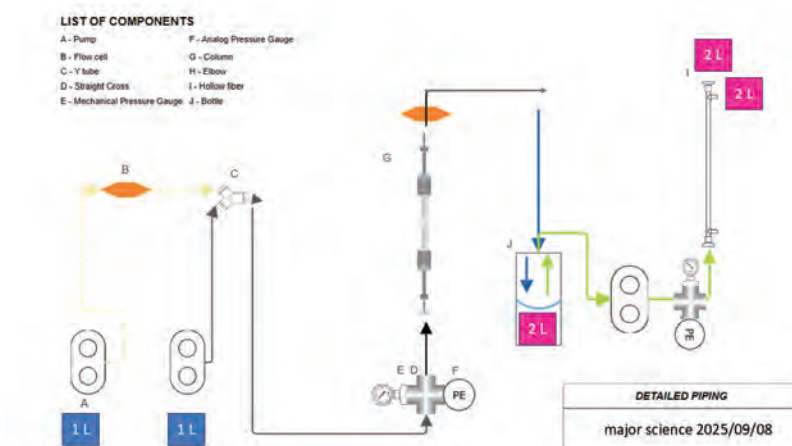
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Customization Experience Sharing

Customization Experience Sharing

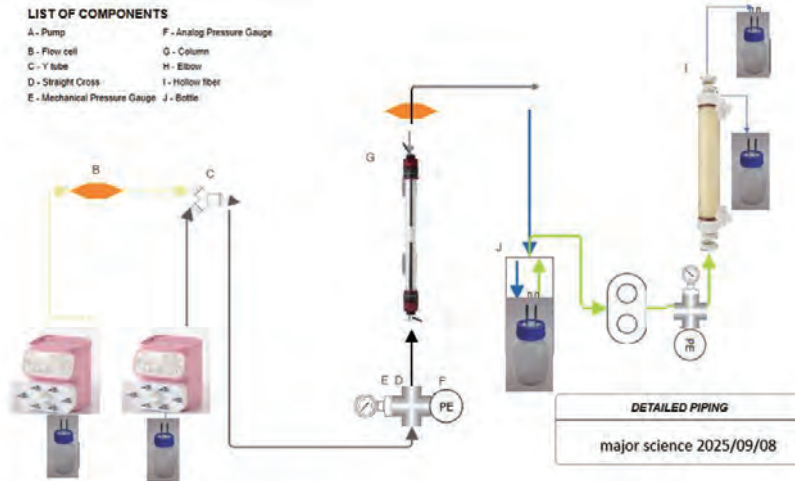


Customization Experience Sharing



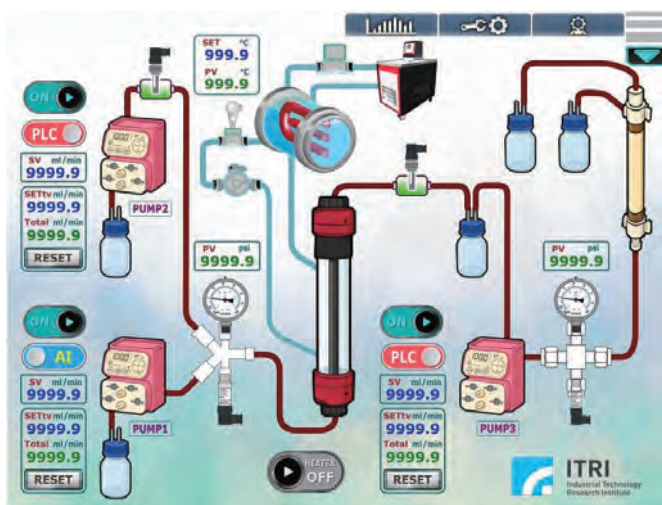
The key advantage of our PFR system lies in its high degree of modularity and customization, ensuring a perfect fit for your specific process requirements.

Customization Experience Sharing



The key advantage of our PFR system lies in its high degree of modularity and customization, ensuring a perfect fit for your specific process requirements.

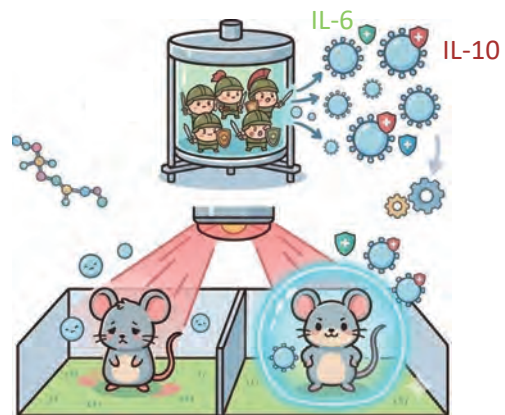
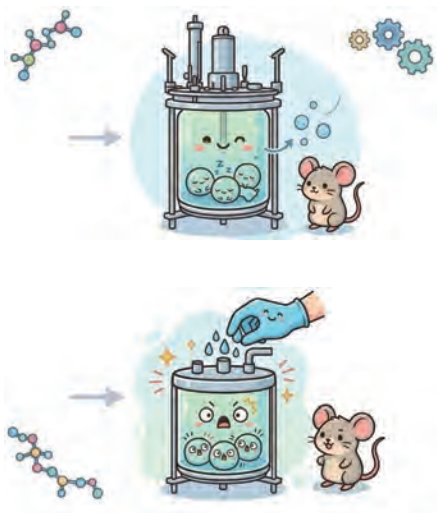
Customization Experience Sharing



03

Product Portfolio

Double jacketed dish bottom vessel



MS-3D-RM

3D Rotating Mixer with Adjustable Speed

Easy to operate

user-friendly operation



It's a perfect fit for the MO-MINI.

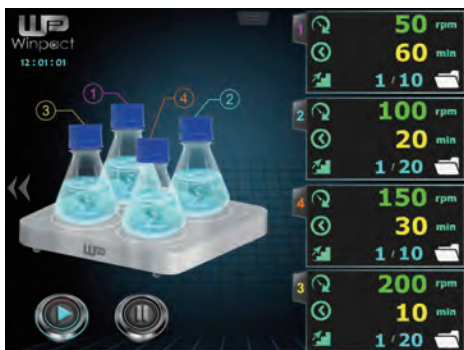
WP-SMS

New Tetrad Slow Speed Magnetic Stirrer

Full stainless steel

CO2 resistant design

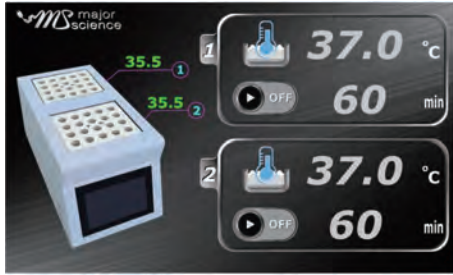
4 individual stirring controls



EL-01DT

New Elite Dry Bath Incubator Dual Unit

Independent dual temperature control



Equipped with alarm notifications



SWB-10LT

New Elite Dry Bath Incubator Dual Unit



Shelf Type Vacuum Freeze Dryer

Name	Shelf Type Vacuum Freeze Dryer
Shelf temperature range	-55°C to +50°C
Condenser temperature	-65°C to 75°C (depending on load)
CFC-free refrigerants	R507 / R508A
Cooling	Air-cooled
Inner chamber material	SUS304 stainless steel with mirror polishing
Tray size	500 × 340 × 30 mm , SUS304, 1.5 mm thickness
Tray number	3 flat trays
Vacuum system	Oil-free vacuum pump, 833 L/min
Vacuum (no-load)	8.0 × 10 ⁻³ Torr (≈ 1.07Pa)
control	PLC + HMI with temperature & vacuum control
Power	3Φ, AC220V/AC380V , 60Hz



Thank you



No. 156, Sec. 1, Guoji Rd., Taoyuan Dist., Taoyuan City 330041, Taiwan (R.O.C.)



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從基礎研究到生物製程的全方位實驗室設備 整合:PCR實驗流程示範



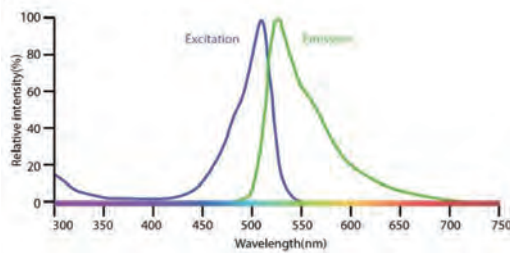
Presenter Name

染劑

	DNA Stains	Blue/Green LED	Blue LED	UV-Light	In-Gel	Poststaining	Direct
	MIDORI Green Advance (MG04)	✓	✓	✓	✓	✓	✗
	MIDORI Green Direct (MG06)	✓	✓	✓	✗	✗	✓
	MIDORI Green Xtra (MG10)	✓	✓	✓	✓	✓	✗
	MIDORI Green Easy (MG12)	✓	✓	✓	✓	✓	✗
	Major Red Plus (MRP-500)	✓	✓	✓	✓	✓	✓
	Compatible Compatible, but not recommended Not Compatible						

Major Red Plus 安全核酸染劑, MRP-500

- 無毒，無致突變性
- 對藍光搭配琥珀色濾光片以及紫外光搭配SYBR濾光片皆具有高靈敏度
- 耐高溫，適用於內染法的膠體鑄膠
- 高信噪比，背景雜訊低
- 使用方便，無需脫色處理
- 適用於瓊脂糖膠與聚丙烯醯胺膠（PAGE）



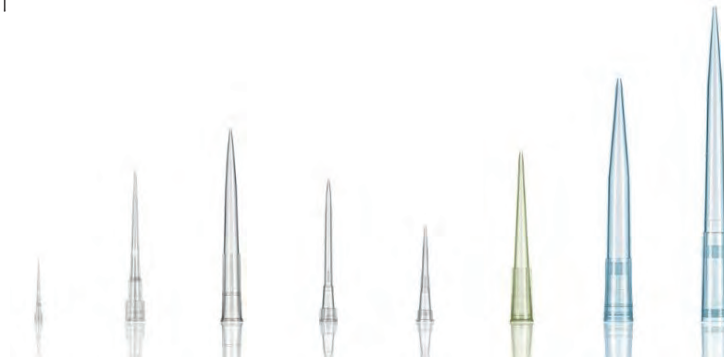
pipette

- 輕巧方便
- 軟彈簧系統輕壓即可準確收放液體
- 有多種顏色旋鈕方便快速辨識微量分注器的操作體積
- 指勾槽：抓握更輕鬆省力
- 三方位退吸頭，左右手皆適用
- 校正流程簡易內含校正工具
- 具高精準度
- 獨特序號編排：方便檢索出廠資料
- 可耐紫外光長時間照射
- 整支可以高壓滅菌 (121°C/0.1MPa/20分鐘)
- 擁有ISO認證。



tips

- 適用於市面上多種品牌移液器
- 操作準確性 內壁光滑設計
- 材質與安全性 原生級PP原料製造
- 污染防護 疏水性濾芯設計
- 耐溫範圍廣 -80°C ~ 121°C



電泳槽



ME7-7-10



ME15-7-10



ME15-7-10-15



ME20-10-20



ME26-16-24-32

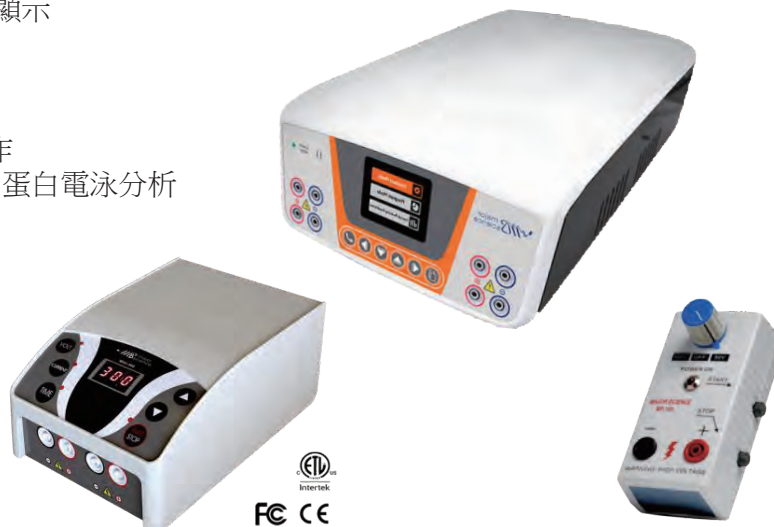
電泳槽

- 單一壓模：一體成形製膠台
- 透明安全上蓋具備通風孔避免水氣影響觀察
- 可耐130°C高溫
- 底部具備距離標線讓判斷與描述跑膠終止時間更加精確
- 鑄膠不需要膠帶，夾子或彈簧
- 電源裝置隔離不會有過熱影響
- 透明的槽體和上蓋
- 可使用MBE-300即時觀察核酸樣本移動狀況



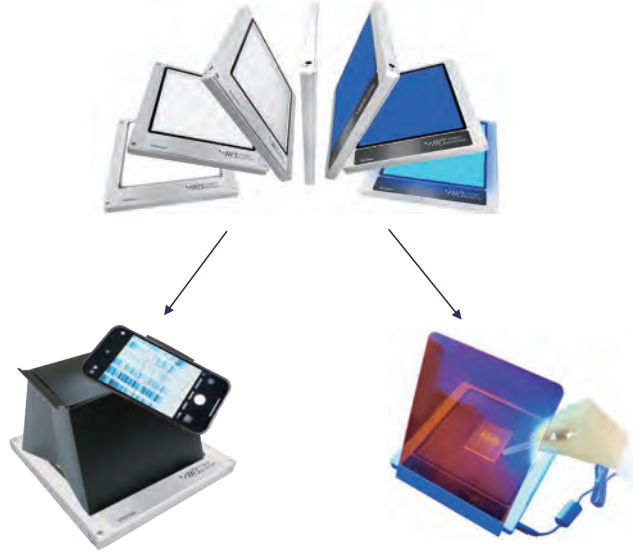
電源供應器

- 2.4吋彩色液晶螢幕實時顯示
- 具警報功能計時器
- 小巧體積可疊放
- 以定電流或定電壓操作
- 典型運作模式供新手操作
- 廣泛實驗室DNA，RNA和蛋白電泳分析及墨點法應用
- 先進的安全作業設計
- 全球通用之額定電壓
- 符合ETL 認證及CE 認證



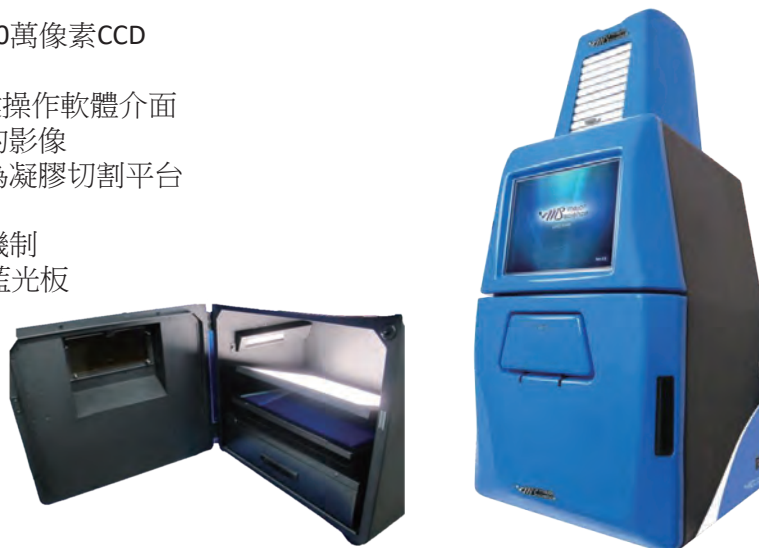
藍光

- 兩側整合不同LED光源
- 便於攜帶的尺寸且重量輕盈
- 安全的470nm藍光波長
- 可即時性觀察結果
- 可進行早期的錯誤檢測結果
- 高效且均勻的光源
- 鋁合金外殼設計
- 低熱傳
- 節能產品



影像系統

- 6倍變焦高品質單色200萬像素CCD
- 可換式濾光片
- 10.4吋彩色螢幕及內建操作軟體介面
- 變焦鏡頭以擷取最佳的影像
- 配有抽屜式燈箱可做為凝膠切割平台
- 提供UV保護罩選配
- 自動關閉紫外光保護機制
- 可選配白光和470 nm藍光板



發酵實驗



大型搖床

- 實驗室認證：內部空間溫度一致。
- 具有大型震盪平台，多樣的容器支架，以及矽膠止滑墊與各種配件可供選用，滿足使用者全方位的實驗需求。
- 系統過熱自動斷電保護機制。
- 擁有可調式高靈敏度水平偵測器，當平台非水平時會發出警告。
- 無刷DC馬達長效耐用，無須時常維護。
- 兩點溫度校正確保溫度的準確性。



大型搖床

- 10吋液晶顯示屏
- 最大容量：250毫升x50 / 500毫升x32 / 1000毫升x18 / 2000毫升x15
- 空氣循環：強制對流，內循環
- 計時：9999分鐘（或9999小時）
- 開門方式：上滑



培養箱

- 多功能性：結合了「精確控溫」與「多種振盪模式」（迴轉、擺動、往復）。
- 節省空間：多款設計具備輕巧尺寸或「可堆疊」特性，非常適合空間有限的實驗室。
 - 彈性配件：提供快速更換的轉輪裝置或配件，能適應微量盤、試管、雜交管等多種容器。



桌上型醱酵槽

- 多功能控制器：具備全彩人機介面 (HMI)，操作直覺，支援遠端監控與數據記錄。
- 多樣化槽體選擇：提供從 0.5 公升到 20 公升不等的玻璃槽體，且可根據需求更換葉片 (Impeller) 類型。
- 精密補料控制：內建蠕動幫浦，可精確控制酸、鹼、消泡劑與補料的添加。
- 高度相容性：支援市面上大多數標準的傳感器（如 pH、DO、溫度、消泡傳感器等）。



SIP

- 多種槽體可供選擇
- 全自動的遠距監控流程
- 支援15階段自動化發酵環境調節設定
- 以環狀方式焊接有效降低殘留物附著
- 採用醫療等級 SUS316L 不鏽鋼蜂巢式雙夾套設計提供卓越的溫度控能
- 配備安全閥當壓力超過臨界值時自動洩壓確保作業安全
- 整合多樣安全設計保護作業人員操作安全
- 附贈遠端監控及操控軟體



建廠

- 設計
- 監造
- 各類計劃書及規範
- 工程管理
- 現場施工
- 電力系統
- 空調系統
- 公用系統
- 中央監控系統
- 確校驗證
- 系統完整性驗證
- 潔淨室設備管線系統 製程設備工程



Thank you





Synthetic biology of 1,12 dodecanediol in engineered *E. coli*

台大生化科技系
李昆達

1

The Flourishing Isododecane Market and Growth Prospects Worldwide and also complete analysis of reports related to this market forecasted for period from 2023 - 2030

PRESS RELEASE

Published August 7, 2023

Prime PR Wire

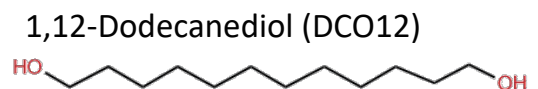
[More from Prime PR Wire](#)

1,12-Dodecanediol Market

The global 1,12-Dodecanediol market size is expected to reach \$1.5 billion by 2030, growing at a CAGR of 7.5% from 2023 to 2030.

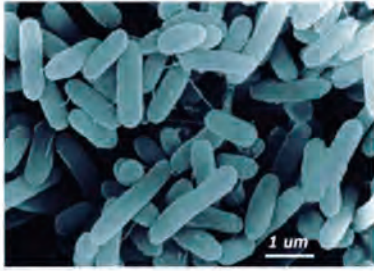
Executive Summary

The global market for 1,12-Dodecanediol is expected to witness significant growth in the coming years. This can be attributed to its extensive usage in various industries such as cosmetics, pharmaceuticals, and textiles. The market research reports suggest that the increasing demand for personal care products and cosmetics, especially in emerging economies, is a key driving factor for the market. Furthermore, technological advancements and the growing trend of using bio-based products are also boosting the market growth.



2

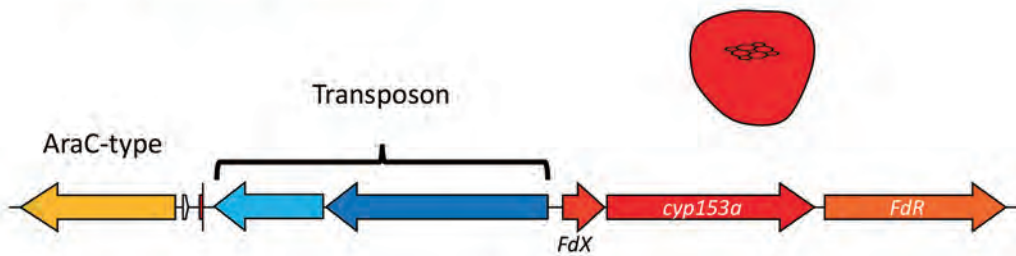
AlkR of *Marinobacter aquaeolei* VT8



M. aquaeolei VT8

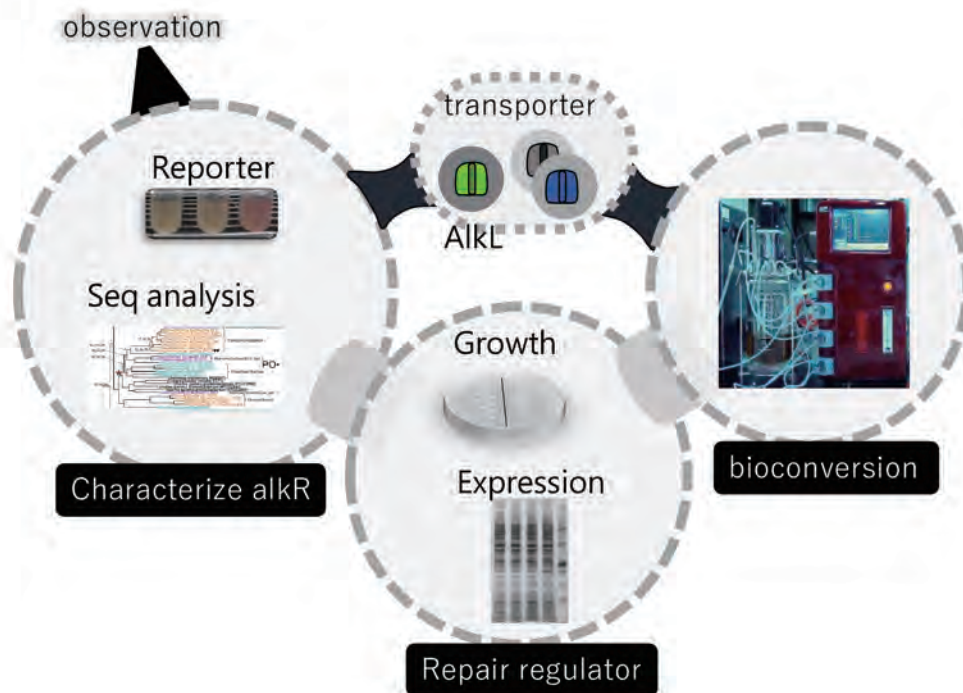
1999 Vietnamese oil-producing well

2011 whole genome sequenced



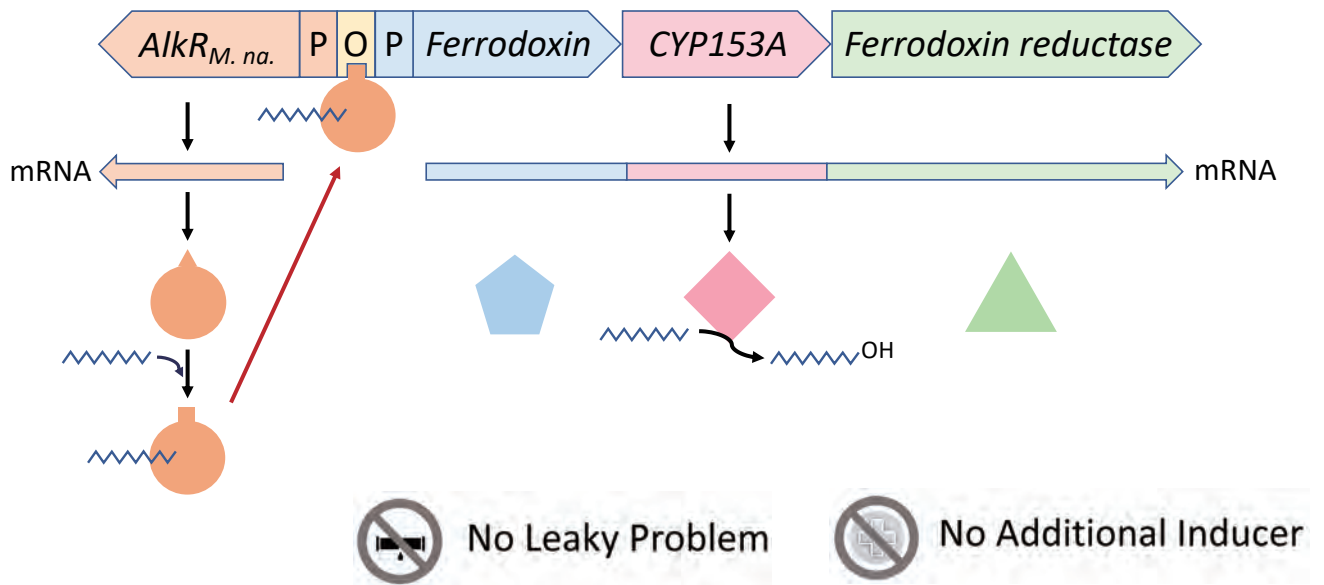
3

Summary



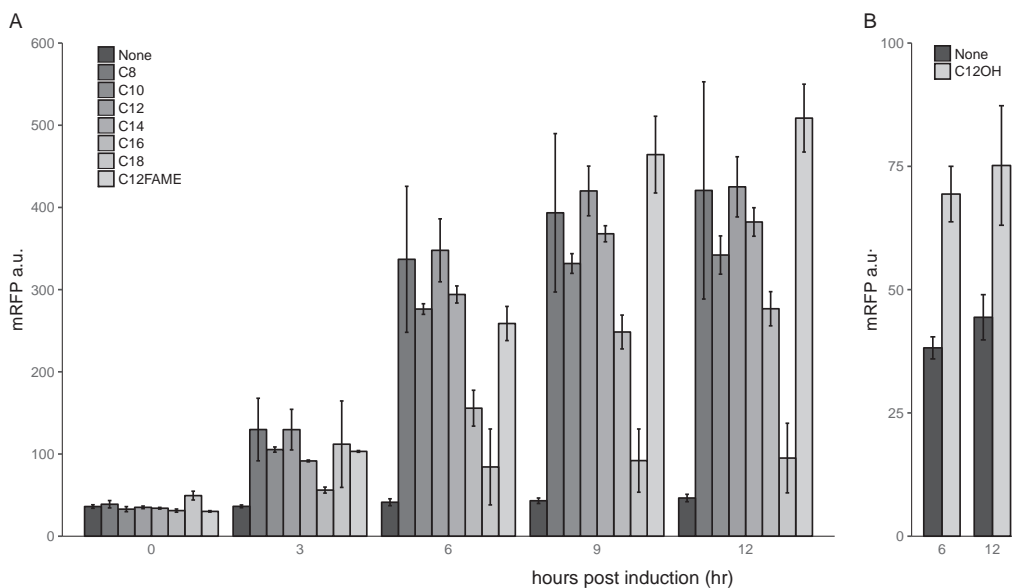
4

CYP153_{Ma.qu.} operon in synthetic *E.coli*



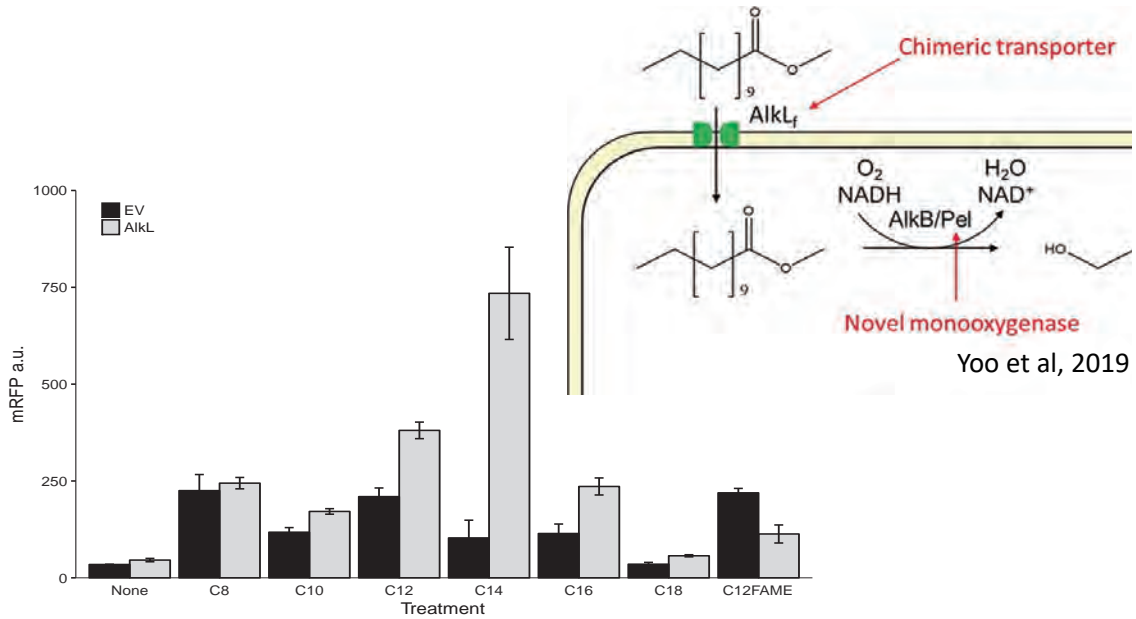
5

Alkane induction assay for CYP153A operon regulator AlkR

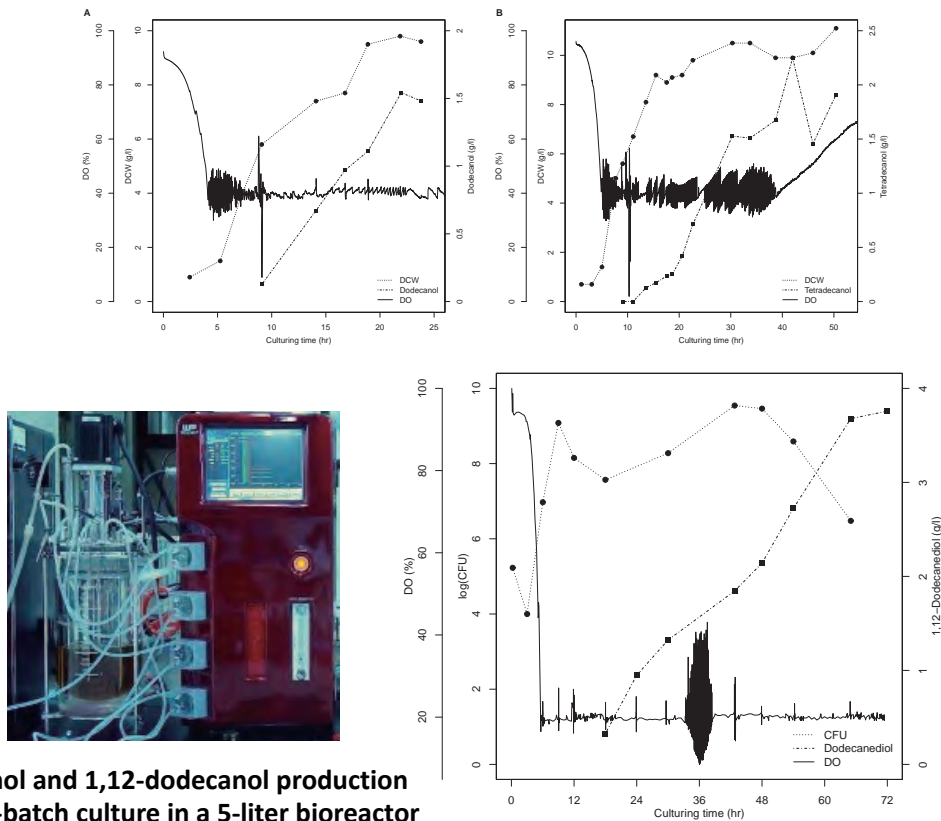


6

Co-expression of AlkL enhances induction of ability of alkanes



7



1-alkanol and 1,12-dodecanol production by Fed-batch culture in a 5-liter bioreactor

8



BIOTECHNOLOGY



Production of 1-Dodecanol, 1-Tetradecanol, and 1,12-Dodecanediol through Whole-Cell Biotransformation in *Escherichia coli*

Shan-Chi Hsieh,^a Jung-Hao Wang,^a Yu-Chen Lai,^a Ching-Yeuh Su,^a Kung-Ta Lee^a

^aDepartment of Biochemical Science and Technology, National Taiwan University, Taiwan, Republic of China

February 2018 Volume 84 Issue 4 e01806-17

9

US011162117B2

(12) **United States Patent**
Lee et al.

(10) **Patent No.:** US 11,162,117 B2
(45) **Date of Patent:** Nov. 2, 2021

(54) **WHOLE-CELL CATALYTIC SYSTEM AND APPLICATIONS THEREOF**

(71) Applicant: **National Taiwan University**, Taipei (TW)

(72) Inventors: **Kung-Ta Lee**, Taipei (TW); **Shan-Chi Hsieh**, Taipei (TW); **Ching-Yeuh Su**, Taipei (TW); **Yu-Chen Lai**, Taipei (TW)

(73) Assignee: **NATIONAL TAIWAN UNIVERSITY**, Taipei (TW)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 188 days.

(21) Appl. No.: **16/192,207**

(22) Filed: **Nov. 15, 2018**

coli, Feb. 2018, Applied and Environmental Microbiology vol. 84—Issue 4, pp. 01806-01817 (Year: 2018).*

Liang et. al. Regulation of the Alkane Hydroxylase CYP153 Gene in a Gram-Positive Alkane-Degrading Bacterium, *Dietzia* sp. Strain DQ12-45-1b, Jan. 2016, Applied and Environmental Microbiology, vol. 82—Issue 2, pp. 608-619 (Year: 2016).*

Genbank Accession No. CP000514 Jan. 2014 (Year: 2014).*

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發明

全 20 頁

【54】 名 稱： 蛋白質的用途及包含該蛋白質之全細胞催化系統及其應用

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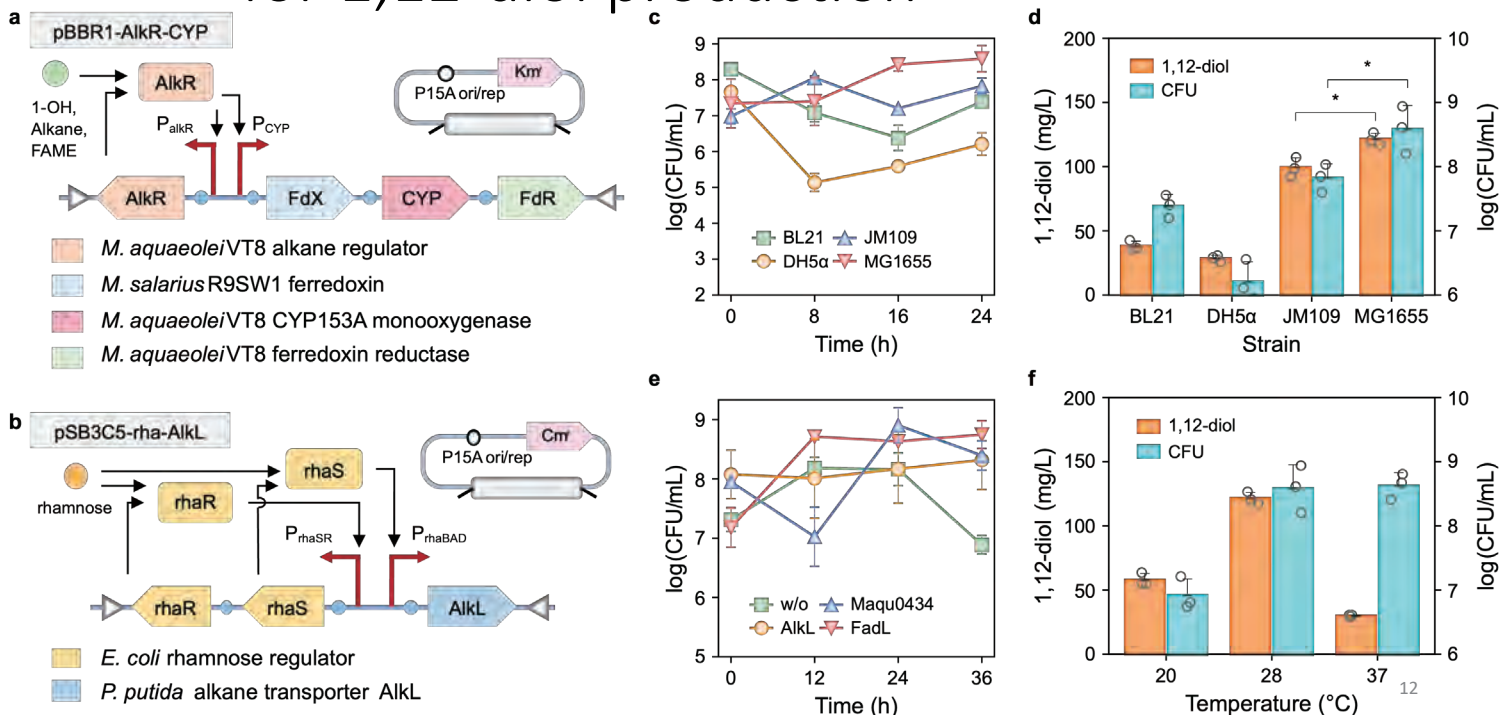
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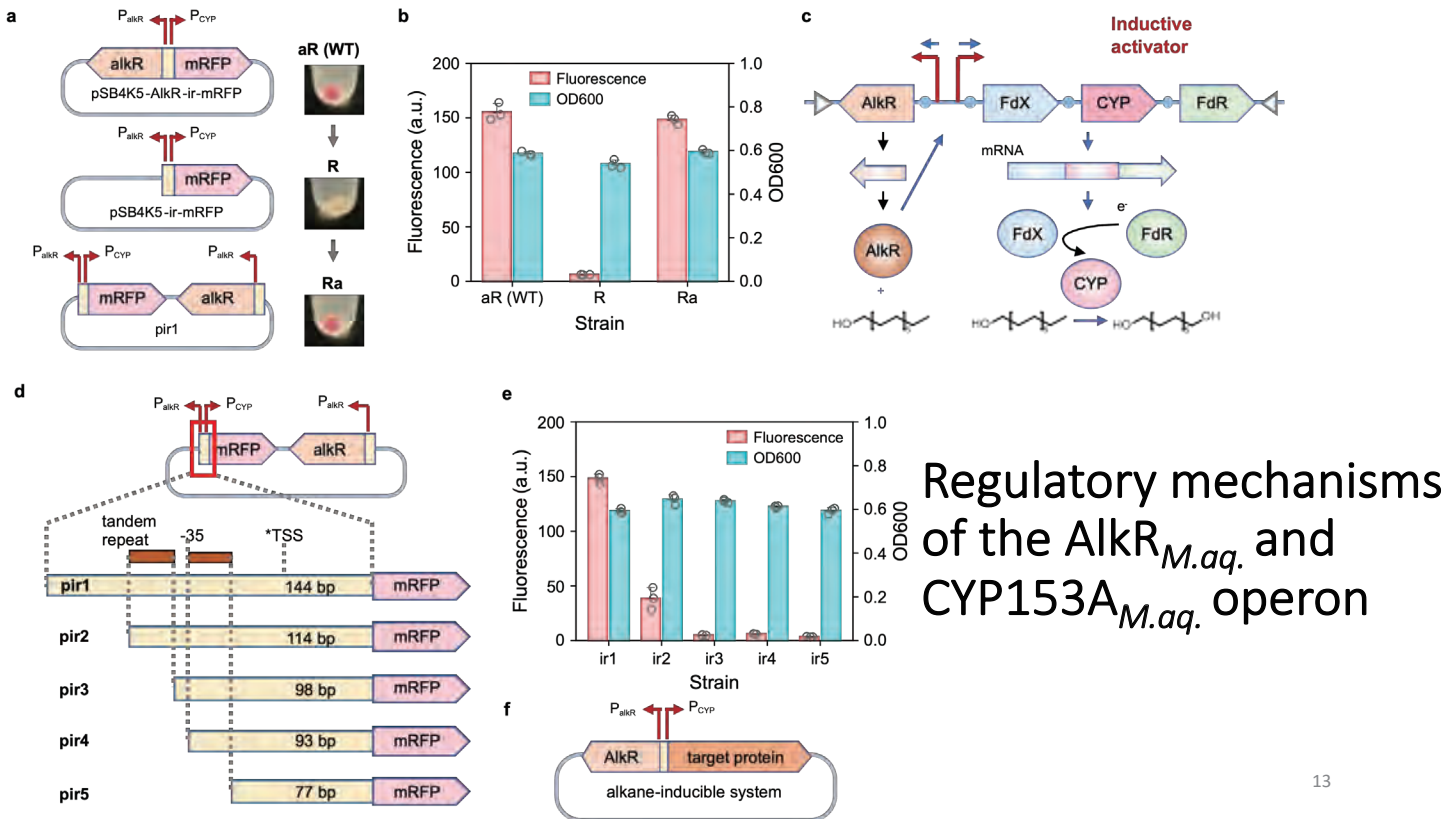
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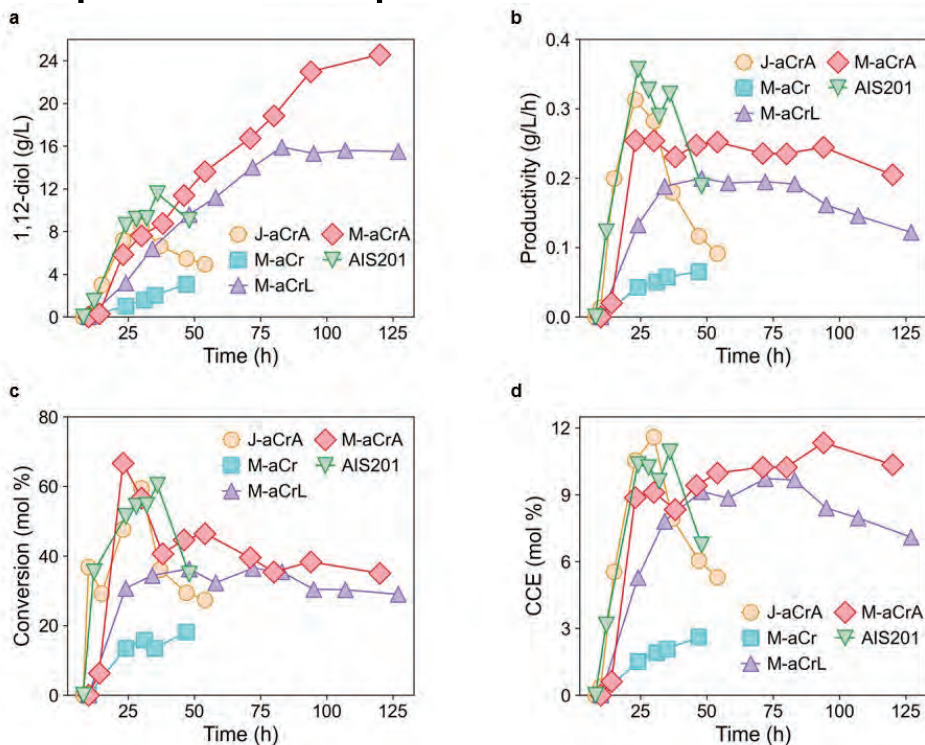
Strain construction, culture optimization for 1,12-diol production



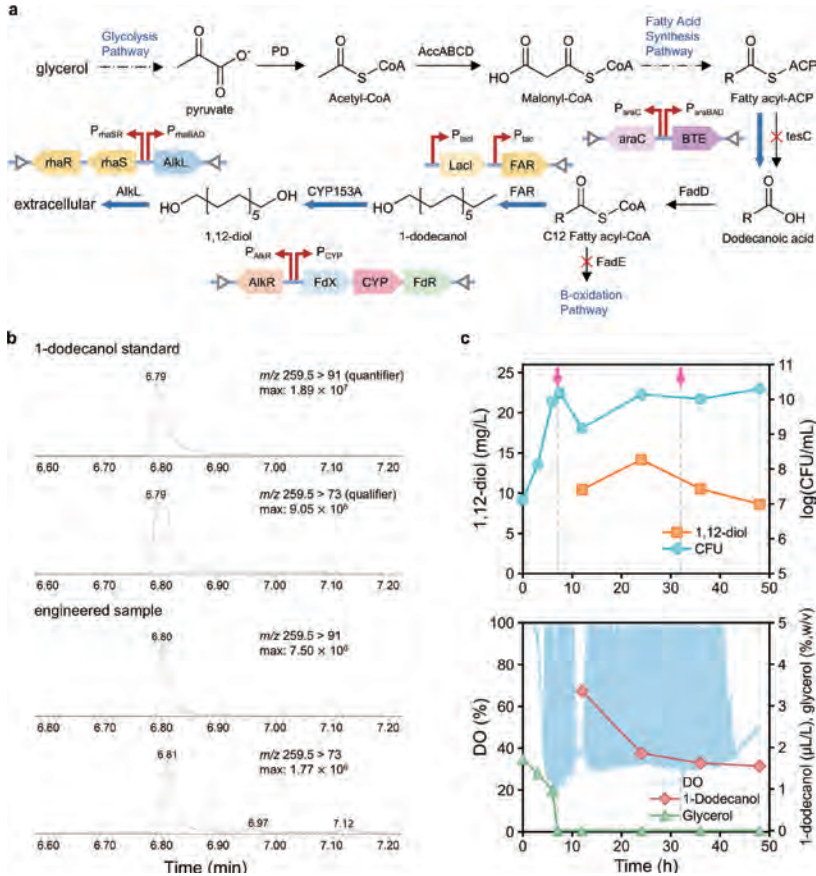


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1,12-diol production parameters in different bioreactors



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Extending the system to de novo 1,12-diol biosynthesis from glycerol

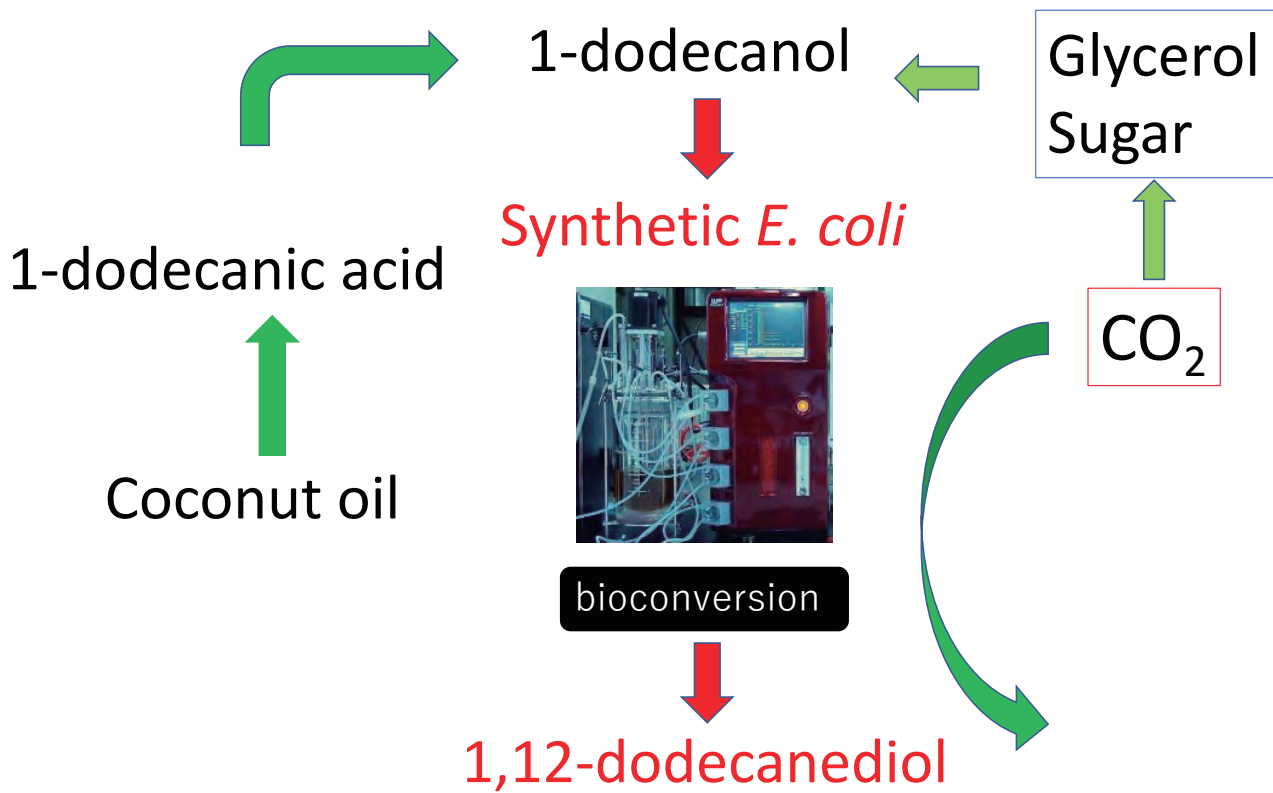


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1,12-Diol production using biocatalytic processes

Host <i>E. coli</i> strain	Overexpressed proteins	Inducer	Culture	Substrate	1,12-Diol titer (g/L)	Year
BL21	CYP153, FdX, FdR (<i>Acinetobacter</i> sp. OC4)	lactose ^a	RCC ^b 1.5 mL, 24 h	1-dodecanol	0.079	2006
in vitro reaction	CYP153A16 (<i>Mycobacterium marinum</i>), CamA, CamB (<i>P. putida</i> ATCC17453)	0.1 mM IPTG	in vitro reaction 0.5 mL, 4 h	1-dodecanol	0.009	2011
BW25113 (DE3) Δ fadD	strain 1: CYP153A33 (<i>M. aquaeolei</i>), CamA, CamB (<i>P. putida</i>) strain 2: CAR (<i>Mycobacterium marinum</i>), SFP, GDH (<i>B. subtilis</i>)	strain 1: 0.01 mM IPTG strain 2: 0.1 mM IPTG	2-step process, RCC (300 g _{CDW} /L) strain 1: 10 mL; 24 h 0.5 mM 5-ALA strain 2: 10 mL; 13 h	dodecanoic acid	1.40	2020
JM109	CYP153A, FdR (<i>M. aquaeolei</i> VT8), FdX (<i>M. salarius</i> R9SW1), AlkL (<i>P. putida</i>)	0.01% (w/v) rhamnose	fed-batch culture 1.5 L, 68 h	dodecane, 1-dodecanol	3.76	2022
BW25113 (DE3) Δ fadD	strain 1: CYP153A33 (<i>M. aquaeolei</i>), CamA, CamB (<i>P. putida</i>) strain 2: CAR (<i>Mycobacterium marinum</i>), SFP, GDH (<i>B. subtilis</i>)	strain 1: 0.01 mM IPTG strain 2: 0.1 mM IPTG	2-step process, RCC (300 g _{CDW} /L) strain 1: 10 mL; 24 h 0.5 mM 5-ALA strain 2: 10 mL; 13 h	dodecanoic acid	1.40	2017
BW25113 (DE3) Δ fadD	strain 1: AlkB (<i>P. pelagia</i>), AlkG, AlkT (<i>P. putida</i>) strain 2: CAR (<i>Mycobacterium marinum</i>), SFP (<i>B. subtilis</i>)	0.05 mM IPTG	2-strain coculture requiring intermediate steps (18 g _{CDW} /L for strain 1, 9 g _{CDW} /L for strain 2) 40 mL, 48 h	dodecanoic acid methyl ester	5.46	2022
<i>C. tropicalis</i> Δ pox4 Δ pox5 and <i>E. coli</i> BW25113 (DE3)	Yeast: CYP52A19, CPRb, FAO (<i>C. tropicalis</i>) <i>E. coli</i> : CAR (<i>Mycobacterium abscessus</i>), SPF (<i>B. subtilis</i>)	Yeast: glucose <i>E. coli</i> : 15 g/L galactose	Yeast: fed-batch culture 1.5 L, 102 h <i>E. coli</i> : fed-batch culture 1.5 L, 96 h	dodecane to 1,12-DDA then to 1,12-diol	68.0	2025
JM109	CYP153A, FdR (<i>M. aquaeolei</i> VT8), FdX (<i>M. salarius</i> R9SW1), AlkL (<i>P. putida</i>)	0.01% rhamnose	fed-batch culture 1.5 L, 68 h	dodecane, 1-dodecanol	3.76	2018
MG1655	CYP153A, FdR (<i>M. aquaeolei</i> VT8), FdX (<i>M. salarius</i> R9SW1), AlkL (<i>P. putida</i>)	0.01% rhamnose	fed-batch culture 1.5 L, 120 h	1-dodecanol	24.56	This study
MG1655	CYP153A, FdR (<i>M. aquaeolei</i> VT8), FdX (<i>M. salarius</i> R9SW1), FadL (<i>E. coli</i>)	0.01% rhamnose	fed-batch culture 1.5 L, 83 h	1-dodecanol	15.90	
MG1655	CYP153A, FdR (<i>M. aquaeolei</i> VT8), FdX (<i>M. salarius</i> R9SW1), AlkL (<i>P. putida</i>)	—	fed-batch culture 1.5 L, 36 h	1-dodecanol	11.56	
MG1655 Δ tesCAFadE	BTE (<i>U. californica</i>), afFAR, CYP153A, FdR (<i>M. aquaeolei</i> VT8), FdX (<i>M. salarius</i> R9SW1), AlkL (<i>P. putida</i>)	—	fed-batch culture 1.5 L, 24 h	—	0.014	

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- 孫浚豪 碩士班在學
- 陳克祺 碩士班在學





Application of ultrasound in the fermentation process with lactic acid bacteria

超音波在乳酸菌發酵過程中之應用

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Ultrasound

- Ultrasound is defined as **sound above the frequency of 20 kHz**, which human beings cannot hear.
- The effect of **ultrasonic irradiation** is to produce the cavitation in liquids to assist the progress of chemical reactions.
- 超音波是屬於最簡單、最安全的非熱加工技術的一種。
- 是較安全與無毒的技術，應用於食品工業和生物技術之製程中常有顯著的促進效果。
- 是屬於對環境友善的「綠色技術」。

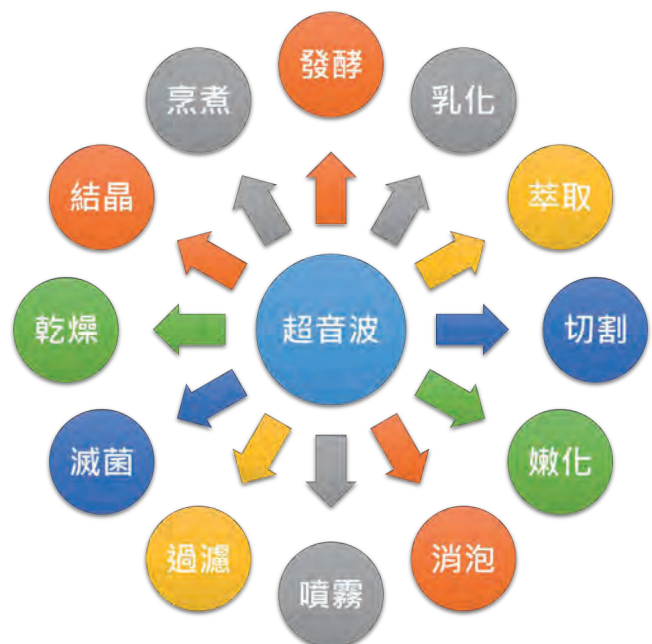
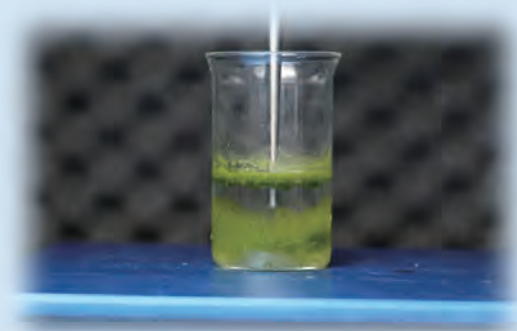


Fig. 1. 超音波在食品科學上之應用 (Yang, 2017)

Types of ultrasound

Ultrasonic Bath

- ✓ Transducer at bottom or side position of bath.
- ✓ Reaction vessel fixed at some positions in bath.



Ultrasonic Probe/ Horn

- ✓ Direct delivery of ultrasonic energy to liquid reactant through immersible horn.
- ✓ Concentrated energy delivery.

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Types of ultrasound

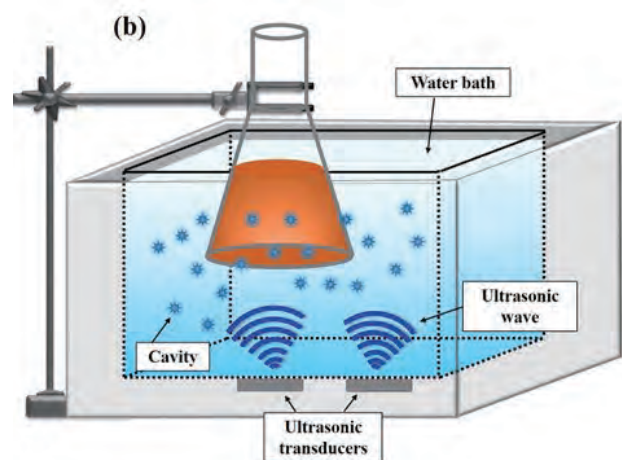
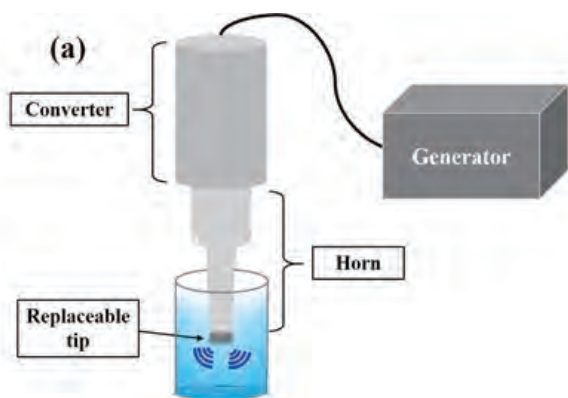


Fig. 2. The types of ultrasonic equipment: (a) ultrasonic probe/ horn; (b) ultrasonic bath

(Yang, 2017)

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Comparison between ultrasonic probe and ultrasonic bath

超音波	探針式 (Probe)	槽式 (Bath)
設備構造	用探針頭 (horn或 probe) 作為超音波產生器	超音波振盪子位於超音波槽體的側面或底部
操作方式	將超音波探針直接置入液體反應物中進行超音波作用	反應容器需固定在超音波槽體的某些位置
頻率	通常為20 kHz	20 kHz – 120 kHz
優點	(1) 集中的能量輸送 (2) 高功率輸出	(1) 低成本 (2) 商業化
缺點	(1) 探針頭易損壞 (2) 反應溫度控制不易	(1) 需要額外的機械攪拌 (2) 超音波強度分散
應用	將微生物菌體表面破壞用以取得酵素 粉碎堅固的固體物質	(1) 清洗金屬片與容器 (2) 簡單的化學反應 (3) 粉碎堅固的固體物質

(Yang, 2017)

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Cavitation of ultrasound

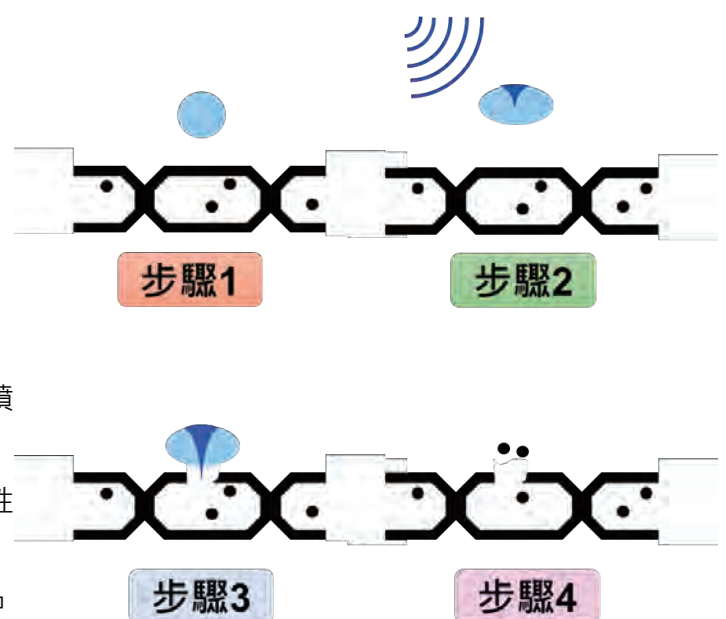
- Cavitation (空穴效應)
- Cavitation microstreaming (空穴化微流)
- Hot-spot (局部熱點)
- 空穴效應作用機制：

[步驟 1] 超音波在基質的表面附近產生空泡

[步驟 2] 空泡崩塌並釋放出具壓力和高溫的微噴流朝向基質表面

[步驟 3] 基質表面細胞壁破裂並使細胞內的活性成分與外部溶劑直接接觸

[步驟 4] 釋放活性成分並將其輸送到萃取溶劑中



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Application of Ultrasound in Microbial Fermentation

- Fermentation: one of the oldest methods of food preservation and preparation.
- Definition of "food fermentation": referring to the decomposition of carbohydrates in anaerobic and aerobic environments. This process involves the use of enzymes and microorganisms to transform complex organic compounds into simpler ones.
- **Application of ultrasound on biological effects:**
 - a) 「 **Inactivation effect (失活效應)** 」 on microbial cells
 - b) 「 **Proliferation effect (增殖效應)** 」 on microbial cells
 - c) Effect on enzyme activity

Application of Ultrasound in Microbial Fermentation

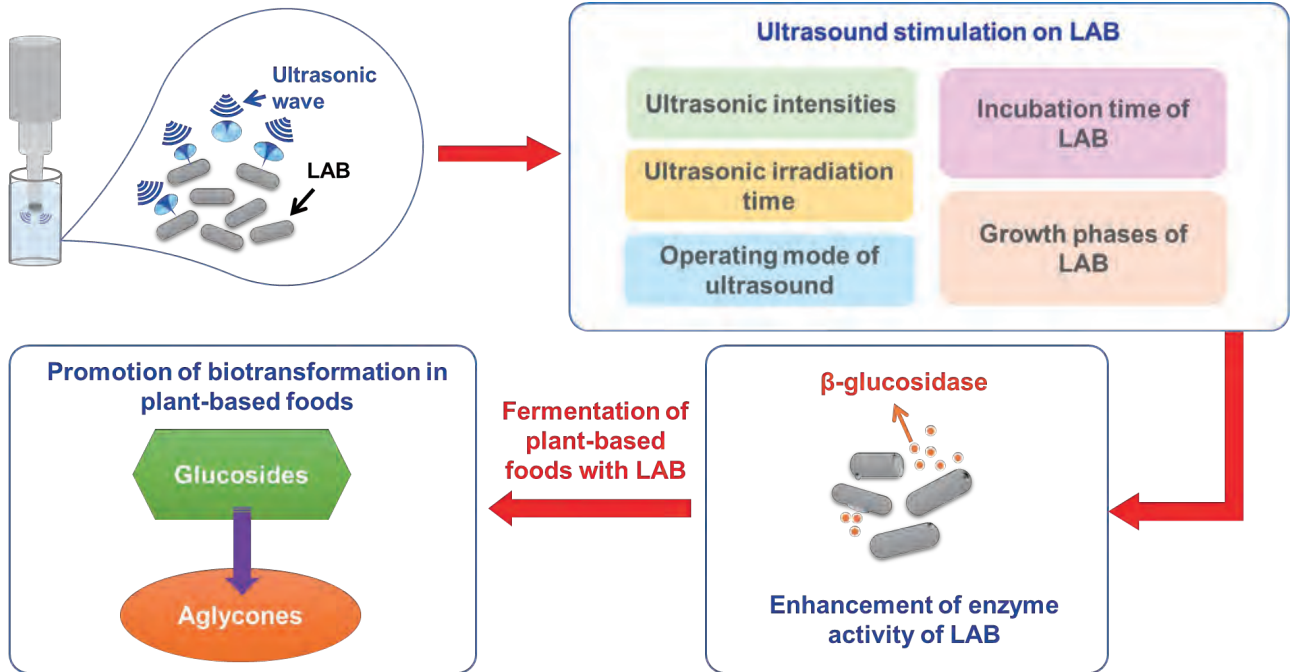
"Inactivation effect" on microbial cells

- Microbes have a hydrophobic surface, which will promote the rupture of bubbles on the surface (cavitation effect), leading to severe damage to the cell wall.
- Microjets can cause erosion of the cell wall, further leading to microbial inactivation.

"Proliferation effect" on microbial cells

- Ultrasound enhances the permeability of cell membranes, accelerates mass transfer and promotes cell growth and reproduction
- Ultrasound provides effects on cellular composition, functionality, and genetics to accelerate the proliferation of microorganisms

Strategic ultrasound-induced stress response of LAB



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Application of ultrasound in the fermentation of soymilk with LAB

UT-12 : bacteria incubated for 12 h then sonicated

UT-24 : bacteria incubated for 24 h then sonicated

UT-36 : bacteria incubated for 36 h then sonicated

C-12 : bacteria incubated for 12 h

C-24 : bacteria incubated for 24 h

C-36 : bacteria incubated for 36 h

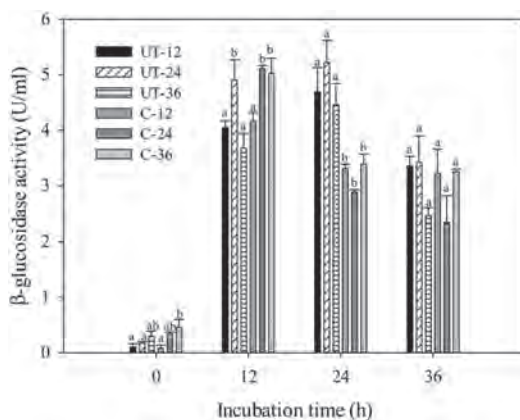


Fig. 3. Effect of incubation time on β -glucosidase activity of *L. acidophilus* BCRC 10695. Ultrasound conditions: amplitude setting at 20%, 20 kHz, 2 min, 37 °C. Each value is expressed as mean \pm S.E. (n=3). Means with different letters within the same group are significantly different at $p < 0.05$.

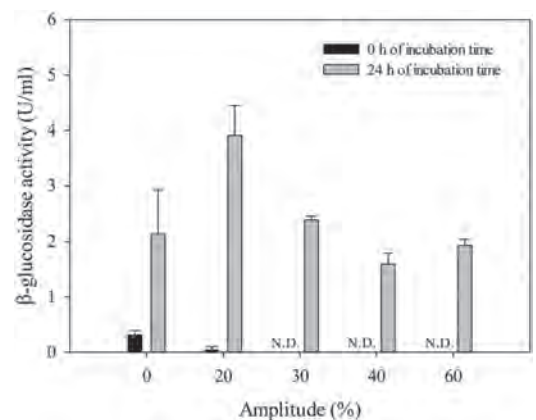


Fig. 4. Effects of different amplitudes of ultrasound treatment (2 min) on β -glucosidase activity of *L. acidophilus* BCRC 10695. Each value is expressed as mean \pm S.E. (n=3). Means with different letters within the same group are significantly different at $p < 0.05$. N.D.: none detected.

(Liu et al., 2018)

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Application of ultrasound in the fermentation of soymilk with LAB

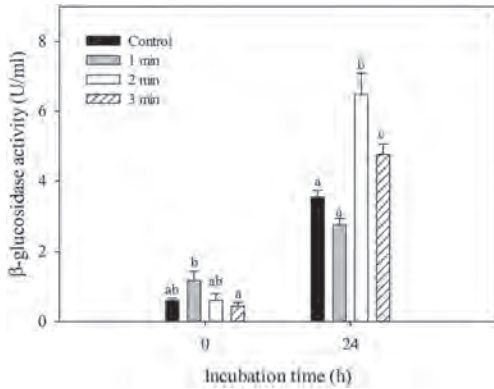


Fig. 5. Effect of irradiation time of ultrasound (amplitude setting at 20%) on β -glucosidase activity of *L. acidophilus* BCRC 10695. Each value is expressed as mean \pm S.E. (n=3). Means with different letters within the same group are significantly different at $p < 0.05$.

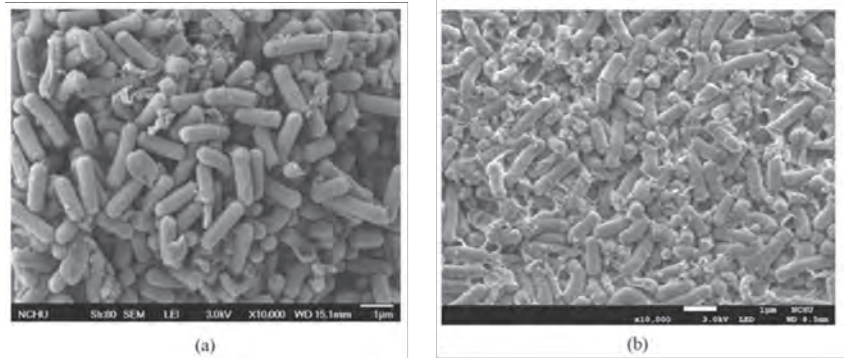


Fig. 6. FESEM images for surface morphology of *L. acidophilus* BCRC 10695: (a) bacteria without ultrasonic treatment, (b) bacteria treated with ultrasound (amplitude setting at 20%, 2 min).

(Liu et al., 2018)

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Application of ultrasound in the fermentation of okara with LAB

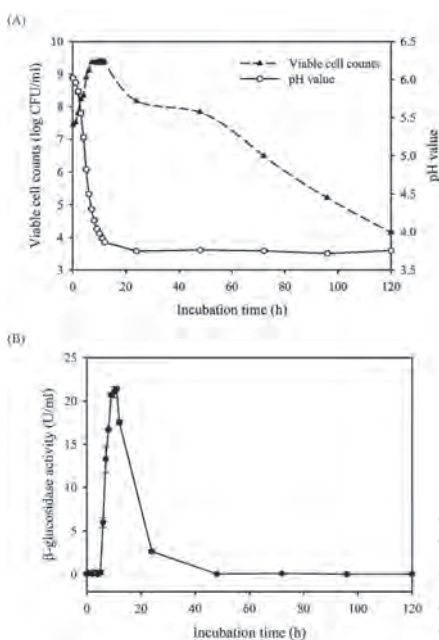


Fig. 7. Variations of (A) viable cell counts and pH values, and (B) β -glucosidase activity of *L. plantarum* BCRC 10357 incubated in MRS broth at 37 °C for 120 h. Data were expressed as mean \pm standard deviations from triplicate experiments.

Table 1 Effect of ultrasound treatment with different intensities and durations on viable cell counts of *L. plantarum* BCRC 10357 in MRS broth after incubation at 37 °C for 48 h.

Incubation time (h)	Ultrasound amplitude (%)	Viable cell counts (log CFU/ml)		
		1 min	2 min	3 min
0		Control : 7.26 \pm 0.00 ^a		
	20	7.08 \pm 0.02 ^b	6.85 \pm 0.05 ^c	6.76 \pm 0.02 ^d
	40	7.00 \pm 0.01 ^b	6.58 \pm 0.06 ^c	6.41 \pm 0.04 ^d
12	60	6.72 \pm 0.10 ^d	6.11 \pm 0.05 ^e	5.83 \pm 0.07 ^b
		Control : 9.41 \pm 0.06 ^a		
	20	9.38 \pm 0.05 ^a	9.43 \pm 0.04 ^a	9.43 \pm 0.04 ^a
24	40	9.46 \pm 0.06 ^a	9.41 \pm 0.03 ^a	9.36 \pm 0.01 ^a
	60	9.43 \pm 0.06 ^a	8.51 \pm 0.08 ^b	8.32 \pm 0.12 ^c
		Control : 9.18 \pm 0.06 ^b		
36	20	9.18 \pm 0.04 ^b	9.48 \pm 0.07 ^a	9.46 \pm 0.04 ^a
	40	9.43 \pm 0.02 ^a	9.45 \pm 0.04 ^a	9.43 \pm 0.03 ^a
	60	9.49 \pm 0.02 ^a	9.49 \pm 0.04 ^a	9.49 \pm 0.01 ^a
48		Control : 8.28 \pm 0.04 ^b		
	20	8.00 \pm 0.08 ^{bc}	8.26 \pm 0.01 ^{bc}	8.30 \pm 0.13 ^b
	40	7.92 \pm 0.08 ^c	8.23 \pm 0.10 ^{bc}	8.36 \pm 0.02 ^b
	60	8.15 \pm 0.02 ^{cd}	8.28 \pm 0.11 ^b	8.60 \pm 0.06 ^c
		Control : 7.71 \pm 0.08 ^c		
	20	7.08 \pm 0.12 ^d	7.96 \pm 0.03 ^{ab}	7.92 \pm 0.02 ^{ab}
	40	6.92 \pm 0.10 ^e	7.83 \pm 0.04 ^{bc}	7.94 \pm 0.05 ^{ab}
	60	7.72 \pm 0.10 ^c	7.91 \pm 0.15 ^b	8.08 \pm 0.13 ^a

Data were expressed as mean \pm standard deviations from triplicate experiments. Different superscript letters at the same time were significantly different ($p < 0.05$) by Duncan's test. (Peng et al., 2018)

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Application of ultrasound in the fermentation of okara with LAB

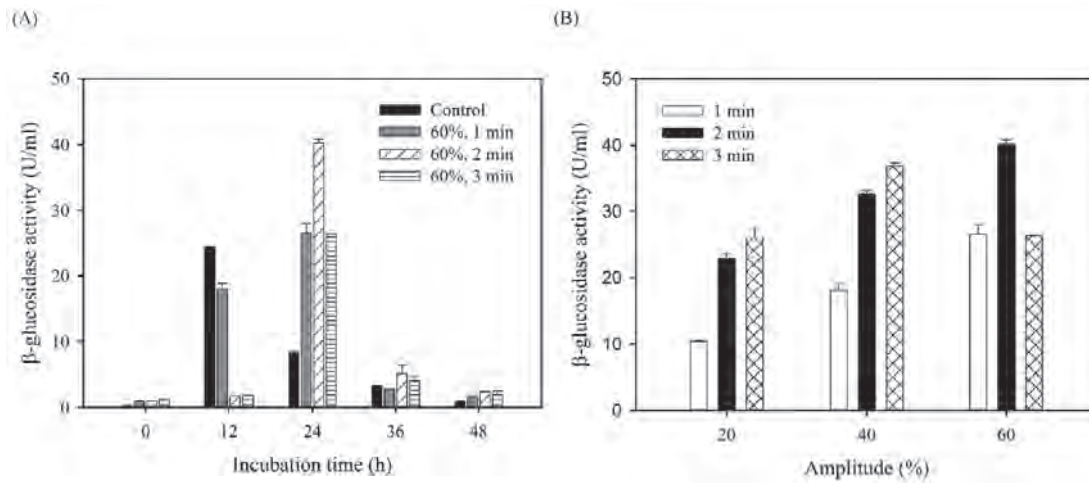


Fig. 8. Comparison of β -glucosidase activity of *L. plantarum* BCRC 10357 for 24 h of incubation at 37 °C with ultrasound at various amplitudes and durations: (A) sonication at 60 % amplitude for various incubation times; (B) sonication at various amplitudes and durations. Control group: without ultrasound treatment. Data were expressed as mean \pm standard deviations from triplicate experiments.

(Peng et. al., 2018)

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Application of ultrasound in the fermentation of okara with LAB

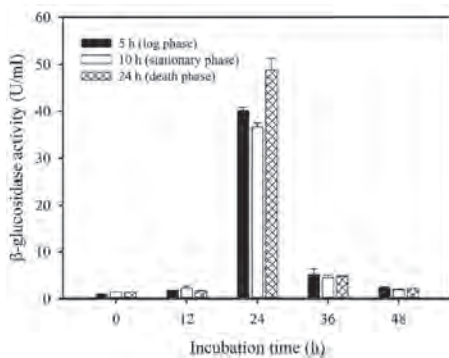


Fig. 9. Comparison of β -glucosidase activity of *L. plantarum* BCRC 10357 for 48 h of incubation at 37 °C after ultrasonic stimulation (60 % amplitude, 2 min) on various growth phases. Data were expressed as mean \pm standard deviations from triplicate experiments.

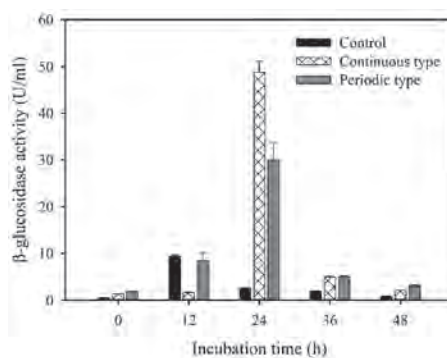


Fig. 10. Effect of operating mode of ultrasound (60 % amplitude, 2 min) on β -glucosidase activity of *L. plantarum* BCRC 10357 at 37 °C for 48 h of incubation. Data were expressed as mean \pm standard deviations from triplicate

- **Continuous type:** run for 2 min
- **Periodic type:** run for 1 min, stopped for 1 min, and run for 1 min

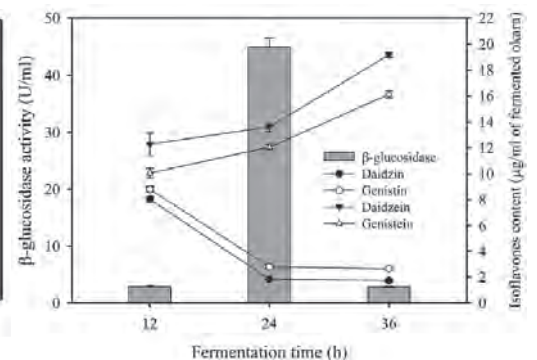


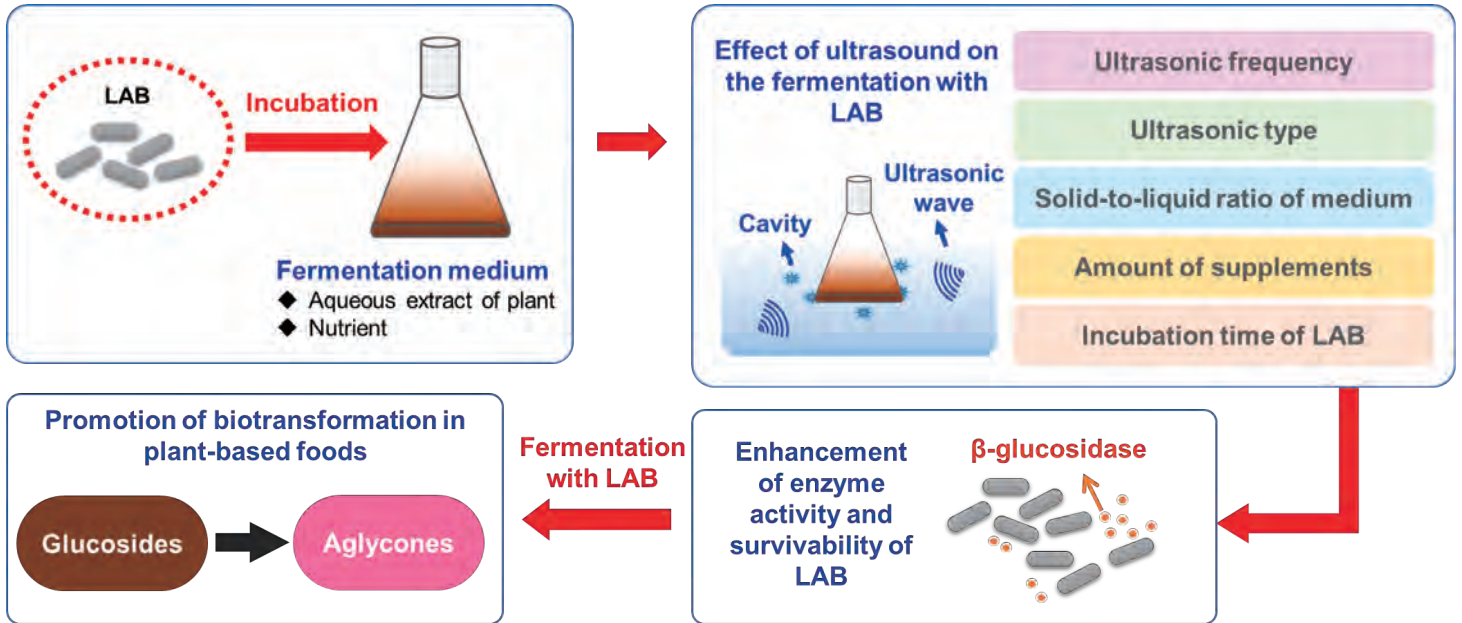
Fig. 11. The contents of isoflavones and β -glucosidase activity during fermentation by *L. plantarum* BCRC 10357 after ultrasonic stimulation at 60 % amplitude for 2 min with 3 % okara in MRS broth at 37 °C. Data were expressed as mean \pm standard deviations from triplicate experiments.

(Peng et. al., 2018)

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Impact of ultrasonic stress on the fermentation process



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Application of ultrasound in the fermentation of burdock roots with LAB

Table 2. Effect of solid-to-liquid ratio on the ultrasound-assisted extraction of fructose and glucose from dried burdock-root powder (BP) using water as the solvent^a.

Solid-to-liquid ratio (g-BP/mL-water)	Fructose (mg/g-BE)	Glucose (mg/g-BE)
1:10	14.47 ± 1.64 ^b	4.24 ± 0.21 ^b
1:20	15.65 ± 0.76 ^b	4.67 ± 0.20 ^a
1:30	27.51 ± 1.09 ^a	4.93 ± 0.08 ^a
1:40	26.03 ± 1.10 ^a	4.75 ± 0.27 ^a

Different superscript letters at the same column indicated significant differences ($p < 0.05$) by Duncan's multiple range test.

^a Conditions: 40 kHz/300 W of ultrasound, 10 min of extraction time, 50 °C. BE: dried aqueous extract of burdock-root. Data were expressed as mean ± standard deviations ($n = 3$).

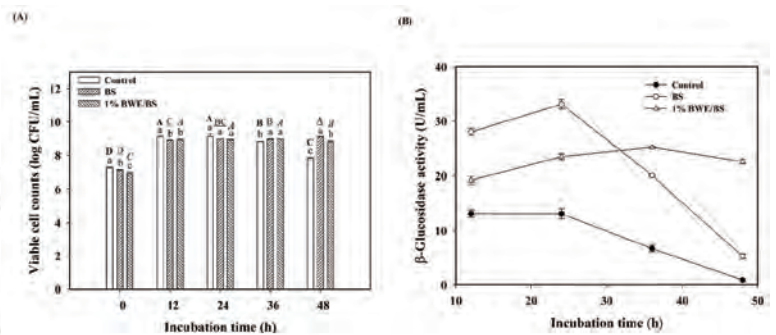


Fig. 12. Effect of various types of culture medium on (A) viable cell counts, and (B) β -glucosidase activity of *L. plantarum* FEL112 incubated at 37 °C for 48 h. BS: black soymilk; BWE: dried aqueous extract of burdock-root with U40 for 10-min; 1% BWE/BS: 1% BWE added in black soymilk (BS) (w/v); Control: MRS medium. Data were expressed as mean ± standard deviations ($n = 3$). Different lowercase letters at the same incubation time and different uppercase (bold, underline, or italic) letters at the same medium indicated significant differences ($p < 0.05$) by Duncan's multiple range test.

(Su et al., 2023)

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Application of ultrasound in the fermentation of burdock roots with LAB

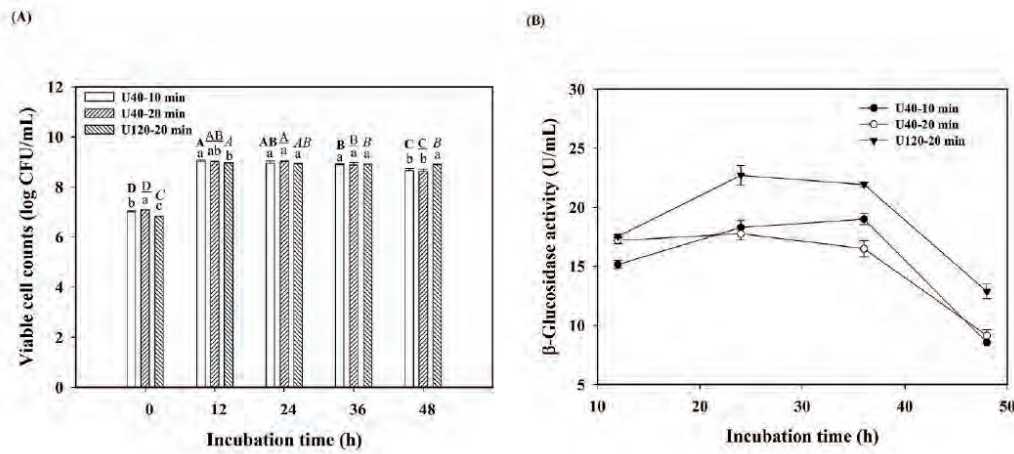


Fig. 13. Effect of ultrasonic treatment on (A) viable cell counts, and (B) β -glucosidase activity of *L. plantarum* FEL112 incubated at 37 °C for 48 h using 1% BWE/BS. BWE: dried aqueous extract of burdock-root with U40 for 10-min; 1% BWE/BS: 1% BWE added in black soymilk (BS) (w/v); Uy-t min: using 1% BWE/BS medium with y-kHz ultrasonic (U) treatment for t min after inoculation of the bacteria. Data were expressed as mean \pm standard deviations ($n = 3$). Different lowercase letters at the same incubation time and different uppercase (bold, underline, or italic) letters at the same ultrasonic treatment indicated significant differences ($p < 0.05$) by Duncan's multiple range test.

(Su et al., 2023)

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Application of ultrasound in the fermentation of burdock roots with LAB

Table 3. Profile of isoflavones in the fermented product using 1% BWE/BS as the medium fermented by *L. plantarum* FEL112 without or with ultrasonic treatment^a.

Ultrasonic treatment	Isoflavones ($\mu\text{g/g-FP}$)				AI/TI (%)
	Daidzin	Genistin	Daidzein	Genistein	
None	40.01 \pm 4.08 ^a	34.56 \pm 0.45 ^a	131.18 \pm 0.66 ^a	80.44 \pm 0.27 ^a	73.95
	U40-10 min	23.65 \pm 2.62 ^b	29.93 \pm 1.28 ^b	133.95 \pm 4.88 ^a	
U40-20 min	22.93 \pm 1.96 ^b	25.60 \pm 1.55 ^c	126.99 \pm 7.82 ^a	82.91 \pm 5.38 ^a	81.22
	U120-20 min	25.00 \pm 3.63 ^b	25.61 \pm 0.94 ^c	131.80 \pm 4.01 ^a	

BWE: dried aqueous extract of burdock-root with U40 for 10-min; FP: dried fermented product; 1% BWE/BS: 1% BWE added in black soymilk (BS) (w/v); Uy-t min: using 1% BWE/BS medium with y-kHz ultrasonic (U) treatment for t min after inoculation of the bacteria; AI = daidzein + genistein; TI = daidzin + genistin + daidzein + genistein. Data were expressed as mean \pm standard deviation ($n = 3$). Different superscript letters at the same column indicated significant difference ($p < 0.05$) by Duncan's multiple range test.

^a Conditions: 37 °C, 48 h of fermentation time.

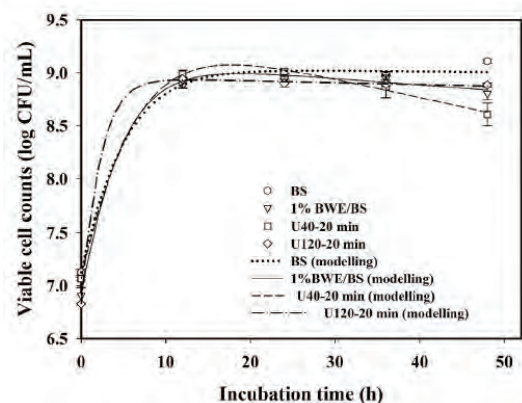


Fig. 14. Plot for the modelling of viable cell counts of *L. plantarum* FEL112 for different growth conditions. BS: black soymilk medium; BWE: dried aqueous extract of burdock-root with U40 for 10-min; 1% BWE/BS: 1% BWE added in BS (w/v); Uy-t min: using 1% BWE/BS medium with y-kHz ultrasonic (U) treatment for t min after inoculation of the bacteria. Symbol: experimental data; line: modelling results.

(Su et al., 2023)

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Application of ultrasound in the fermentation of burdock roots with LAB

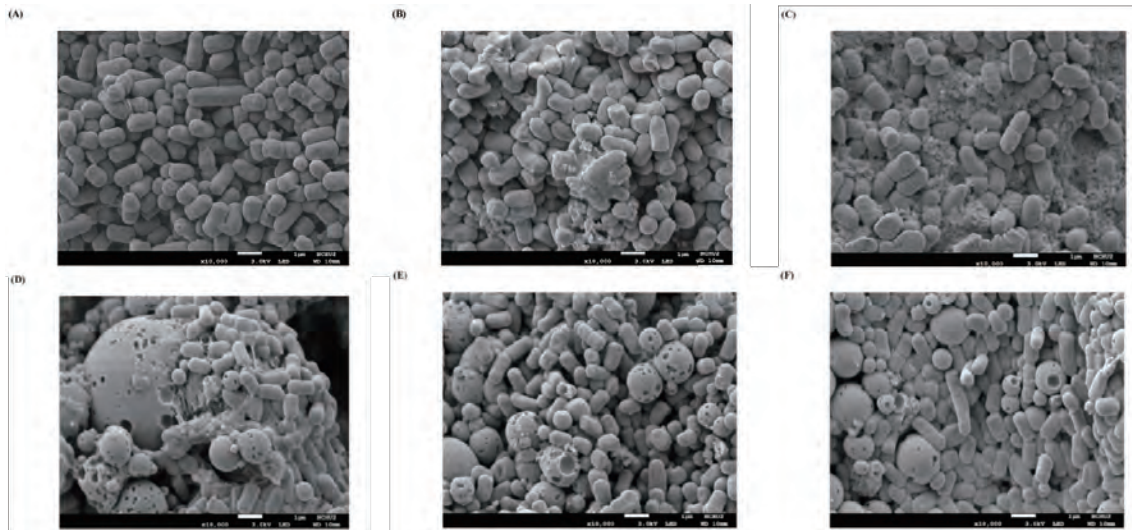


Fig. 15. FE-SEM images of the morphological structures of *L. plantarum* FEL112 incubated at 37 °C for 24 h without or with BWE (dried aqueous extract of burdock root with U40 for 10-min) in the medium and ultrasonic treatment: (A) MRS; (B) 1% BWE in MRS; (C) 7% BWE in MRS; (D) 1% BWE in black soymilk (BS); (E) 1% BWE in BS with 40 kHz/300 W of ultrasonic treatment for 20 min (U40-20 min); (F) 1% BWE in BS with 120 kHz/300 W of ultrasonic treatment for 20 min (U120-20 min).

(Su et. al., 2023)

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Application of ultrasound in the fermentation of black soybean okara & choline chloride with LAB

Oka (no US): the Oka medium without ultrasonic treatment

Oka-US-L: the Oka medium with ultrasonic treatment at 30°C for 20 min before inoculation

Oka-US: the Oka medium with ultrasonic treatment at 60°C for 3 h before inoculation

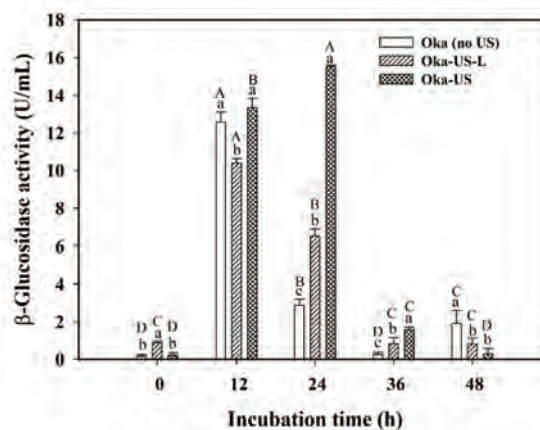


Fig. 16. Variations in β -glucosidase activity of *L. plantarum* BCRC 10357 incubated at 37 °C for 48 h using different conditions of ultrasonic treatment (40 kHz/300 W) for the medium of MRS with 3% black soybean okara (Oka). Data were expressed as mean \pm standard deviation with triplicate experiments ($n = 3$). Different superscript lowercase letters at the same incubation time and different superscript uppercase letters at the same conditions with or without ultrasonic treatment were significantly different ($p < 0.05$) by Duncan's multiple range test.

(Wu and Yang., 2023)

CY Yang, FJCUFS

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Application of ultrasound in the fermentation of black soybean okara & choline chloride with LAB

Oka-US: the Oka medium with ultrasonic treatment (40 kHz/300 W) at 60 °C for 3 h before inoculation

x%ChCl-US: the Oka medium combined with x % ChCl using ultrasonic treatment (40 kHz/300 W) at 60 °C for 3 h before inoculation.

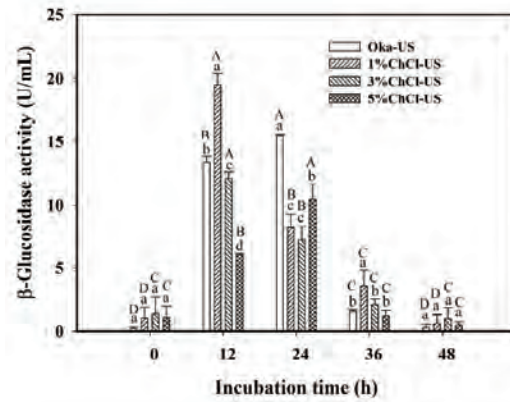


Fig. 17. Effect of different amounts of choline chloride (ChCl) added to the medium of MRS with 3% black soybean okara (Oka) on the β -glucosidase activity of *L. plantarum* BCRC10357 incubated at 37 °C for 48 h. Data were expressed as mean \pm standard deviation (n = 3). Different superscript lowercase letters at the same incubation time and different superscript uppercase letters at the same amounts of ChCl were significantly different ($p < 0.05$) by Duncan's multiple range test.

(Wu and Yang., 2023)

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Application of ultrasound in the fermentation of black soybean okara & choline chloride with LAB

1%ChCl (no US): the Oka medium combined with 1% choline chloride (ChCl) without ultrasonic treatment

1%ChCl-US: the Oka medium with ultrasonic treatment (40 kHz/300 W) at 60 °C for 3 h before inoculation

1%ChCl-USP: the medium of 1%ChCl-US using *L. plantarum* BCRC 10357 that had been pretreated with an ultrasound probe (20 kHz/200 W) at 60% amplitude and 25 °C for 2 min

Oka: the medium of MRS with 3% black soybean okara

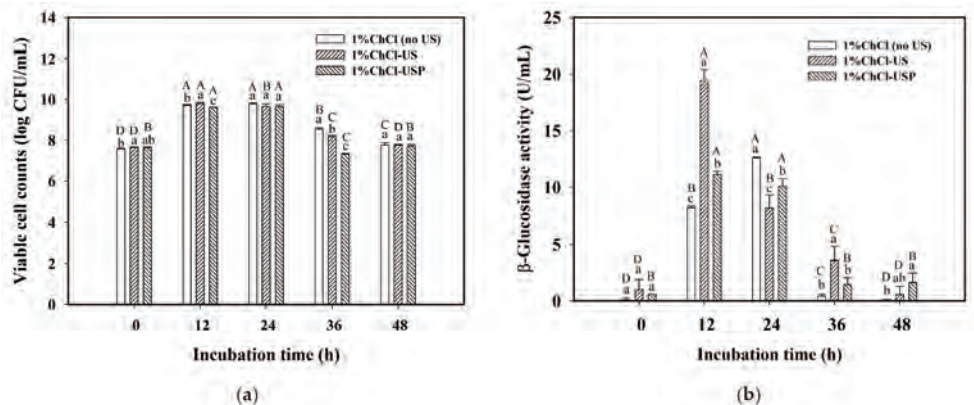


Fig. 18. Effect of various modes of ultrasonic treatment on (a) viable cell counts; (b) β -glucosidase activity of *L. plantarum* BCRC 10357 incubated at 37 °C for 48 h. Data were expressed as mean \pm standard deviation with triplicate experiments (n = 3). Different superscript lowercase letters at the same incubation time and different superscript uppercase letters at the same modes of ultrasonic treatment were significantly different ($p < 0.05$) by Duncan's multiple range test.

(Wu and Yang., 2023)

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Application of ultrasound in the fermentation of black soybean okara & choline chloride with LAB

Oka-US: the Oka medium with ultrasonic treatment (40 kHz/300 W) at 60 °C for 3 h before inoculation

1%ChCl (no US): the Oka medium combined with 1% ChCl without ultrasonic treatment

x%ChCl-US: the Oka medium combined with x% ChCl using ultrasonic treatment (40 kHz/300 W) at 60 °C for 3 h before inoculation

1%ChCl-USP: the medium of 1%ChCl-US inoculated with *L. plantarum* BCRC 10357 pretreated with ultrasound probe (20 kHz/200 W) at 25 °C for 2 min

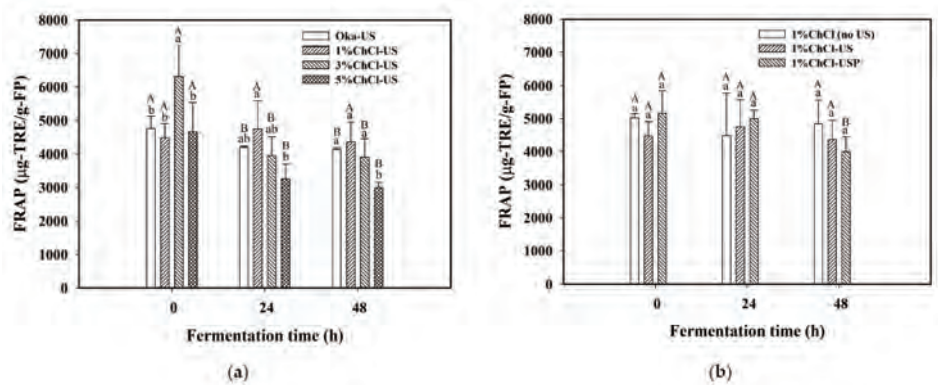


Fig. 19. Variations in ferric-reducing antioxidant power (FRAP) in the dried fermented product (FP) at 0, 24, and 48 h of fermentation time for the effects of (a) amount of choline chloride (ChCl) added to the Oka medium and (b) mode of ultrasonic treatment on the medium or on *L. plantarum* BCRC 10357. Data were expressed as mean \pm standard deviation (n = 3). Different superscript lowercase letters at the same fermentation time and different superscript uppercase letters at the same amounts of ChCl for (a) or at the same modes of ultrasonic treatment for (b) were significantly different (p < 0.05) by Duncan's multiple range test.

(Wu and Yang., 2023)

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23

Application of ultrasound in the fermentation of black soybean okara & choline chloride with LAB

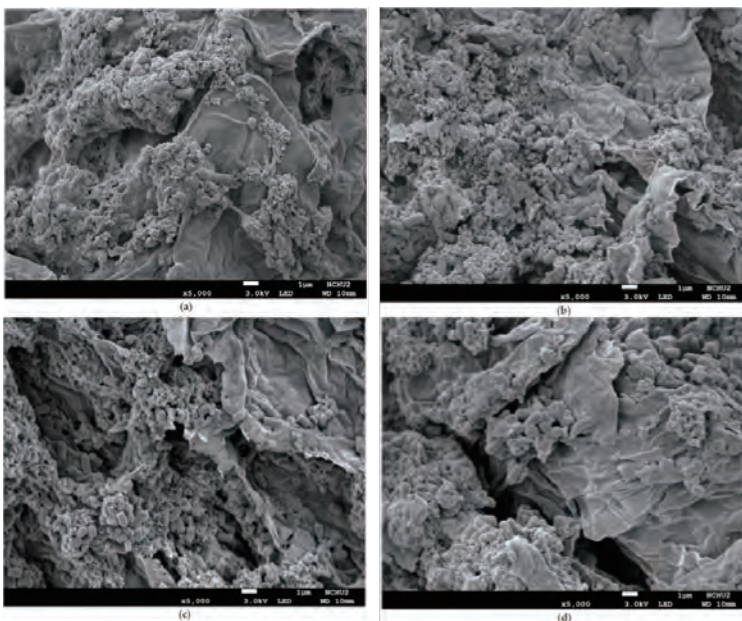


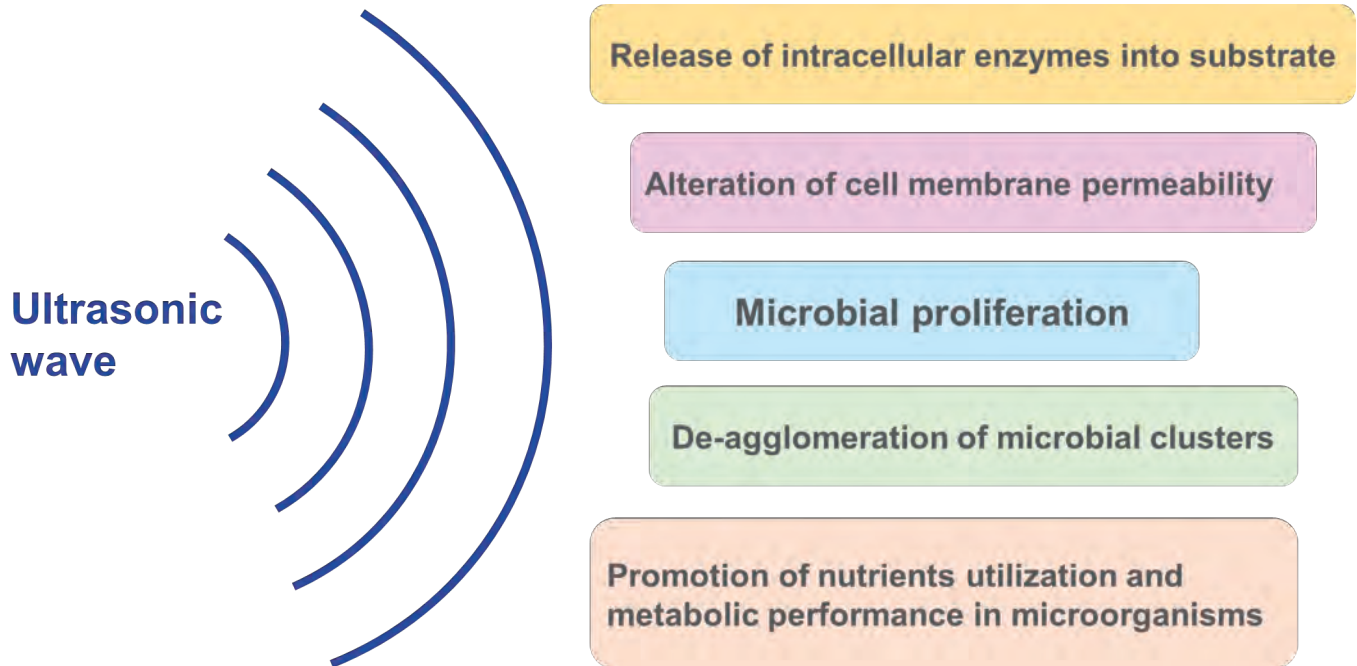
Fig. 20. FE-SEM images of the solids separated from the medium in 12 h with *L. plantarum* BCRC 10357: (a) Oka-US; (b) 1%ChCl (no US); (c) 1%ChCl-US; (d) 1%ChCl-USP. Oka: the medium of MRS combined with 3% black soybean okara; Oka-US: the Oka medium with ultrasonic treatment (40 kHz/300 W) at 60 °C for 3 h before inoculation; 1%ChCl (no US): the Oka medium combined with 1% choline chloride (ChCl) without ultrasonic treatment; 1%ChCl-US: the Oka medium combined with 1% ChCl using ultrasonic treatment (40 kHz/300 W) at 60 °C for 3 h before inoculation; 1%ChCl-USP: the medium of 1%ChCl-US using *L. plantarum* BCRC 10357 that had been pretreated with an ultrasound probe (20 kHz/200 W) at 25 °C for 2 min.

(Wu and Yang., 2023)

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Mechanisms of ultrasonic stimulation on microorganisms



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Conclusion

- Ultrasonic waves are **non-toxic**, safe, and environmentally friendly.
- It involves lower running cost, ease of operation, and efficient power output, and it does not need sophisticated machinery and wide range of technologies.
- A limited strength of nutrient and ultrasonic stresses would be beneficial to enhance the survivability of lactic acid bacteria.
- It has gained huge applications in the food industry such as processing, fermentation, extraction, emulsification, preservation, homogenization, etc.



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Reference

- Chia-Min Wu, **Chun-Yao Yang***, 2023. Impacts of Ultrasonic Treatment for Black Soybean Okara Culture Medium Containing Choline Chloride on the β -Glucosidase Activity of *Lactiplantibacillus plantarum* BCRC 10357. *Foods*, 12(20), 3781.
- Jing-Yi Su, Yuan Chen, **Chun-Yao Yang***, 2023. Impact of nutrient from aqueous extract of burdock roots and ultrasonic stress on the growth and β -glucosidase activity of *Lactiplantibacillus plantarum* FEL112. *LWT-Food Science and Technology*, 175, 114495.
- Hui-Tzu Peng, **Chun-Yao Yang***, Tony J. Fang, 2018. Enhanced β -glucosidase activity of *Lactobacillus plantarum* by a strategic ultrasound treatment for biotransformation of isoflavones. *Food Science and Technology Research*, 24 (5), 777-784.
- Wen-Sin Liu, **Chun-Yao Yang***, Tony J. Fang, 2018. Strategic ultrasound-induced stress response of lactic acid bacteria on enhancement of β -glucosidase activity for bioconversion of isoflavones in soymilk. *Journal of Microbiological Methods*, 148, 145-150.
- **Chun-Yao Yang***, 2017. Application of Non-thermal Ultrasonic Technology in Food Extraction and Fermentation. *Journal of Agriculture and Forestry*, 65(3): 125 – 136.

Thanks for your attention

2026年第六屆發酵技術研討會

微生物發酵技術的各種應用

生技製程自動化
- 機器手臂在發酵與食品產業的革新應用場合 -

時機允晟股份有限公司 邱志雄 總經理

(2026/03/19 @ 台大食品科技館)

1

生技、發酵與食品產業的現狀與挑戰

- 製程痛點：高重複性、繁瑣或重負荷的搬運、取樣、分裝與篩選。
- 人力風險：操作人員疲勞導致的失誤或污染風險。
- 法規要求：嚴格的 GMP/ISO 追蹤追溯紀錄需求與追溯性。
- 核心思維：從「人力操作」轉向「數位自動化」。

機器手臂的核心優勢

- 精準度 (Precision)：輕盈或重型物件搬運精度的一致性。
- 耐受性 (Durability)：24/7 不間斷運作，處理重複、無聊且容易出錯的工序。
- 無菌性 (Sterility)：減少人員進入潔淨室，降低外源微生物污染機率。
- 數位化 (Data Logging)：自動記錄動作參數，完美對接 AI 分析。

2

食品加工應用

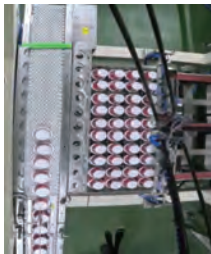
堆棧



卸棧



排/卸盤



裝盒/裝箱



特殊充填



搬運



開箱

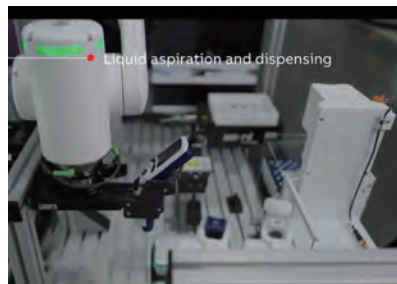


搬運

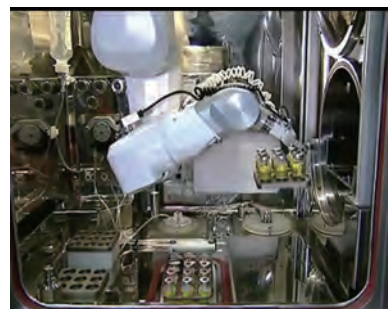


其他生技應用

LAB automation

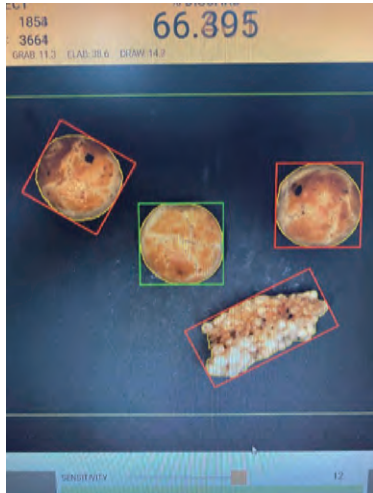


藥劑調配



未來趨勢

- 協作機器人 (Cobots)：安全地與工作人員在同一工作空間協作。
- AI 整合：視覺/力量感測器結合 AI，擷取老師傅經驗，自我學習，品質與品管趨近人類



評估指標	人工操作 (Manual)	機器手臂自動化 (Robotic)	改進效益
連續工作時間	8 小時 (需休息)	24 小時 (全年無休)	300% 產能提升
菌種篩選通量	約 200–500 樣本/日	3,000–10,000 樣本/日	>15 倍效率
移液精準度 (CV%)	2.0% – 5.0%	< 0.5%	極高的一致性
污染風險 (人為)	高 (皮膚、呼吸、觸碰)	極低 (封閉系統/減少人員進入)	顯著降低批次失敗率
數據紀錄	手動紀錄 (易漏、易錯)	自動數位化掛鉤 (LIMS)	100% 可追溯性

領域	應用場景	機器手臂具體任務	核心好處
發酵工程	上游菌種開發	高通量挑選菌落、培養基優化配比	縮短研發週期 (R&D)
生技製藥	疫苗/抗體生產	自動化取樣監測、精準調配合填	符合 GMP 嚴格合規性
食品工業	發酵食品加工	產品翻動、搬運	解決惡劣環境缺工問題
品管檢驗	外觀、物性檢驗	自動化搬運	節省人力減少人為錯誤

項目	傳統生產線 (人工為主)	自動化生產線 (手臂輔助)
初期投資成本	低	高 (設備採購與系統整合)
長期營運成本 (OPEX)	高 (薪資、勞保、訓練)	低 (電力、定期保養)
錯誤成本	難以估計 (單次污染損失數百萬)	極低 (製程高度受控)
回收週期 (Payback)	N/A	約 18–30 個月 (視規模而定)

在 2026 年的今天，我們追求的不再只是『實驗成功』，而是『每一次實驗都像影印一樣精準可複製』。

關於『法規與數據完整性 (Data Integrity)』：當機器手臂在無菌環境中完成每一個動作，系統會同步生成電子紀錄，這完全符合 CFR Part 11 或食品追蹤追溯等法規要求。我們不需要再擔心漏填紀錄或筆誤，因為每一個動作、每一次移動，都是可追蹤、不可篡改的數位足跡。

總結來說，在實驗室、製造工廠導入機器手臂，不只是節省了繁瑣的工作，更是一場關於『品質保證』的升級。它讓我們的操作人員能從繁重、無趣、長時間的操作中解放，轉而投入更具價值的數據分析與製程優化。」

感謝聆聽
敬請指導

Cellometer X2 高倍率自動化計數器 專為酵母菌和細菌設計

Billy Cheng | Product supervisor

Mar 19, 2026



Nexcelom-Revvity致力於細胞定量方法的研究和參與相關標準的建立

- Since 2003
- Nexcelom創始人兼CTO Dr. Jean Qiu是ISO美國技術專家委員會成員
- 和美國計量院 (NIST) 合作開發基於成像原理細胞計數和活率分析的控制策略和標準
- 合作發表了多篇同行評議文章以及組織多場研討會
- Nexcelom獨立發表了約60篇細胞計數相關文獻，是這一研究領域的重要貢獻者之一



釀酒工業品管 Brew beer

“ Our new Cellometer X2 has **cut the time we spend** on cell counts drastically, freeing up time for much more. The transition was very easy, the **software is a piece of cake** to learn and the support is excellent!”
-美國威斯布魯克釀酒公司

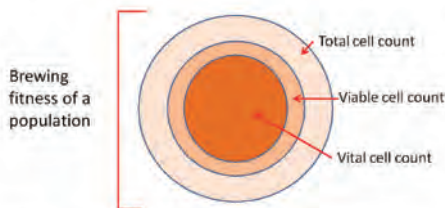
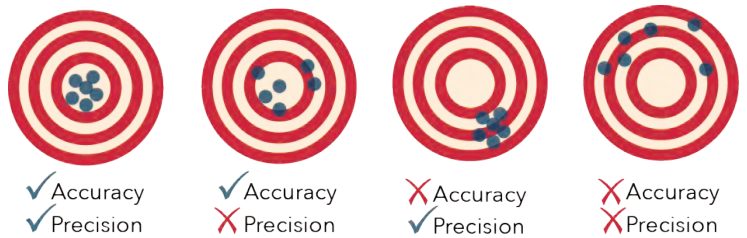


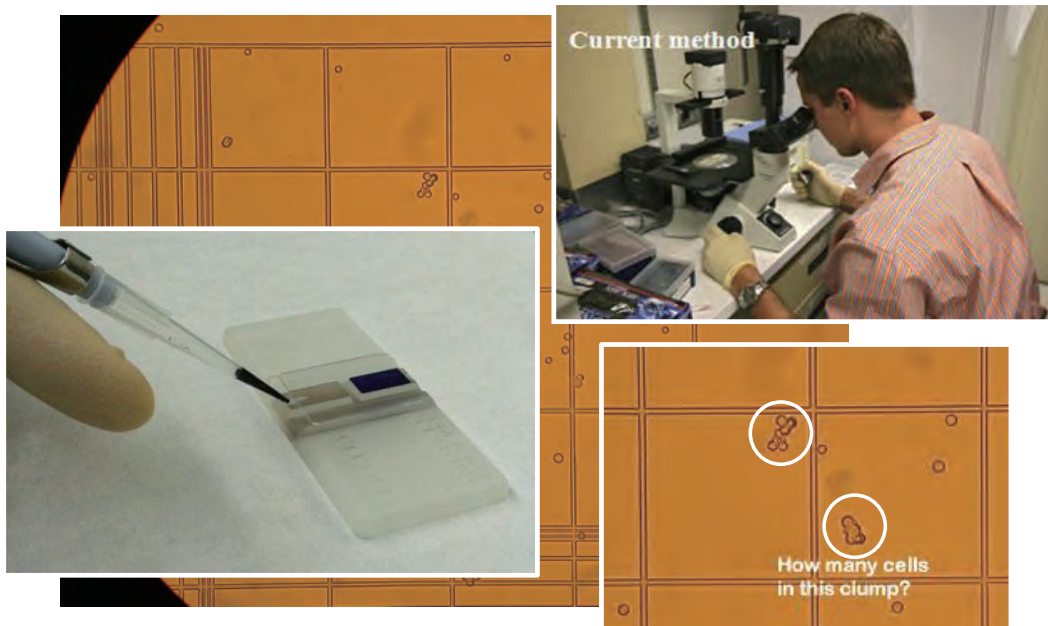
Figure 1. Parameters that contribute to overall brewing fitness (37).



revvity

Revvity Proprietary Information

傳統人工細胞計數：費工、費時、人為差異



revvity

Revvity Proprietary Information

Nexcelom – Revvity 的三個世界首創

更方便



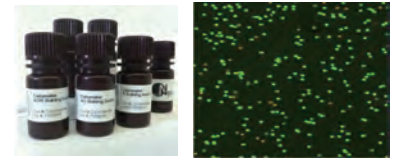
2003:
發明一次性細胞計數板

自動化



2006:
發佈世界首個基於血球計數板原理的細胞計數儀

更準確



2008:
首次將AO/PI雙螢光細胞染色法商業化

revvity

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5

Cellometer X2細胞分析系統 - 工業酵母監控與研究

Cellometer® X2

專為酵母菌和細菌所設計 · 快速、準確的自動化計數平台



樣本濃度與存活率：明視野與紅綠螢光雙視野偵測成像

快速偵測：上樣至分析結束僅需60秒

僅需少量樣本：僅20 µl樣本即可偵測

可靠的線性範圍：2 x 10⁵ – 5 x 10⁷ cells/mL

直覺的操作介面：無學習門檻

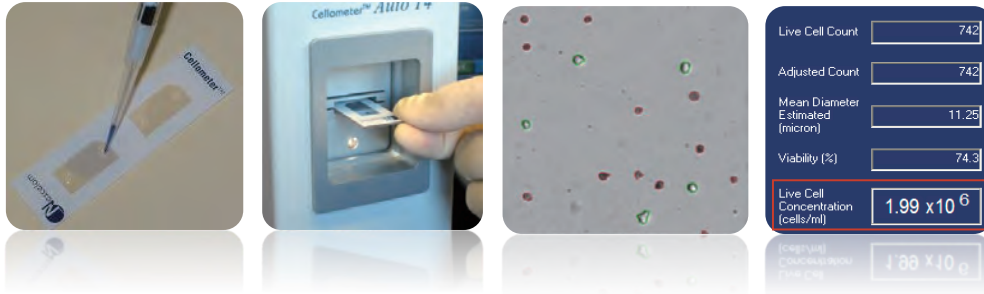
適配染劑：Trypan blue, AO, PI, EB, 7AAD, AO/PI, AO/EB, Calcein AM, CFDA-AM, Calcein AM/PI, CFDA/PI

revvity

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Cellometer 細胞計數儀

簡單3步完成細胞計數



- 細胞數, 濃度
- 細胞活率
- 細胞直徑
- 1分鐘/樣本
- 資料保存和匯出

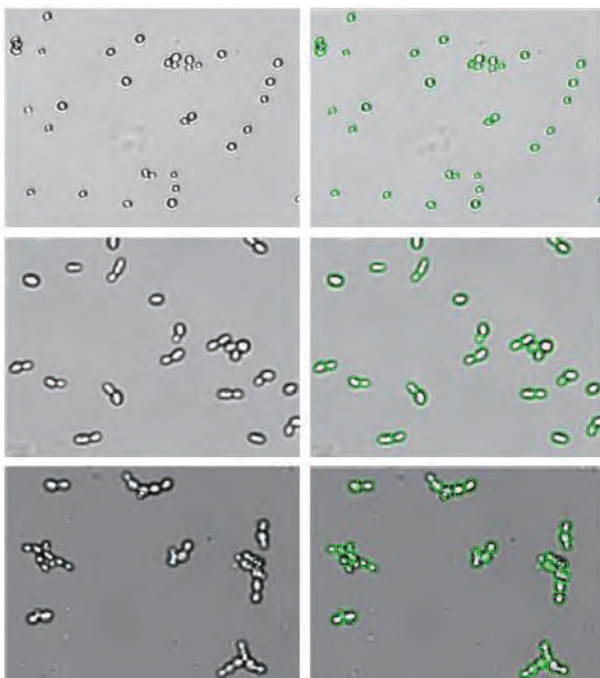


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Revvity Proprietary Information

7

X2 可辨識不同形態的酵母細胞



單個游離酵母

- 計數單個細胞粒子
- 通過細胞大小參數排除碎片或細胞團

出芽酵母的去聚團 (de-cluster)

- 圖像分析演算法去聚團和計數單個酵母細胞

成鏈酵母的去聚團

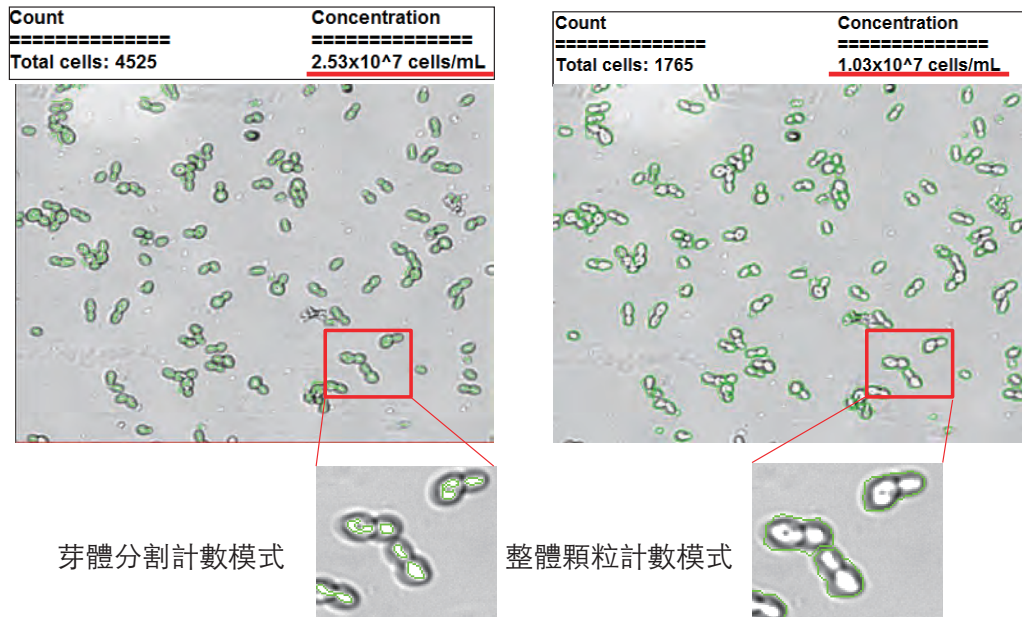
- 計數形成鏈的單個酵母細胞

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7

X2 可辨識不同形態的酵母細胞



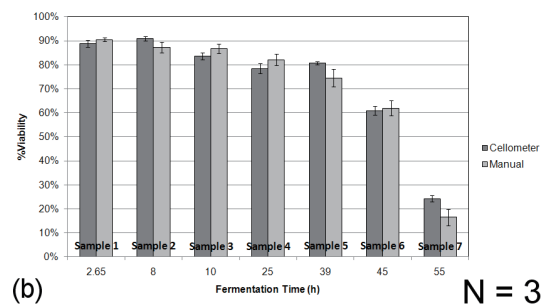
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使用AO/PI測量酵母存活率



乙醇發酵過程中監測酵母樣品
發酵早期活率約90%
發酵結束時活率低於30%
與人工計數方法一致



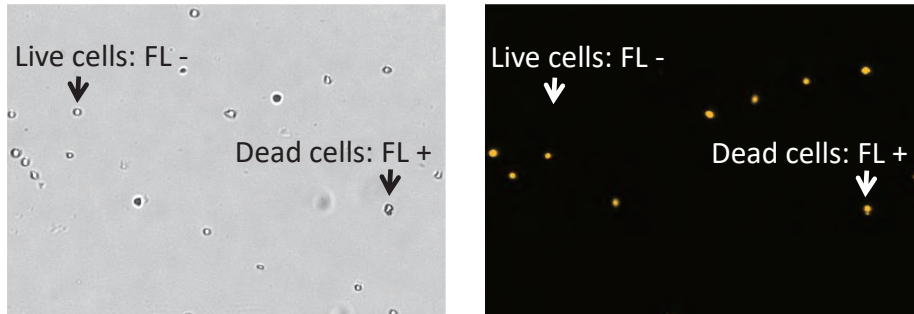
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Propidium iodide——膜完整性的存活率檢測

螢光核酸活性染色分子與DNA結合時會發出強烈的螢光

- PI染料分子不可滲透膜完整的活細胞
- PI染料分子容易通過膜受損的死亡細胞

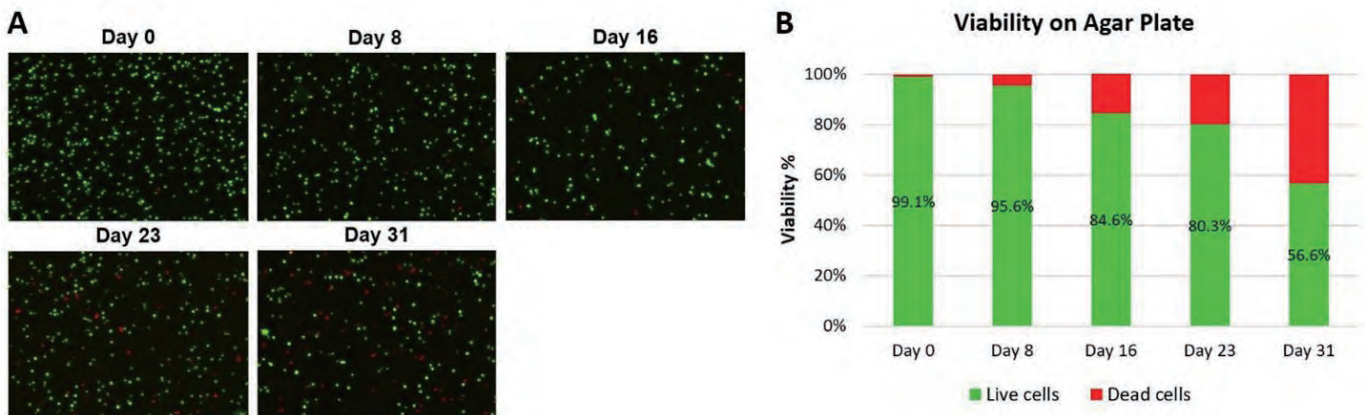


revvity

Revvity Proprietary Information

白色念珠菌在培養皿 4°C 長時間培養的存活率變化

Stability of *C. albicans* culture on agar plate stored at 4°C from Day 0 to Day 31



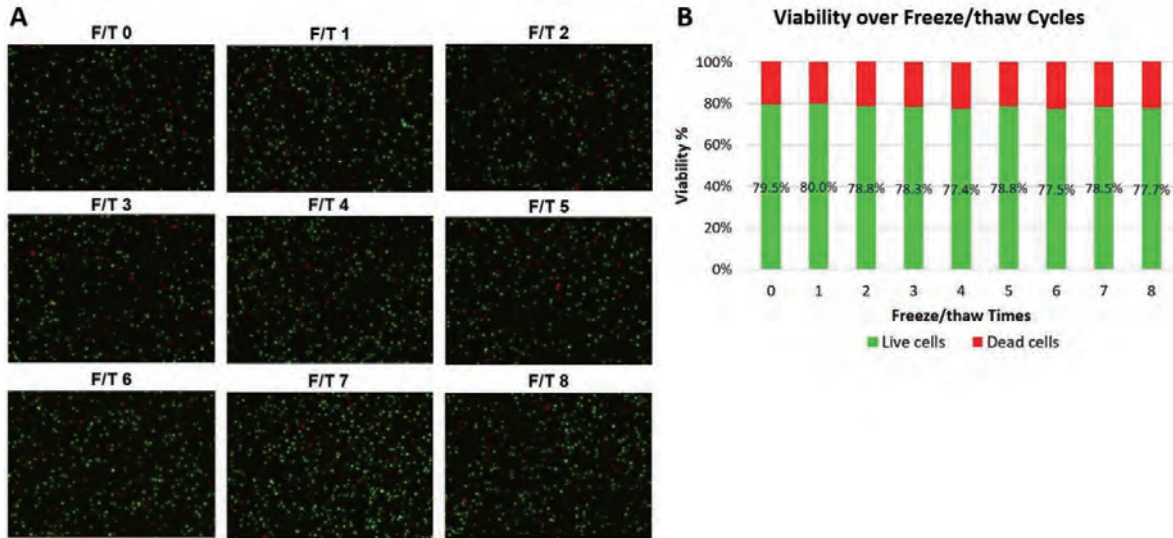
revvity

Revvity Proprietary Information

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白色念珠菌保存在甘油重複冷凍/解凍的存活率檢測

Stability of *C. albicans* frozen culture stock in 10% glycerol over 8 freeze/thaw cycles.



revvity

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X2 在發酵工業品管帶來的好處

- 絕對計數與存活率計數準確，高線性範圍。
- 操作快速，從取樣到分析完成 < 5min。
- 操作簡單，看過一次就上手。
- 拋棄式耗材，無交叉感染，儀器無須維護。

X2 在發酵工業品管的相關應用

- 快速偵測不同時間製程樣本數與存活率。
- 製程管理、購買菌株確認、品管確效。
- 客製化輸出報告，減少人為操作差異。





主辦單位：台大食科所、台大生技所、教育部教學實踐研究計畫

協辦單位：台灣農業化學會、台灣乳酸菌協會、國際精準健康協會、台灣食品保護協會、台灣食品科技學會、台灣保健食品學會

主辦單位：



協辦單位：



贊助單位：

進階生物科技股份有限公司
整合股份有限公司
佶駿實業有限公司
桂鼎科技股份有限公司



進階生物科技
Level Biotechnology Inc.



RADISTAR CORP.
整合股份有限公司



佶駿實業有限公司
G JIUNN INDUSTRIAL CO., LTD.



桂鼎科技股份有限公司