



電子報第 173 期

專家介紹

- ◆ 李金樹副教授(國防大學理工學院化學及材料工程學)
- ◆ 連培榮組長(金屬中心天然物創新應用組)

教育訓練班

- ◆ (在職)高壓氣體特定設備操作人員安全衛生在職教育訓練 08/30(一)
- ◆ (日間班)高壓氣體特定設備操作人員安全衛生教育訓練班 08/30~09/03
- ◆ (夜間班)高壓氣體特定設備操作人員安全衛生教育訓練班 09/06~09/19

產業新聞

- ◆ 2021 年台北國際食品系列展延期至 10 月
資料來源：<https://www.foodtech.com.tw/zh-tw/news/03A08DD264C63340/info.html>
- ◆ 富邦證券輔導 高階醫材廠亞果生醫 27 日興櫃掛牌
資料來源：<https://finance.ettoday.net/news/2040612>

技術文摘

- ◆ 3D composite engineered using supercritical CO₂ decellularized porcine cartilage scaffold, chondrocytes, and PRP: Role in articular cartilage regeneration 使用超臨界 CO₂ 脫細胞豬軟骨支架、軟骨細胞和 PRP 設計的 3D 複合材料：在關節軟骨再生中的作用
- ◆ Advances in Supercritical Carbon Dioxide Extraction of Bioactive Substances from Different Parts of Ginkgo biloba L 超臨界二氧化碳萃取銀杏不同部位生物活性物質的研究進展
- ◆ Comparison of the Phytochemical Composition and Antibacterial Activities of the Various Extracts from Leaves and Twigs of Illicium verum 八角葉和嫩枝各種提取物的植物化學成分和抗菌活性比較
- ◆ Development of a decellularized porcine bone graft by supercritical carbon dioxide extraction technology for bone regeneration 超臨界二氧化碳萃取技術開發用於骨再生的脫細胞豬骨移植
- ◆ High performance liquid chromatographic method for determination of active components in lithospermum oil and its application to process optimization of lithospermum oil prepared by supercritical fluid extraction 紫草油中活性成分的高效液相色譜測定方法及其在超臨界流體萃取紫草油工藝優化中的應用



- ◆ Neuroprotective Effect of Terpenoids Recovered from Olive Oil By-Products 從橄欖油副產品中回收的萜類化合物的神經保護作用
- ◆ Novel trends in extraction and optimization methods of bioactives recovery from pomegranate fruit biowastes: Valorization purposes for industrial applications 從石榴果實生物廢棄物中提取和優化生物活性物質回收方法的新趨勢：工業應用價值
- ◆ Protocols for the preparation and characterization of decellularized tissue and organ scaffolds for tissue engineering 組織工程用去細胞組織器官支架之特性及製程步驟
- ◆ Supercritical Fluid Extraction Kinetics of Cherry Seed Oil: Kinetics Modeling and ANN Optimization 櫻桃籽油的超臨界流體萃取動力學：動力學建模和人工神經網絡優化

台灣超臨界流體協會

電話：(07)355-5706

E-mail：tscfa@mail.mirdc.org.tw



專家介紹

【國防大學理工學院化學及材料工程學系 李金樹副教授】



- ❖專長：火炸藥安全技術、最適化分析、超臨界流體應用
- ❖研究方向：製程分析改善、火炸藥、綠色製程
- ❖email：lijinshuh@gmail.com

李金樹副教授取得國防大學理工學院應化博士學位後，至海軍後勤司令部先後擔任彈藥技術官及水雷修護官，目前擔任國防大學理工學院化學及材料工程學系擔任助理教授兼化工組組長乙職。

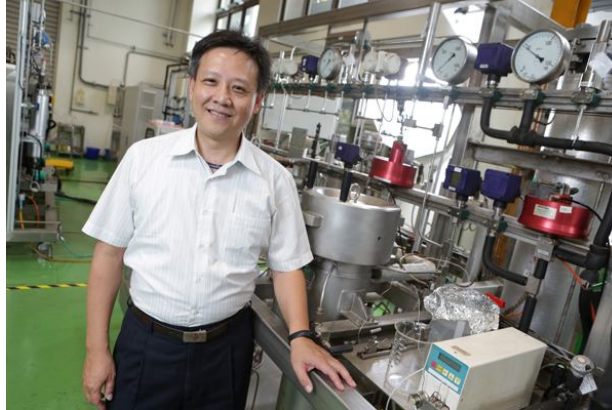
李副教授的研究領域主要著重在火炸藥及超臨界流體的應用，由於傳統的廢舊彈藥處理方法所費不貲，在處理過程中也潛在風險，超臨界流體技術是近年來化學工業快速發展的技術，以二氧化碳作為溶劑，具有低污染、低成本、化學穩定性好、可在較低溫條件下操作等優點。

李副教授目前擔任本會第九屆候補監事乙職，對於本會相關會務與活動，皆盡力參與並給予支持。



專家介紹

【金屬中心天然物創新應用組 連培榮組長】



- ❖專長：天然物創新應用技術與產品開發、保健與化妝品開發、六級產業鏈結整合
- ❖研究方向：超臨界流體產業應用與跨域整合
- ❖email：lienpj@mail.mirdc.org.tw

連培榮組長取得台灣科技大學化工博士學位前，先後任職於私立明新工專及私立開南商工，2003-2004年在國立台灣科技大學化工系擔任博士後研究員。2004年起任職於金屬工業研究發展中心精密機電組工程師，2014年晉升為天然物創新應用組正工程師兼組長迄今。期間曾擔任生技能源設備組正工程師兼副組長、輔英科技大學應用化材系兼任助理教授、高雄應用科技大學機械系&化工系兼任助理教授、台灣超臨界流體協會監事及中國化學會嘉義分會監事乙職。

連組長的研究領域主要在超臨界流體產業應用與跨域整合，金屬中心於2014年成立了天然物創新應用研究所(NPiL)，透過快速試製試量產服務平台的建置，提供保健食品、化妝品試量產和商品化研發，協助農林漁牧剩餘物之天然機能性成分萃取，提升再利用價值。在連組長的帶領之下，NPiL是目前國內唯一可以提供業者從原料安全栽種、成分確效，到前處理、萃取、分餾與純化等綠色深加工，軟性晶球與微膠囊包覆劑型多元化選擇，及行銷策略輔導與整廠整線等完整六級產業服務模式的服務單位。該團隊擁有超臨界流體萃取分餾純化技術、酒精/水萃取濃縮技術、化妝品/保養品開發技術微、膠囊包覆應用技術、軟性晶球配方與設備、機能性微粒製備與滴丸機等技術能量。為國內外產業提供實驗室製程放大，並解決初期設備與產線建置的成本，增進天然物產品開發的契機。



高壓氣體特定設備操作人員安全衛生在職教育訓練

需要有操作證照的單位，歡迎向協會報名。

- 上課日期：**110/08/30(一) 13:30~16:30**
- 上課時數：3 小時
- 課程內容：高壓氣體特定設備相關法規、職災案例探討預防、安全須知及自動檢查
- 上課地點：高雄市楠梓區高楠公路 1001 號【金屬工業研究發展中心研發大樓 2 樓 產業人力發展組】
- 參加對象：高壓氣體特定設備操作人員安全衛生訓練結業滿三年者，需有結業証書。
- 費用：本班研習費新台幣 400 元整。
- 名額：每班 30 名，額滿為止。
- 報名辦法：1. 傳真報名：(07)355-7586 台灣超臨界流體協會
2. 報名信箱：tscfa@mail.mirdc.org.tw
3. 研習費請電匯至 兆豐國際商銀 港都分行(代碼017)
戶名：社團法人台灣超臨界流體協會 帳號：002-09-018479 (註明參加班別及服務單位) 或以劃線支票抬頭寫「台灣超臨界流體協會」連同報名表掛號郵寄台灣超臨界流體協會，本會於收款後立即開收據寄回。

※洽詢電話：(07)355-5706 吳小姐 繳交一寸相片一張及身份證正本



報 名 表

課程名稱	高壓氣體特定設備操作人員安全衛生在職教育訓練				上課日期	110 年 8 月 30 日	
姓名	出生年月日	身份證字號	手機號碼	畢業校名	公司產品		
服務單位					電 話		
服務地址	□□□				傳 真		
發票住址	□□□				統 一 編 號		
負 責 人				訓練聯絡人 / 職稱	email :		
參加費用	共		元	參加性質	<input type="checkbox"/> 公司指派	<input type="checkbox"/> 自行參加	
繳費方式	<input type="checkbox"/> 郵政劃撥 <input type="checkbox"/> 支票 <input type="checkbox"/> 附送現金			報名日期		年	月 日

※ 出生年月日、身份證字號、畢業校名、電話、地址須詳填，以利製作證書。〔！〕

**(日間班)高壓氣體特定設備操作人員安全衛生教育訓練班**

需要有操作證照的單位，歡迎向協會報名。

- 上課日期：**(日班)110/08/30~09/03 08:00~17:00；09/02~09/03 08:00~17:00(實習)**
- 上課時數：高壓氣體特定設備操作人員安全衛生教育訓練課程時數 35 小時+2 小時(測驗)。
- 課程內容：高壓氣體概論 3HR、種類及構造 3HR、附屬裝置及附屬品 3HR、自動檢查與檢點維護 3HR、安全裝置及其使用 3HR、操作要領與異常處理 3HR、事故預防與處置 3HR、安全運轉實習 12HR、高壓氣體特定設備相關法規 2HR，共 35 小時。(另加學科測驗 1 小時及術科測驗約 1~2 小時)
- 上課地點：高雄市楠梓區高楠公路 1001 號【金屬工業研究發展中心研發大樓 2 樓 產業人力發展組】
- 參加對象：從事高壓氣體特定設備操作人員或主管人員。
- 費用：本班研習費**新台幣 7,000 元整**(含教材、文具、實習)，**本會會員享九折優惠**。
- 名額：每班 30 名，額滿為止。
- 結訓資格：期滿經測驗成績合格者，取得【高壓氣體特定設備操作人員安全衛生訓練】之證書。
- 報名辦法：1.傳真報名：(07)355-7586台灣超臨界流體協會
2.報名信箱：tscfa@mail.mirdc.org.tw
3.研習費請電匯至 兆豐國際商銀 港都分行(代碼017)
戶名：社團法人台灣超臨界流體協會 帳號：002-09-018479 (註明參加班別及服務單位) 或以劃線支票抬頭寫「台灣超臨界流體協會」連同報名表掛號郵寄台灣超臨界流體協會，本會於收款後立即開收據寄回。

※洽詢電話：(07)355-5706 吳小姐 繳交一寸相片一張及身份證正本



報 名 表

課程名稱	高壓氣體特定設備操作人員安全衛生教育訓練				上課日期	110 年 8/30~9/3	
姓 名	出生年月日	身份證字號	手機號碼	畢業校名	公司產品		
服務單位					電 話		
服務地址	□□□				傳 真		
發票住址	□□□				統一編號		
負 責 人	人	訓練聯絡人 / 職稱		email :			
參加費用	共 元		參加性質	<input type="checkbox"/> 公司指派		<input type="checkbox"/> 自行參加	
繳費方式	<input type="checkbox"/> 郵政劃撥		<input type="checkbox"/> 支票	<input type="checkbox"/> 附送現金	報名日期	年 月 日	

※ 出生年月日、身份證字號、畢業校名、電話、地址須詳填，以利製作證書。〔！〕

上課日期時間表

課程名稱：(日間班)高壓氣體特定設備操作人員安全衛生教育訓練班

2021/08/30 (一)	08:00 ~ 17:00
2021/08/31 (二)	08:00 ~ 17:00
2021/09/01 (三)	08:00 ~ 17:00
2021/09/02 (四)	08:00 ~ 17:00 (實習第 1 組)
2021/09/03 (五)	08:00 ~ 14:00 (實習第 1 組)

**(夜間班)高壓氣體特定設備操作人員安全衛生教育訓練班**

需要有操作證照的單位，歡迎向協會報名。

- 上課日期：**(夜班)110/09/06~09/16 18:30~21:30；09/18~09/19 08:00~17:00(實習)**
- 上課時數：高壓氣體特定設備操作人員安全衛生教育訓練課程時數 35 小時+2 小時(測驗)。
- 課程內容：高壓氣體概論 3HR、種類及構造 3HR、附屬裝置及附屬品 3HR、自動檢查與檢點維護 3HR、安全裝置及其使用 3HR、操作要領與異常處理 3HR、事故預防與處置 3HR、安全運轉實習 12HR、高壓氣體特定設備相關法規 2HR，共 35 小時。(另加學科測驗 1 小時及術科測驗約 1~2 小時)
- 上課地點：高雄市楠梓區高楠公路 1001 號【金屬工業研究發展中心研發大樓 2 樓 產業人力發展組】
- 參加對象：從事高壓氣體特定設備操作人員或主管人員。
- 費用：本班研習費**新台幣 7,000 元整**(含教材、文具、實習)，**本會會員享九折優惠**。
- 名額：每班 30 名，額滿為止。
- 結訓資格：期滿經測驗成績合格者，取得【高壓氣體特定設備操作人員安全衛生訓練】之證書。
- 報名辦法：1.傳真報名：(07)355-7586台灣超臨界流體協會
2.報名信箱：tscfa@mail.mirdc.org.tw
3.研習費請電匯至 兆豐國際商銀 港都分行(代碼017)
戶名：社團法人台灣超臨界流體協會 帳號：002-09-018479 (註明參加班別及服務單位) 或以劃線支票抬頭寫「台灣超臨界流體協會」連同報名表掛號郵寄台灣超臨界流體協會，本會於收款後立即開收據寄回。

※洽詢電話：(07)355-5706 吳小姐 繳交一寸相片一張及身份證正本



報名表

課程名稱	高壓氣體特定設備操作人員安全衛生教育訓練				上課日期	110 年 9/06~9/19	
姓名	出生年月日	身分證字號	手機號碼	畢業校名	公司產品		
服務單位					電話		
服務地址	□□□				傳真		
發票住址	□□□				統一編號		
負責人	人	訓練聯絡人 / 職稱		email :			
參加費用	共	元	參加性質	<input type="checkbox"/> 公司指派		<input type="checkbox"/> 自行參加	
繳費方式	<input type="checkbox"/> 郵政劃撥		<input type="checkbox"/> 支票	<input type="checkbox"/> 附送現金	報名日期	年 月 日	

※ 出生年月日、身分證字號、畢業校名、電話、地址須詳填，以利製作證書。〔！〕

上課日期時間表

課程名稱：(夜間班)高壓氣體特定設備操作人員安全衛生教育訓練班

2021/09/06 (一)	18:30 ~ 21:30
2021/09/07 (二)	18:30 ~ 21:30
2021/09/08 (三)	18:30 ~ 21:30
2021/09/09 (四)	18:30 ~ 21:30
2021/09/13 (一)	18:30 ~ 21:30
2021/09/14 (二)	18:30 ~ 21:30
2021/09/15 (三)	18:30 ~ 21:30
2021/09/16 (四)	18:30 ~ 21:30
2021/09/18 (六)	08:00 ~ 17:00 (實習第 1 組)
2021/09/19 (日)	08:00 ~ 14:00 (實習第 1 組)



2021 年台北國際食品系列展延期至 10 月 線上展首次推出 虛實整合拓銷全方位

2021/05/27

原訂今年 6 月 23 日至 26 日舉辦的「台北國際食品系列展」(FOOD TAIPEI MEGA SHOWS)，因應新冠肺炎(COVID-19)疫情，主辦單位外貿協會、台灣食品暨製藥機械工業同業公會、台灣包裝協會、展昭國際企業股份有限公司共同決議，基於維護參展廠商及參觀者的健康與安全，並顧及參展效益，決定延期至 2021 年 10 月 6 日至 9 日在台北南港展覽 1、2 館舉辦。

「台北國際食品系列展」包含「台北國際食品展」、「台北國際食品加工機械展」、「臺灣國際生技製藥設備展」、「台北國際包裝工業展」與「台灣國際飯店暨餐飲設備用品展」，本年度除舉辦實體展覽之外，首次推出自實體展開展日起，為期一個月的線上展覽(10 月 6 日至 11 月 5 日)，提供線上攤位展示、預約會議、即時對談(包含視訊、通話及留言功能)，並辦理線上採購洽談會，透過外貿協會 64 個駐外單位廣邀全球買主參加，線上線下虛實整合，全方位拓銷。「台北國際食品系列展」將於 10 月重新登場，集結食品產業上、中、下游完整供應鏈，便利全球買主進行一站式採購。

主辦單位將隨時更新資訊，請參考下列官網：

Food Taipei 官網: www.foodtaipei.com.tw

Foodtech Taipei 官網: www.foodtech.com.tw

Bio/Pharmatech Taiwan 官網: www.foodtech.com.tw

Taipei Pack 官網: www.taipeipack.com.tw

Taiwan Horeca 官網: www.taiwanhoreca.com.tw

更多防疫資訊，可至衛生福利部疾病管制署全球資訊網(<https://www.cdc.gov.tw/>)查詢。

資料來源: <https://www.foodtech.com.tw/zh-tw/news/03A08DD264C63340/info.html>



富邦證券輔導 高階醫材廠亞果生醫 27 日興櫃掛牌

2021-07-26

由富邦證券輔導的亞果生醫(6748)將於(27 日)興櫃掛牌，富邦證券資深副總經理吳春敏表示，亞果生醫設立於 2014 年 6 月，為研發及生產人體組織工程修護材料相關之高階醫材廠商，且採用超臨界二氧化碳(scCO₂)流體技術，保留豬隻組織器官中完整的膠原蛋白支架結構，產品涵蓋膠原蛋白敷料、骨材、牙材及眼角膜，應用在傷口修復、醫美、膝軟骨修復及眼角膜市場。

吳春敏指出，亞果生醫主要發展優勢在於透過超臨界二氧化碳(scCO₂)技術平台研發生產醫材，將完全克服萃取過程中有機溶劑的殘留問題，提高安全性；不僅可以保存生醫原料的結構與其生物力學性，更能保留組織原料的生物活性，提高清除及萃取效果。

其次，生醫產業進入門檻高，以 scCO₂ 技術平台開發之植入式醫療器材屬於法規規範之二類/三類醫療器材，需要長時間的研發並執行生物相容性試驗、安定性試驗、動物功效試驗以及人體臨床試驗，因此投入資金及時間成本，取得專利及開發品項，是新競爭者難逾越之障礙

此外，市場需求上升：全球組織工程市場 2021 年度規模預計達 61.6 億美元，2017~2021 年度年複合成長率高達 27.9%。2024 年度台灣再生醫療市場規模估計達新台幣 40.1 億元，其中因醫美微整形風潮帶動膠原蛋白及玻尿酸植入物需求，使得組織工程市場成長更為快速。

吳春敏強調，全球人口老化，亞洲更加速進入超高齡社會，因此市場對再生醫療產業，包括細胞治療及組織工程等，具高度期待，因此台灣需要更多人才與供應鏈把產業撐起，富邦證券將積極協助輔導高階醫材產業鏈，以滿足日益提高之市場需求，而亞果生醫以 scCO₂ 技術平台研發生產高階醫材，深具市場發展前景更是未來商機。

亞果生醫董事長謝達仁表示，亞果生醫除了已開發之人工眼角膜在台灣進行人體臨床試驗，並同步申請國外專利，預備搶進中國大陸及印度等海外市場外；亦在醫學美容領域突破，開發膠原蛋白植入劑，並瞄準抗老化肌膚再生醫學領域。

謝達仁也指出，公司與三軍總醫院心臟外科團隊合作，進行器官重建研發計畫，期許未來能運用豬隻器官，滿足器官移植與器官捐贈間供需失衡之缺口，展現公司在再生醫療產業發展的決心，開拓其他利基市場，以持續締造優良的經營實績，以回報股東對於公司之長期投資。

資料來源：<https://finance.ettoday.net/news/2040612>



3D composite engineered using supercritical CO₂ decellularized porcine cartilage scaffold, chondrocytes, and PRP: Role in articular cartilage regeneration

使用超臨界CO₂脫細胞豬軟骨支架、軟骨細胞和PRP設計的3D複合材料：在關節軟骨再生中的作用

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Abstract :

At present, no definitive treatment for articular cartilage defects has been perfected. Most of the previous treatments involved multiple drilling and microfracture over defect sites with repair-related substances, which poses a limited therapeutic effect. End-stage therapy includes artificial knee joint replacement. In this study, we prepared a novel decellularized natural cartilage scaffold from porcine articular cartilage by **supercritical** CO₂ extraction technology and three-dimensional (3D) composites made using decellularized porcine cartilage graft (dPCG) as scaffolds, platelet-rich plasma (PRP), thrombin as signals and chondrocytes as cells for the treatment of articular cartilage defects. In this study, *in vitro* and *in vivo* cartilage regeneration and the expression of chondrogenic markers were examined. Decellularized cartilage graft (dPCG) was evaluated for the extent of cell and DNA removal. Residual cartilage ECM structure was confirmed to be type II collagen by SDS PAGE and immunostaining. The new 3D composite with dPCG (100 mg and 2×10^6 chondrocytes) scaffold promotes chondrogenic marker expression *in vitro*. We found that the *in vivo* 3D composite implanted cartilage defect showed significant regeneration relative to the blank and control implant. Immunohistochemical staining showed increase of expression including Collagen type II and aggrecan in 3D composite both *in vitro* and *in vivo* studies. In this study, the bioengineered 3D composite by combining dPCG scaffold, chondrocytes, and PRP facilitated the chondrogenic marker expression in both *in vitro* and *in vivo* models with accelerated



cartilage regeneration. This might serve the purpose of clinical treatment of large focal articular cartilage defects in humans in the near future.

Keywords : 3D composite, articular cartilage defect, decellularized porcine cartilage graft (dPCG), [supercritical](#) carbon dioxide (SCCO₂)



Advances in Supercritical Carbon Dioxide Extraction of Bioactive Substances from Different Parts of Ginkgo biloba L

超臨界二氧化碳萃取銀杏不同部位生物活性物質的研究進展

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Molecules: a Journal of Synthetic Chemistry and Natural Product Chemistry 2021 June 30, 26 (13)

Abstract :

Ginkgo biloba L. has always been a popular area of research due to its various active ingredients and pharmacological effects. Ginkgo biloba is rich in ginkgo flavonoids, ginkgolides, and ginkgolic acid, with anti-inflammation, antioxidation, neuroprotection, anti-platelet agglutination, hypolipidemic effect, anti-cancer, and anti-radiation properties. There are many methods to extract and separate the active components of ginkgo. Among them, **supercritical** carbon dioxide fluid extraction (SFE-CO₂) is known for its green, clean, and environment-friendly properties. In this paper, the pharmacological activities, the active components, and structures of different parts of ginkgo, the extraction methods of its effective ingredients, and the application of the SFE-CO₂ method for the extraction and separation of active ingredients in Ginkgo biloba from leaves, seeds, pollen, and roots were reviewed, in order to make best use of ginkgo resources, and provide support and references for the development of SFE-CO₂ of active components from Ginkgo biloba.

Keywords : Ginkgo biloba L.; active ingredients; **supercritical** CO₂ fluid extraction



Comparison of the Phytochemical Composition and Antibacterial Activities of the Various Extracts from Leaves and Twigs of *Illicium verum*

八角葉和嫩枝各種提取物的植物化學成分和抗菌活性比較

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Molecules: a Journal of Synthetic Chemistry and Natural Product Chemistry 2021
June 26, 26 (13)

Abstract :

Previous studies have revealed the numerous biological activities of the fruits of *Illicium verum*; however, the activities of its leaves and twigs have remained undiscovered. The study aimed to investigate the phytochemical components and antibacterial activity of the various extracts from the leaves and twigs of *Illicium verum*. The herbal extracts were prepared by **supercritical** CO₂ extraction (SFE) and 95% ethanol extraction, followed by partition extraction based on solvent polarity. Analysis of antimicrobial activity was conducted through the usage of nine clinical antibiotic-resistant isolates, including *Staphylococcus aureus*, *Pseudomonas aeruginosa* and *Acinetobacter baumannii*. Among the tested samples, the SFE extracts exhibited broader and stronger antibacterial activities against the test strains, with a range of MIC between 0.1–4.0 mg/mL and MBC between 0.2–4.5 mg/mL. Observations made through scanning electron microscopy revealed potential mechanism of the antimicrobial activities involved disruption of membrane integrity of the test pathogens. Evaluation of the chemical composition by gas chromatography-mass spectrometry indicated the presence of anethole, anisyl aldehyde, anisyl acetone and anisyl alcohol within the SFE extracts, demonstrating significant correlations with the antibacterial activities observed. Therefore, the leaves and twigs of *Illicium verum* hold great potential in being developed as new natural antibacterial agents.

Keywords : *Illicium verum*; **supercritical** fluid extraction; traditional solvent extraction; antimicrobial activity



Development of a decellularized porcine bone graft by supercritical carbon dioxide extraction technology for bone regeneration

超臨界二氧化碳萃取技術開發用於骨再生的脫細胞豬骨移植

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Abstract :

A series of novel decellularized porcine collagen bone graft (DPB) materials in a variety of shapes and sizes were developed by the **supercritical** carbon dioxide (SCCO₂) extraction technique. The complete decellularization of DPB was confirmed by hematoxylin and eosin staining, 4,6-diamidino-2-phenylindole (DAPI) staining, and residual DNA analysis. The native intact collagen remained in the DPB after the SCCO₂ process was confirmed by Masson trichrome staining. The physicochemical characteristics of DPB were investigated by scanning electron microscopy and x-ray diffraction. The cytotoxicity and biocompatibility tests according to ISO10993 and its efficacy for bone regeneration in osteochondral defects in rabbits were evaluated. The rabbit pyrogen test confirmed DPB was non-toxic. In vitro and in vivo biocompatibility tests of the DPB did not show any toxic or mutagenic effects. The bone regeneration potential of the DPB presented no significant histological differences compared to commercially available deproteinized bovine bone. In conclusion, DPB produced by SCCO₂ exhibited similar chemical characteristics to human bone, no toxicity, good biocompatibility, and enhanced bone regeneration in rabbits comparable to that of deproteinized bovine bone. Results from this study could shed light on the potential application of the SCCO₂ extraction technique to generate a native decellularized scaffold for bone tissue regeneration in human clinical trials.

Keywords : biocompatibility testing, bone regeneration, bone substitutes, carbon dioxide, **supercritical**fluid, toxicity tests



High performance liquid chromatographic method for determination of active components in lithospermum oil and its application to process optimization of lithospermum oil prepared by supercritical fluid extraction

紫草油中活性成分的高效液相色譜測定方法及其在超臨界流體萃取紫草油工藝優化中的應用

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Lithospermum erythrorhizon has the functions of cooling blood, activating blood, as well as detoxifying and penetrating rash. Lithospermum oil extracted from Lithospermum erythrorhizon can prevent and treat diaper rash, skin ulceration, eczema, and other skin diseases. **Supercritical** fluid extraction is the optimal method for the extraction of active components from lithospermum. In this study, an analytical method was established for simultaneously determination of six active components in lithospermum oil with high performance liquid chromatography (HPLC), and the contents of the active components as the evaluation index were used to investigate several important factors in the preparation of lithospermum oil by **supercritical** fluid extraction. The optimized HPLC conditions were as follows: separation column, Diamonsil C18 (250 mm×4.6 mm, 5 μm); mobile phases, acetonitrile containing 0.1% (v/v) formic acid-0.1% (v/v) formic acid aqueous solution containing 5 mmol/L ammonium formate (75:25, v/v); flow rate, 1 mL/min; injection volume, 15 μL; room temperature; photodiode array detector (PAD); detection wavelength, 275 nm. The **supercritical** fluid extraction was optimized for ensuring stability of the amounts of effective components and the reliability of the quality of lithospermum oil. This will serve as the basis for preparation and quality control processes. Three factors and three levels orthogonal tests were adopted to investigate the important factors, viz. the pressure, temperature and CO₂ flow rate in the preparation of lithospermum oil. The results showed that the developed HPLC-PAD method can be used for the simultaneous determination of shikonin, acetylshikonin, β-acetoxyisovaleryl akanin, isobutyryl shikonin, β, β-dimethylacryl shikonin, and 2-methylbutyryl shikonin in 30 min. The method has good precision,



accuracy and repeatability. The contents of the active components were the highest when the extraction pressure, extraction temperature, and CO₂ flow rate were 23 MPa, 40 °C, and 27 L/h, respectively. The optimized conditions are suitable for the preparation and actual production of lithospermum oil. The HPLC-PAD method is simple, feasible, accurate, and reliable. It can be used for the preparation and quality control of lithospermum oil by [supercritical](#) fluid extraction. Thus, with this method, the stability of the contents of active ingredients and the reliability of the quality of lithospermum oil can be ensured; moreover, safe and effective drug use can be realized. The established method has obvious advantages over the traditional process and is a good candidate for widespread use.



Neuroprotective Effect of Terpenoids Recovered from Olive Oil By-Products

從橄欖油副產品中回收的萜類化合物的神經保護作用

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Abstract :

The neuroprotective potential of 32 natural extracts obtained from olive oil by-products was investigated. The online coupling of [supercritical fluid](#) extraction (SFE) and dynamic adsorption/desorption allowed the selective enrichment of olive leaves extracts in different terpenoids' families. Seven commercial adsorbents based on silica gel, zeolite, aluminum oxide, and sea sand were used with SFE at three different extraction times to evaluate their selectivity towards different terpene families. Collected fractions were analyzed by gas chromatography coupled to quadrupole-time-of-flight mass spectrometry (GC-QTOF-MS) to quantify the recoveries of monoterpenes (C10), sesquiterpenes (C15), diterpenes (C20), and triterpenes (C30). A systematic analysis of the neuroprotective activity of the natural extracts was then carried out. Thus, a set of in vitro bioactivity assays including enzymatic (acetylcholinesterase (AChE), butyrylcholinesterase (BChE)), and antiinflammatory (lipoxidase (LOX)), as well as antioxidant (ABTS), and reactive oxygen and nitrogen species (ROS and RNS, respectively) activity tests were applied to screen for the neuroprotective potential of these extracts. Statistical analysis showed that olive leaves adsorbates from SS exhibited the highest biological activity potential in terms of neuroprotective effect. Blood–brain barrier permeation and cytotoxicity in HK-2 cells and human THP-1 monocytes were studied for the selected olive leaves fraction corroborating its potential.

Keywords : olive oil by-products; terpenes fractionation; adsorbent-assisted processes; [supercritical](#) CO₂ extraction; Alzheimer's disease; neuroprotective effect



Novel trends in extraction and optimization methods of bioactives recovery from pomegranate fruit biowastes: Valorization purposes for industrial applications
從石榴果實生物廢棄物中提取和優化生物活性物質回收方法的新趨勢：工業應用價值

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Abstract :

Pomegranate biowastes present potential economic value worldwide owing to their several health benefits mediated by a complex mixture of unique bioactives. The exploitation of these bioactives has motivated the exploration of eco-friendly, efficient, and cost-effective extraction techniques to maximize their recovery. The current review aims to provide updated technical information about bioactives extraction mechanisms from pomegranate wastes (seeds and peel), their advantages and disadvantages, and factors towards optimization. A comparative overview of the modern green extraction techniques *viz.*, **supercritical** fluid extraction, ultrasound-assisted extraction, microwave-assisted extraction, pressurized liquid extraction, and eutectic solvent mixture as alternatives to conventional extraction methods for seeds and peel is presented. Approaches focused on biowastes modification for properties improvement are also discussed. Such comprehensive review shall provide the best valorization practices of pomegranate biowastes and its application in food and non-food areas focusing on original methods, innovation, protocols, and development to be considered for other fruit biowastes.

Keywords : Biowastes, Extraction, Modification, Optimization, Pomegranate, Valorization



Protocols for the preparation and characterization of decellularized tissue and organ scaffolds for tissue engineering

組織工程用去細胞組織器官支架之特性及製程步驟

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Abstract :

Extracellular matrix (ECM) scaffolds are extensively used in tissue engineering studies and numerous clinical applications for tissue and organ reconstructions. Due to the global severe shortage of human tissues and organs, xenogeneic biomaterials are a common source for human tissue engineering and regenerative medicine applications. Traditional methods for decellularization often disrupt the 3D architecture and damage the structural integrity of the ECM scaffold. To efficiently obtain natural ECM scaffolds from animal tissues and organs with intact architecture, we have developed a platform decellularization process using **supercritical** CO₂ and tested its potential application in tissue engineering. A combination of human mesenchymal stem cells with a decellularized dermal matrix scaffold allowed complete regeneration of skin structure in a porcine full-thickness wound model.

Keywords : 3D bioprinting, decellularized tissue scaffolds, organ regeneration, organ scaffolds, porcine organs, porcine tissues, regenerative medicine, **supercritical** carbon dioxide, tissue engineering, tissue regeneration



Supercritical Fluid Extraction Kinetics of Cherry Seed Oil: Kinetics Modeling and ANN Optimization

櫻桃籽油的超臨界流體萃取動力學：動力學建模和人工神經網絡優化

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Abstract :

This study was primarily focused on the **supercritical fluid** extraction (SFE) of cherry seed oil and the optimization of the process using sequential extraction kinetics modeling and artificial neural networks (ANN). The SFE study was organized according to Box-Behnken design of experiment, with additional runs. Pressure, temperature and flow rate were chosen as independent variables. Five well known empirical kinetic models and three mass-transfer kinetics models based on the Sovová's solution of SFE equations were successfully applied for kinetics modeling. The developed mass-transfer models exhibited better fit of experimental data, according to the calculated statistical tests (R^2 , SSE and AARD). The initial slope of the SFE curve was evaluated as an output variable in the ANN optimization. The obtained results suggested that it is advisable to lead SFE process at an increased pressure and CO_2 flow rate with lower temperature and particle size values to reach a maximal initial slope.

Keywords : cherry seed oil; **supercritical** fluid extraction; kinetics modeling; mass-transfer model; artificial neural network