TSCFA台灣超臨界流體協會
Taiwan Supercritical Fluid Association

電子報第 184 期

近期會務

◆ **111年度常年會費繳納通知**

即日起已開始受理會費繳納，秘書處提醒您繳交111年度常年會費。

◆ **會籍清查**

本會第九屆理監事將於 111 年 11 月 23 日任期二年屆滿，為辦理第十屆改選事宜，依據「人民團體選舉罷免辦法第 5 條」之規定，理監事選舉前，應審定會員代表之資格。

貴會員如有變更事項，務請正楷詳填於附件表格，或直接回覆 email 告知，謝謝！

活動訊息

◆ ***論文徵稿***

即日起徵求SuperGreen2022論文，主題：

(1)**“Physicochemical properties and thermodynamics”**

(2)**“Natural products, pharmaceutical and biomedical applications”**

(3)**“Reactions, material design and nanotechnology”**

(4)**“Process intensification, CO_2 utilization and industrial applications”**

(5)**“Applications of SCF technology in Taiwan”**

等5大主題領域的研究論文，邀請各界踴躍投稿，及蒞臨與會交流。

https://supergreen2022.conf.tw/

專家介紹

◆ 賴秉杉教授(國立中興大學化學系)

◆ 陳冠翰董事長(愛之味股份有限公司)

團體會員介紹

◆ 愛之味股份有限公司

教育訓練班

◆ (夜間班)高壓氣體特定設備操作人員安全衛生教育訓練班 08/30~09/11

技術文摘

- An Investigation on Phase Transitions in a Supercritical CO_2 Dry Gas Seal 超臨界 CO_2 乾式密封中的相變研究
- Antioxidant, Antimicrobial and Antibiofilm Properties of *Glechoma hederacea* Extracts Obtained by Supercritical Fluid Extraction, Using Different Extraction Conditions 不同萃取條件下超臨界流體萃取獲得之*常春藤*提取物 的抗氧化、抗菌和抗生物膜特性
- Application of the Integrated Supercritical Fluid Extraction–Impregnation Process (SFE-SSI) for Development of Materials with Antiviral Properties 整合超臨界流體萃取-植入工藝 (SFE-SSI) 在開發抗病毒材料的應用
- Computational Model Development for Hybrid Tilting Pad Journal Bearings Lubricated with Supercritical Carbon Dioxide 超臨界二氧化碳潤滑混合可傾墊軸頸軸承的計算模型開發
- Static and Rotordynamic Characteristics for Two Types of Novel Hole-Pattern Seals Operating in Supercritical CO_2 Turbomachinery 在超臨界 CO_2 渦輪機械 中運行的兩種新型孔型密封件的靜態和轉動力學特性
- Supercritical Fluid Application in the Oil and Gas Industry: A Comprehensive Review 超臨界流體在石油和天然氣行業的應用：綜合回顧
- Thermophysical Analysis of Microconfined Turbulent Flow Regimes at Supercritical Fluid Conditions in Heat Transfer Applications 傳熱應用中超臨界流體條件下微約束渦流狀態的熱物理分析

台灣超臨界流體協會
電話：(07)355-5706
E-mail：tscfa@mail.mirdc.org.tw

TSCFA 台灣超臨界流體協會

111 年度常年會費繳納通知

親愛的會員您好：

衷心感謝您對『台灣超臨界流體協會』的支持與愛護。面對新的年度，我們將再接再厲，也期許您繼續支持本會，給我們提攜與指導，讓協會更為茁壯。

為利本會後續相關會務推動，即日起已開始受理會費繳納，秘書處提醒您繳交 111 年度常年會費，為利作業方便，懇請您使用匯款或郵政劃撥、支票等方式繳納，敬請於儘速撥冗繳費，本會當於收款後，奉寄收據，謝謝!!

團體會員 NTD10,000，個人會員 NTD1,000，學生會員 NTD500，博士後研究人員 NTD750。

繳費相關資訊如下：

◆ 電匯或 ATM 轉帳

帳號：002-09-01847-9

戶名：社團法人台灣超臨界流體協會

銀行：兆豐國際商業銀行 (港都分行)　銀行代碼 017

※ATM 轉帳請務必告知轉帳帳號末五碼，以利對帳。

◆ 郵政劃撥

戶名:台灣超臨界流體協會

帳號:42221636

※請於劃撥單詳註姓名、聯絡電話、單位名稱及開立收據抬頭，以利收據開立。

◆ 郵寄支票

支票抬頭：台灣超臨界流體協會（禁止背書轉讓）

郵寄地址：81160 高雄市楠梓區高楠公路 1001 號

備註：

1. 本會將於 10 月 29 日召開第十屆第一次會員大會，並進行第十屆理監事改選，8 月份將審定會員資格並造具名冊，報請主管機關備查。

2. 依據本會章程第八條：本會會員享有下列各項權利：表決權、選舉權、被選舉權與罷免權(贊助會員、名譽會員、學生會員及未按期繳納會費之會員無此權利)。
3. 依據本會章程第十二條：連續兩年未繳交年費者視為自動退會。
4. 檢附會員異動資料表，若您的資料遇有變更(如通訊處、服務單位等)，請填寫會員資料異動表表格，擲回秘書處，以利本會會員資料更新。
5. 聯絡人：吳家瑩 07-3555706，電子郵件：tscfa@mail.mirdc.org.tw。

台灣超臨界流體協會 秘書處 謹上

會員資料異動表

會員編號	（不知會員編號者可免填）	姓 名		電 話	
電子郵件				行動電話	
服務機關		單位		職 稱	
公司地址	□□□			公司電話	( ) 分機
住家地址	□□□			住家電話	( )
通 訊 處	□ 同住家地址 □ 同公司地址			傳 真	( )

（※資料遇有異動時，請填寫本表格，擲交回本會秘書處）

地址：81160 高雄市楠梓區高楠公路 1001 號

電話:（07）355-5706 聯絡人：吳家瑩

傳真：（07）355-7586

電子郵件：tscfa@mail.mirdc.org.tw

12th International Conference on Supercritical Fluids (Supergreen 2022)
October 27-29, 2022

12th International Conference on Supercritical Fluid (Supergreen 2022) Abstract Template

Author 1[a], Author 2[b,*]

[a]Author's affiliation, City, Country

[b]Author's affiliation, City, Country

*Corresponding author: E-mail address

This is the abstract template for the 12th International Conference on Supercritical Fluid (Supergreen 2022). Please follow these instructions to prepare your abstract.

1) Page format

Prepare **one page** abstract in **A4-size**. Top, bottom, right and left margins are set to **25.4 mm**. 'Times New Roman' or similar fonts are used throughout the abstract.

2) Title

Title should be **centered** and presented in **14 pt, bold** with a fixed line spacing of **20 pt**. Leave one-line space after the title. The first letter of words in title should be capitalized except for articles, short prepositions, and conjunctions.

3) Author name(s)

Author name(s) are centered and presented in **12 pt** with a fixed line spacing of **20 pt**. The corresponding author should be labelled with '*' and the presenting author should be underlined.

4) Affiliation(s)

Affiliations are centered and presented in **10 pt** with a fixed line spacing of **20 pt**. Leave one-line space after the affiliation.

5) Abstract

Abstract is presented in **12 pt** with a fixed line spacing of **20 pt**. The text should be **justified left and right**. Figures and tables could be included in the abstract with the sequential numbering. All figures and tables are accompanied with a caption.

專家介紹

【國立中興大學化學系 賴秉杉教授】

❖學術專長：生化組 / 生醫奈米、藥物傳輸

❖email：pslai@email.nchu.edu.tw

賴秉杉教授於 2000 年取得國立中興大學學士學位，2006 年取得國立台灣大學博士學位，且於 2006 年 2 月至 7 月於國立中興大學擔任博士後研究員，同年 5 月至 8 月於東京大學擔任訪問研究員，回國後任職於國立中興大學迄今，於 2015 年升等為教授，2016 年至 2019 年擔任農產品驗證中心技術發展組組長，2018 年至 2019 年為理學院副院長。

賴教授的研究領域主要著重在生醫奈米和組織工程與再生醫學，以需求導向為出發點，透過研究開發功能性奈米材料來解決臨床上所遇到之問題，包含癌症早期診斷及治療、克服癌細胞抗藥性等，相關技術可延伸應用到保健食品、保養品方面。目前主要研究方向為：玻尿酸藥物接枝技術、新穎多功能性奈米載體的開發、細胞內藥物控制釋放之機制研究、口服劑型藥物開發、免疫劑型開發、保健食品與化妝保養品研發。賴教授於生醫奈米、組織工程與再生醫學等相關研究傑出，成果斐然，至今發表超過 70 篇期刊論文，其中包括許多指標性的專業期刊。

賴教授之學術地位崇高，獲得多項頂尖傑出榮譽，2010 年榮獲興大之光、2011 年獲得傑出青年教師、2012 年榮獲 Rising Suns in Asian (Controlled Release Society)以及「臺綜大年輕學者創新研究成果選拔」生科組優等獎、2013 年榮獲第十屆國家新創獎、學年度傑出青年教師、中興大學研究績優獎及興大之光，2015 年至 2021 年獲得每年度產學績優教師。其與藥廠合作開發的抗癌新藥 CA102N 已完成美國臨床一期試驗，即將進入臨床二期，是國內學界少見開發藥物進入臨床試驗的成功案例。

去(2021)年透過邱常務監事永和的邀請，賴秉杉教授加入本會，期待賴教授能與本會會員激盪出更多的合作機會。

專家介紹

【愛之味股份有限公司 陳冠翰董事長】

陳冠翰董事長擁有美國康乃爾大學財務工程碩士，以及食品工程博士學位，過去曾在聯合利華（Unilever）擔任資深食品科學家，甚至還是台大食品研究所兼任助理教授，在 10 多年前，陳董事長就進公司歷練，一直負責研發，並推出許多產品，其中最有名的就是純濃燕麥。在台灣，純濃燕麥每年銷售額至少 10 億元以上，還是好市多熱門商品，正因為銷售成績亮眼，目前韓國 14 家好市多也跟進販售，包裝採用符合當地文化的設計，熱銷的純濃燕麥，正是陳董事長一手催生的產品。除了在食品領域學經歷完整外，陳董事長也代表愛之味與國際食品大廠雀巢談合作，成功拿下代工訂單，讓前董事長陳哲芳放心交棒，於 2018 年 6 月正式完成世代交替。

陳董事長成功出擊的首役是愛之味明星商品「純濃燕麥」，他運用獨家專利技術「酵素轉化」，讓本來只能吃的燕麥，變成可以飲用、更好吸收的飲品，因此在國內備受消費者青睞。現在他再推咖啡師燕麥奶搶攻市場，已於前(2020)年年底推出在口感上能搭配咖啡飲用的「咖啡師燕麥奶」，和全台分店數最多的連鎖咖啡通路路易莎和 85 度 C 合作。

陳董事長擔任許多食品領域的演講，國內很多單位聘請他當顧問、委員，在食品界備受肯定。除了愛之味公司，亦擔任台灣第一生化科技股份有限公司董事長、台灣食品科學技術學會理事長、國立臺灣大學食品科技研究所、台灣罐頭食品工業同業公會理事長。2020 年經本會第九屆監事廖怡禎，同時也是愛之味公司食品安全管理所所長的邀請下，愛之味公司加入本協會團體會員，本會於同年 6 月前往第一生技公司拜訪，並召開理監事會議、參觀工廠製程，期望愛之味公司未來能將超臨界流體技術導入新產品開發中。

愛之味股份有限公司

企業簡介

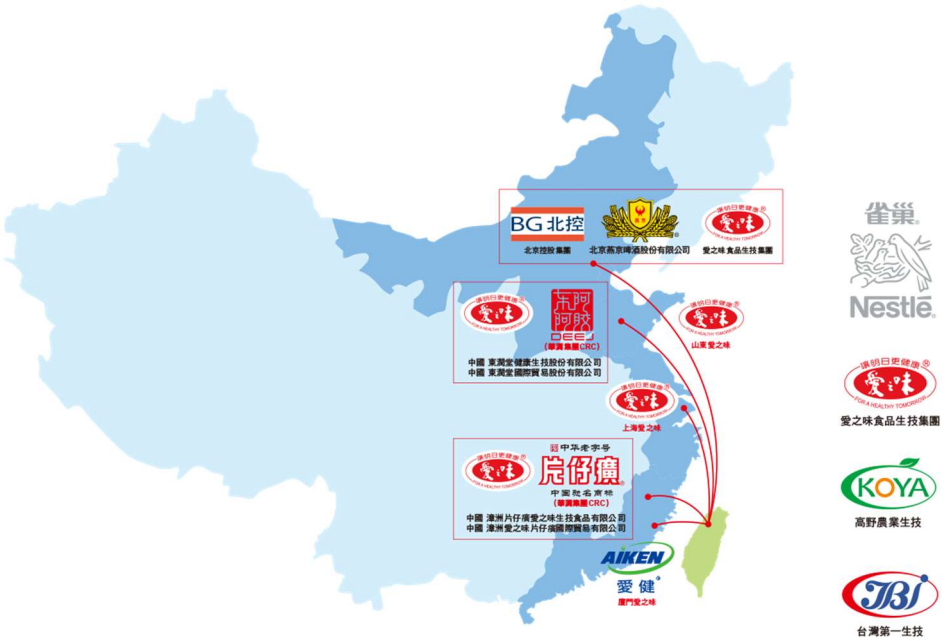
愛之味股份有限公司，創立於 1971 年，提供大眾高品質中華美食，創造領導潮流商品，到專注於抗氧化，預防文明病等預防醫學的研究與開發。生技中心、中央健康科學研究院是愛之味領先業界創造新產品的中心。

近年來愛之味公司著重發展生物科技，全力發展提昇人類生命科學的保健食品。

經營理念

愛之味食品生技集團(AGV)立足台灣近半世紀，一向秉持**「讓明日更健康 FOR A HEALTHY TOMORROW」**的產品宣言，並以極具前瞻性之「樂活環保、綠色健康」之經營理念引導食品潮流、創造消費趨勢。

愛之味食品生技集團(AGV)旗下中央健康科學研究所擁有國內外碩博士人才及世界級尖端檢驗設備，屢獲國內外政府、民間第三方公正單位頒發之專利、認證及獎項：如國家生技醫療品質獎(SNQ)、國家品質標章、健康食品認證、世界品質評鑑大會(Monds Selection Award)金牌獎、世界乳品協會最佳乳飲品獎及最佳新品獎(IDF，The Best New Comer, The Best Dairy Drink)、中國、美國、台灣及世界各國專利(功效、製程)、TFDA/TAF國家級實驗室等多項認證。



多年來愛之味食品生技集團(AGV)在國內業績不但呈倍數成長，近年來更與中國北京控股集團、首都農業集團旗下全球 10 大啤酒品牌之一「燕京啤酒」在兩岸展開合作，亦與中華馳名商標、中華老字號、國家機密配方的「漳州片仔癀、東阿阿膠」(隸屬中國最大投資控股集團華潤公司) 等成為大中華區戰略合作夥伴，積極在大陸市場推出聯合品牌產品，同時於許多省份銷售愛之味品牌的相關產品。

愛之味食品生技集團(AGV)及台灣第一生化科技(TBI)的全方位解決方案與服務，結合雀巢公司傲視全球的品牌價值，持續引領食飲品潮流、創造消費趨勢、期許一起再創食飲品產業新高峰！

無菌冷充填

「愛之味」為了確保消費大眾喝的品質，轉投資全國第一家榮獲國際 ISO22000、HACCP 等國際認證的**「台灣第一生化科技公司」**，是專業的 OEM、ODM 生產工廠，建構與國際接軌與世界同步的科學化、生技化、數位化優勢產銷平台，爲**「愛之味」**產品開發提供堅強厚實的後盾，目前擁有三大廠：保特瓶一廠、保特瓶二廠、健康食用油廠。愛之味麥仔茶就是用這一套全國唯一無菌冷充填所生產的，無菌冷充填才能保持麥仔茶天然的原味！

更能將蕃茄汁的健康營養素- Lycopene 茄紅素完整保留，營養衛生又健康。

愛之味健康科學研究所，運用最新生物科技雙酵微分解技術(Dual Enzyme Hydrolysis)，領先推出保留燕麥營養精華的『純濃燕麥』，口感滑順香醇、自然甘甜，是一款可以隨時隨地、輕鬆方便享用的 100 % 燕麥營養品。

官方網址：愛之味股份有限公司 – 好料多、營養多、愛心多 (agv.com.tw)

TSCFA 台灣超臨界流體協會
Taiwan Supercritical Fluid Association

(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)111/8/30~09/08 18:30~21:30；09/10~09/11 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**，**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 吳小姐繳交一吋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	111 年 08/30~09/11	
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		□公司指派　　□自行參加		
繳費方式	□郵政劃撥　□支票　□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

2022/08/30 (二)	18:30 ~ 21:30
2022/08/31 (三)	18:30 ~ 21:30
2022/09/01 (四)	18:30 ~ 21:30
2022/09/02 (五)	18:30 ~ 21:30
2022/09/05 (一)	18:30 ~ 21:30
2022/09/06 (二)	18:30 ~ 21:30
2022/09/07 (三)	18:30 ~ 21:30
2022/09/08 (四)	18:30 ~ 21:30
2022/09/10 (六)	08:00 ~ 17:00 (實習第 1 組)
2022/09/11 (日)	08:00 ~ 14:00 (實習第 1 組)

An Investigation on Phase Transitions in a Supercritical CO_2 Dry Gas Seal

超臨界 CO_2 乾式密封中的相變研究

by **Cong Zhang**, **Jinbo Jiang**, **Xudong Peng** & **Xuan Zhang**

College of Mechanical Engineering, Zhejiang University of Technology, Hangzhou, 310023, China

Abstract

Dry gas seals with extremely low leakage are the preferred sealing technology in the supercritical carbon dioxide (SCO_2) Brayton cycle. However, dry gas seals are subject to a significant risk of CO2 phase transitions on the seal face, which has yet to be numerically investigated. A comparison study of SCO_2 dry gas seals with two typical inlet temperatures is presented in this paper. The seal clearance, leakage rate, and gas mass fraction under different inlet pressures and inlet temperatures are analyzed, along with further insights into the CO_2 expansion process. Some operating and design considerations for CO_2 dry gas seals to avoid going through the liquid and two-phase states are finally discussed. The results indicate that liquid CO_2 and two-phase CO_2 appear on the seal face when operating near the critical temperature. Vaporization of CO2 always occurs near the inner radius of the seal face. The CO_2 expansion processes can be decomposed into two slowly decreasing stages and a rapidly decreasing stage. The starting point of the rapidly decreasing stage plays an essential role in CO_2 phase transitions. Both low pressure and high temperature help avoid CO_2 on the seal face transitioning to the liquid and two-phase states.

Keywords: Supercritical carbon dioxide, Dry gas seal, Phase transition, Expansion processes

資料來源：https://www.tandfonline.com/doi/abs/10.1080/10402004.2022.2085641

Tribology Transactions >Latest Articles

Antioxidant, Antimicrobial and Antibiofilm Properties of *Glechoma hederacea* Extracts Obtained by Supercritical Fluid Extraction, Using Different Extraction Conditions

不同萃取條件下超臨界流體萃取獲得之*常春藤*提取物 的抗氧化、抗菌和抗生物膜特性

by **Daniela Gwiazdowska** [1,*],**Pascaline Aimee Uwineza** [2],**Szymon Frąk** [1],**Krzysztof Juś** [1],**Katarzyna Marchwińska** [1],**Romuald Gwiazdowski** [3] and **Agnieszka Waśkiewicz** [2]

[1] Department of Natural Science and Quality Assurance, Institute of Quality Science, Poznań University of Economics and Business, Niepodległości 10, 61-875 Poznań, Poland

[2] Department of Chemistry, Poznań University of Life Sciences, Wojska Polskiego 75, 60-625 Poznań, Poland

[3] Research Centre for Registration of Agrochemicals, Institute of Plant Protection-National Research Institute, Władysława Węgorka 20, 60-318 Poznań, Poland

Abstract

Glechoma hederacea var. *longituba* is a herbaceous plant from the *Lamiaceae* family, used in herbal medicine. In this work, we aimed to assess the total phenolic content, antioxidant, antimicrobial and antibiofilm activity of extracts obtained from *G. hederacea* via supercritical dioxide extraction with methanol as a co-solvent under different extraction conditions. The results showed that the activity of the obtained SC-CO_2 extracts is strongly dependent on the extraction temperature. Significantly higher total polyphenol content, as well as antioxidant and antimicrobial activity towards bacteria and yeasts, was observed in the extract obtained at 40 °C, compared to extracts obtained at 50 °C and 60 °C; however, antifungal activity against filamentous fungi was not dependent on the extraction conditions. Antimicrobial activity also depended on the microorganism type. Higher sensitivity was exhibited by Gram-positive bacteria than by Gram-negative bacteria, with *S. aureus* and *P. aeruginosa* being the most sensitive species among each group. The most susceptible fungi were *Candida albicans* and *Sclerotinia sclerotiorum*. The antibiofilm activity was differentiated and depended on the extraction conditions, the microorganism and the method of biofilm treatment. All tested extracts inhibited biofilm formation, with the extract obtained at 40 °C showing the highest value, whereas only extract obtained at 60 °C efficiently removed mature biofilm. **View Full-Text**

Keywords: antioxidant activity; antimicrobial properties; biofilm; *Glechoma hederacea*; plant extracts; supercritical fluid extraction

資料來源：*Appl. Sci.* **2022**, *12*(7), 3572; **https://doi.org/10.3390/app12073572**

Application of the Integrated Supercritical Fluid Extraction–Impregnation Process (SFE-SSI) for Development of Materials with Antiviral Properties

整合超臨界流體萃取-植入工藝 (SFE-SSI) 在開發抗病毒材料的應用

by **Ivana Lukic** [1,*],**Jelena Pajnik** [2],**Jakov Nisavic** [3],**Vanja Tadic** [4],**Erika Vági** [5],**Edit Szekely** [5] and **Irena Zizovic** [6,*]

[1] Faculty of Technology and Metallurgy, University of Belgrade, Karnegijeva 4, Belgrade, Serbia

[2] Innovation Center of the Faculty of Technology and Metallurgy, University of Belgrade, Karnegijeva 4, 11200 Belgrade, Serbia

[3] Faculty of Veterinary Medicine, University of Belgrade, Bulevar Oslobođenja 18, 11000 Belgrade, Serbia [4]

Institute for Medical Plant Research "Dr Josif Pancic", Tadeusa Koscuska 1,Belgrade, Serbia

[5] Department of Chemical and Environmental Process Engineering, Budapest University of Technology and Economics, H-1521 Budapest, Hungary

[6] Faculty of Chemistry, Wroclaw University of Science and Technology, Wybrzeze Wyspianskiego 27, 50-370 Wroclaw, Poland

Abstract

The integrated supercritical fluid extraction–impregnation process (SFE-SSI) was performed to fabricate material with antiviral properties against the herpes simplex virus (HSV). Cotton gauze and starch/chitosan polymer films (SCF) were impregnated with components extracted from *Melissa officinalis* at 10 MPa and 40 °C using a green medium, supercritical carbon dioxide ($scCO_2$). The influences of the processing mode regarding the flow of the supercritical fluid through the system, and the mass ratio of the plant material and the solid carrier, on the impregnation yield of *M. officinalis* extract were studied. The results revealed that the introduction of a fresh amount of CO_2 into the system enabled the highest impregnation yield of 2.24% for cotton gauze and 8.71% for SCF. The presence of *M. officinalis* extract on the surface of both impregnated cotton gaze and SCF was confirmed by FTIR and GC analyses after the re-extraction of the impregnated samples. The *M. officinalis* impregnated materials showed a strong inhibitory effect against Bovine herpesvirus type 1 (BHV-1). **View Full-Text**

Keywords: *Melissa officinalis*; supercritical extraction; supercritical impregnation; antiviral activity

資料來源：*Processes* **2022**, *10*(4), 680; **https://doi.org/10.3390/pr10040680**

Computational Model Development for Hybrid Tilting Pad Journal Bearings Lubricated with Supercritical Carbon Dioxide

超臨界二氧化碳潤滑混合可傾墊軸頸軸承的計算模型開發

by **Syed Muntazir Mehdi** [1] and **Tae Ho Kim** [2,]

[1] Department of Mechanics and Design, Kookmin University, Seoul 02707, Korea

[2] School of Mechanical Engineering, Kookmin University, Seoul 02707, Korea

Abstract:

Fluid film bearings lubricated with supercritical carbon dioxide (sCO_2) eliminate the infrastructural requirement for oil lubricant supply and sealing in turbomachinery for sCO_2 power systems. However, sCO_2's thermohydrodynamic properties, which depend on pressure and temperature, pose a challenge, particularly with computational model development for such bearings. This study develops a computational model for analyzing sCO_2-lubricated tilting pad journal bearings (TPJBs) with external pressurization. Treating sCO_2 as a real gas, the Reynolds equation for compressible turbulent flows solves the pressure distribution using the finite element method, and the Newton−Raphson method determines the static equilibrium position by simultaneously calculating forces, moments, flow rates of externally pressurized sCO_2, and pressure drop due to flow inertia. The finite difference method solves the energy equation for temperature distribution. The density and viscosity of sCO_2 are converged using the successive substitution method. The obtained predictions agree with the previous and authors' computational fluid dynamics predictions, thus validating the developed model. Hybrid lubrication increases the minimum film thickness and stiffness up to 80% and 65%, respectively, and decreases the eccentricity ratio by up to 65% compared to those of pure hydrodynamic TPJB, indicating significant improvement in the load capacity. The bearing performance is further improved with increasing sCO_2 supply pressure. **View Full-Text**

Keywords: tilting-pad journal bearing; hybrid lubrication; supercritical carbon dioxide; load capacity

資料來源：*Appl. Sci.* **2022**, *12*(3), 1320; **https://doi.org/10.3390/app12031320**

Static and Rotordynamic Characteristics for Two Types of Novel Hole-Pattern Seals Operating in Supercritical CO_2 Turbomachinery

在超臨界 CO_2 渦輪機械 中運行的兩種新型孔型密封件的靜態和轉動力學特性

by **Zhigang Li**, **Zhuocong Li**, **Jun Li**, **Zhenping Feng**

Institute of Turbomachinery, School of Energy & Power Engineering, Xi'an Jiaotong University, Xi'an 710049, China

Abstract

In this paper, two novel hole-pattern seals were assessed for applications at the balance piston in a 14 MW supercritical CO_2 turbine, focusing on the improvement of the seal leakage and rotordynamic performances. These two novel hole-pattern seals were derived from the conventional straight-through hole-pattern seal (HPS) with the same sealing clearance, diameter, axial length, hole diameter and depth, including a stepped hole-pattern damper seal (SHPS) and a grooved hole-pattern damper seal (GHPS). To enhance the seal net damping capability at high inlet preswirl condition, a straight swirl brake also was designed and employed at seal entrance for each type seal. A comprehensive assessment and comparison was conducted on the conventional HPS and the present two novel hole-pattern seals (SHPS and GHPS) with a static concentric rotor. The leakage flow rates, rotordynamic force coefficients, cavity pressure, and swirl velocity developments were analyzed for three hole-pattern seal designs with/without swirl brakes at two inlet preswirl ratios (0.1, 0.5), using a transient computational fluid dynamics (CFD)-based perturbation method based on the multiple-frequency elliptical-orbit rotor whirling model and the mesh deformation technique. To take into account of real gas effect with high accuracy, a table look-up procedure based on the National Institute of Standards and Technology (NIST) database was implemented, using an in-house code, for the fluid properties of CO_2 in both supercritical and subcritical conditions. Results show that the present two novel hole-pattern seals have better sealing capability, especially for the GHPS seal which leaks less by a factor of 44%. In general, the GHPS seal possesses the lowest positive effective stiffness, highest effective damping, and the lowest crossover frequency of 60–70 Hz, especially at high inlet preswirl case. From a viewpoint of the rotor stability and unbalance sensitivity analysis, the GHPS seal without entrance swirl brake is a better seal design scheme for the balance piston seal in sCO_2 turbine.

資料來源：*J. Eng. Gas Turbines Power*. Jul 2022, 144(7): 071006 (14 pages)

Paper No: GTP-21-1636 https://doi.org/10.1115/1.4054374

Supercritical Fluid Application in the Oil and Gas Industry: A Comprehensive Review

超臨界流體在石油和天然氣行業的應用：綜合回顧

by **Praskovya L. Pavlova** [1,*], **Andrey V. Minakov** [1,2,3], **Dmitriy V. Platonov** [1], **Vladimir A. Zhigarev** [1] and **Dmitriy V. Guzei** [1]

[1] Institute of Oil and Gas, Siberian Federal University, 660041 Krasnoyarsk, Russia

[2] Department of Thermophysics, Siberian Federal University, 660041 Krasnoyarsk, Russia

[3] Kutateladze Institute of Thermophysics, SB RAS, 630090 Novosibirsk, Russia

Abstract

The unique properties of supercritical fluid technology have found wide application in various industry sectors. Supercritical fluids allow for the obtainment of new types of products with special characteristics, or development and design of technological processes that are cost-effective and friendly to the environment. One of the promising areas where supercritical fluids, especially carbon dioxide, can be used is the oil industry. In this regard, the present review article summarizes the results of theoretical and experimental studies of the use of supercritical fluids in the oil and gas industry for supercritical extraction in the course of oil refining, increasing oil recovery in the production of heavy oil, hydraulic fracturing, as well as processing and disposal of oil sludge and asphaltenes. At the end of the present review, the issue of the impact of supercritical fluid on the corrosion of oil and gas equipment is considered. It is found that supercritical fluid technologies are very promising for the oil industry, but supercritical fluids also have disadvantages, such as expansion or incompatibility with materials (for example, rubber). **View Full-Text**

Keywords: supercritical fluid; enhanced oil recovery; carbon dioxide; supercritical extraction; oil recovery; oil sludge; hydraulic fracturing; asphaltenes; equipment corrosion

資料來源：*Sustainability* **2022**, *14*(2), 698; **https://doi.org/10.3390/su14020698**

Thermophysical Analysis of Microconfined Turbulent Flow Regimes at Supercritical Fluid Conditions in Heat Transfer Applications

傳熱應用中超臨界流體條件下微約束渦流狀態的熱物理分析

by **Marc Bernades**, **Lluís Jofre**

Department of Fluid Mechanics, Technical University of Catalonia, Barcelona 08019, Spain

Abstract

The technological opportunities enabled by understanding and controlling microscale systems have not yet been capitalized to disruptively improve energy processes, especially heat transfer and power generation. The main limitation corresponds to the laminar flows typically encountered in microdevices, which result in small mixing and transfer rates. This is a central unsolved problem in the thermal–fluid sciences. Therefore, this work focuses on analyzing the potential of supercritical fluids to achieve turbulence in microconfined systems by studying their thermophysical properties. In particular, a real-gas thermodynamic model, combined with high-pressure transport coefficients, is utilized to characterize the Reynolds number achieved as a function of supercritical pressures and temperatures. The results indicate that fully turbulent flows can be attained for a wide range of working fluids related to heat transfer applications, power cycles and energy conversion systems, and presenting increment ratios of O(100)O(100) with respect to atmospheric (subcritical) thermodynamic conditions. The underlying physical mechanism to achieve relatively high Reynolds numbers is based on operating within supercritical thermodynamic states (close to the critical point and pseudo-boiling region) in which density is relatively large while dynamic viscosity is similar to that of a gas. In addition, based on the Reynolds numbers achieved and the thermophysical properties of the fluids studied, an assessment of heat transfer at turbulent microfluidic conditions is presented to demonstrate the potential of supercritical fluids to enhance the performances of standard microfluidic systems by factors up to approximately 50×50×.

資料來源：*J. Heat Transfer*. Aug 2022, 144(8): 082501 (12 pages)

Paper No: HT-21-1881 https://doi.org/10.1115/1.4054554