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

電子報第 206 期

活動訊息

- ***論文徵稿***

  即日起徵求「能源與綠色製程」、「食品與生技醫藥」、「淨零碳排與精密製造」等3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://www.tscfa.org.tw/ec99/rwd1480/news.asp?newsno=43

- **19 TH ISSF, (European Meeting on Supercritical Fluids EMSF)**

  日期：**MAY 26-29, 2024**

  地點：MARIBOR, SLOVENIA

  CHAIR：ZELJKO KNEZ, SLOVENIA

  Scientific Meetings – ISASF (supercriticalfluidsociety.net)

- **2024 臺灣國際生技製藥設備展/台北國際食品加工機械展**

  日期：**6月26日(三)~6月29日(六)**

  地點：台北南港展覽館1館&2館

  https://www.foodtech.com.tw/zh-tw/index.html

- ***2024 亞洲美容保養．生技保健大展 - 亞洲生技大展系列活動***

  日期：**7月25日(四)~7月28日(日)**

  地點：台北南港展覽館1館1樓&4樓

  ★協會有一攤位，免費提供會員張貼海報(尺寸A0為佳)及擺放DM！！！

  https://www.chanchao.com.tw/healthcos/

- ***第23屆超臨界流體技術應用與發展研討會暨113年度會員大會***

  時間：2024年**10月18日(五)**

  地點：高雄蓮潭國際會館R102會議室

- ***14 th ISSF(International Symposium on Supercritical Fluids)& 9th ISHA (International Solvothermal and Hydrothermal Association Conference)***

  日期：**JUNE 15-20, 2025**

  地點：Bali, Indonesia

  CHAIR：JAEHOON KIM, SOUTH KOREA

  Scientific Meetings – ISASF (supercriticalfluidsociety.net)

淨零永續

- 產業節能減碳資訊網 INDUSTRIAL ENERGY SAVING AND CARBON REDUCTION INFORMATION WEB

  https://ghg.tgpf.org.tw/

- 淨零永續學校
  https://college.itri.org.tw/nzschool/

團體會員介紹

- 綠茵生技股份有限公司

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 06/25~07/07
- (日間班)高壓氣體特定設備操作人員安全衛生教育訓練班 07/01~07/05

技術文摘

- Estimates of the Modular Underwater SNPP Option (模組化水下小型核電廠方案的估算)
- Experimental Investigation of Liquid, Supercritical CO_2, CH_4, and CO_2/CH_4 Mixture to Improve Oil Recovery (液體、超臨界 CO_2、CH_4 和 CO_2/CH_4 混合物提高原油採收率 的實驗研究)
- Integrated Aerodynamic and Mechanical Design of a Large-Scale Axial Turbine Operating With A Supercritical Carbon Dioxide Mixture (使用超臨界二氧化碳混合物運行的大型軸流式渦輪機的氣動和機械整合設計)
- Loss Analysis in Radial Inflow Turbines for Supercritical CO_2 Mixtures(超臨界 CO_2 混合物於徑向流渦輪機的損失分析)
- Performance Prediction and Heating Parameter Optimization of Organic-Rich Shale In Situ Conversion Based on Numerical Simulation and Artificial Intelligence Algorithms (基於數值模擬和人工智慧演算法的富有機質頁岩原位轉化性能預測與加熱參數優化)
- Supercritical CO_2 extraction of lavender flower with antioxidant activity: Laboratory to a large scale optimization process (以超臨界二氧化碳萃取薰衣草花抗氧化活性成份：從實驗室到量產優化過程)

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

第二十三屆
超臨界流體技術應用與發展研討會

論文徵稿

發表日期｜113年10月18日（五）

申請收件截止日期｜113年9月10日(二)

審核結果通知日期｜113年9月20日(五)

發表地點｜蓮潭國際會館R102會議室
(高雄市左營區崇德路801號)

論文主題

- 能源與綠色製程
- 食品與生技醫藥
- 淨零碳排與精密製造

聯絡資訊：
台灣超臨界流體協會 吳家瑩小姐　專線：(07)355-5706　投稿信箱：tscfa@mail.mirdc.org.tw
協會網址：https://www.tscfa.org.tw/

主辦單位｜TSCFA 台灣超臨界流體協會

綠茵生技股份有限公司

企業簡介

綠茵生技成立於 2012 年，為國際生技食品原料研發生產大廠。綠茵生技為綠茵集團母公司，旗下有國外獨家品牌保健食品原料代理康普森生技與 ODM 產品研發設計代工之鋒揚生醫。

綠茵生技研發具台灣特色與國際競爭力之保健原料，並提供專業一站式客製化代工服務，替客戶打造高功效與市場差異化保健品。

綠茵目前每年服務數百位國內、外客戶，已成功打造上千款熱銷產品，並透過專業營養師與行銷團隊替客戶加值品牌產品競爭力。

綠茵獲得多項國際食品品質系統認證包含 FSSC 22000、ISO 22000、HACCP、TQF、GMP、HALAL 與 ISO/IEC 17025 認證實驗室等認證。

經營理念

主要有二：

- 突破現今生技原料市場中，具市場高度需求、但至今生物科技仍未能達到的技術與產品
- 整合台灣在國際上領先的技術與產品，使其得以獲國際主流市場的廣泛接受

綠茵生技以「創新研發」、「精準優化」、「整合行銷」作為三大經營發展主軸，整合全球「產」、「經」、「學」、三方資源，運用豐富的市場營銷經驗、長期的產學合作機制、堅實的技術研發團隊，洞悉市場需求與投入研究計畫，將研發成果快速產業化。

精準計算與持續優化「規格、成本、數據」，達到出口國際主流市場的五大條件：**「國際認證」、「臨床試驗」、「全球專利」、「超越規格」、「合宜價格」**，提供客戶高 CP 值的產品與服務。

生產基地

綠茵生技目前有兩座生產基地，綠茵一廠於 2013 年通過政府審核，獲准設立于知名的創新產業孵化基地-臺灣中部科學園區，廠房內部設有大型的現代化真菌培養中心生產專利固態培養牛樟芝菌絲體。綠茵二廠於 2017 年落成於台中工業園區，專職生產苦瓜胜肽、蔬果酵素、納豆激酶等生技保健產品。

綠茵生技一廠

綠茵生技二廠

研發中心

集合國內醫學、生物科技、食品領域頂尖學者專家，組成實力堅強的綠茵研發團隊，以獨家專利技術、專屬菌種篩選平臺、現代化真菌培養中心、尖端發酵科技、優異水解工藝、超效能無毒環保萃取制程等，達成高機能成分、高生物利用率、高食用安全的保健原料。

多數原料皆以科學化驗證功效，包含動物試驗、人體實驗以佐證產品功效，並充分整合運用生技研究資源，共創生技原料新價值，並向全球市場邁進。

廠區認證

綠茵生技高規格廠商並已通過**TQF、ISO22000、FSSC22000、HACCP、HALAL**等國際標準認證，提供客戶最安心的保證。

臺灣優良食品驗證制度(TQF)

清真認證 HALAL

食品安全系統驗證

食品安全衛生管理驗證

危害分析重要管制點

FSSC22000 **ISO22000** **HACCP**

獲獎與榮耀

- 囊括世界三大發明展金牌、銀牌及特別獎大獎
- 國家發明獎、專利獎與生技大獎

德國紐倫堡 瑞士日內瓦 美國匹茲堡

發明展 發明展 發明展

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)06/25~7/04 18:30~21:30；07/06~7/07 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	113 年 06/25~07/07	
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

2024/06/25 (二)	18:30 ~ 21:30
2024/06/26 (三)	18:30 ~ 21:30
2024/06/27 (四)	18:30 ~ 21:30
2024/06/28 (五)	18:30 ~ 21:30
2024/07/01 (一)	18:30 ~ 21:30
2024/07/02 (二)	18:30 ~ 21:30
2024/07/03 (三)	18:30 ~ 21:30
2024/07/04 (四)	18:30 ~ 21:30
2024/07/06 (六)	08:00 ~ 17:00 (實習第 1 組)
2024/07/07 (日)	08:00 ~ 14:00 (實習第 1 組)

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

(日間班)高壓氣體特定設備操作人員安全衛生教育訓練班

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●上課日期：**113/07/01~07/03 08:00~17:00**；**07/04~07/05 08:00~17:00(實習)**

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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	113 年 07/01~07/05	
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

2024/07/01 (一)	08:00 ~ 17:00
2024/07/02 (二)	08:00 ~ 17:00
2024/07/03 (三)	08:00 ~ 17:00
2024/07/04 (四)	08:00 ~ 17:00 (實習第 1 組)
2024/07/05 (五)	08:00 ~ 14:00 (實習第 1 組)

Estimates of the Modular Underwater SNPP Option

模組化水下小型核電廠方案的估算

By **Vladimir V. Romanov; Yury V. Lunchev; Mikhail M. Kaverznev; Vladislav V. Romanov**

Nuclear Power Plant Departament, National Research University “MPEI”, Moscow, Russian

Abstract

One of the most promising and growing areas in nuclear energy today is low-power nuclear power plants (LPNPs), what is caused by the inherent features of this area. But technical solutions used in the state of the art NPP designs do not allow to create a single ready-to-use fabricated module in transport dimensions, so it requires separate delivery of the reactor, turbine and other equipment and causes a significant amount of construction and installation work on site. This approach, due to «economies of scale», does not allow to create a cheap source of energy. The purpose of this work is to carry out calculations of an alternative NPP design based on the socalled «nuclear battery» approach or «Vinogradov scheme» –a single module that contain main equipment of the nuclear power plant (reactor, turbine, generator, heat regeneration system and condenser). There was considered a fast reactor with 125 MW thermal power with a lead coolant, parameters of the primary circuit are similar to BREST reactor (inlet/outlet coolant temperature −420/540°C) and supercritical Brayton cycle on carbon dioxide (initial/final pressure 20.0/8.0 MPa, initial/final temperature of the cycle 520/390 ^{0} C) with single-stage regeneration. Received results confirm the possibility of creating a single-module SMR with the following parameters: electrical power −32 MW, efficiency −25.6%, housing length of the module −18.7 m, housing diameter 4.3 m, weight −900-950 tons, fuel lifetime −1080 days.

Keywords: Nuclear power plant, NPP, small nuclear power plant, SNPP, small modular reactor, SMR, Brayton cycle, supercritical cycle, carbon dioxide, CO_2

資料來源：https://ieeexplore.ieee.org/abstract/document/10479801

Experimental Investigation of Liquid, Supercritical CO_2, CH_4, and CO_2/CH_4 Mixture to Improve Oil Recovery

液體、超臨界 CO_2、CH_4 和 CO_2/CH_4 混合物提高原油採收率的實驗研究

By **Khaled Enab; Thomas Elizondo; Youssef Elmasry; Leonel Flores; Alfred Addo-Mensah**

Department of Biology & Chemistry Program, Texas A&M International University, Laredo, Texas, USA

Abstract

This study investigates the efficiency of injecting CO_2 and CH_4 in improving oil production from black oil reservoirs. While prior research highlights the effectiveness of these gases in enhancing oil recovery factors, comparing their performance in bulk interaction to their performance in the porous medium is scarce. Furthermore, the impact of the physical state of the injected CO_2—liquid, gas, or supercritical— on oil extraction mechanisms still needs to be explored. Hence, our study aims to bridge this gap through a comprehensive experimental analysis of gas-oil interactions in the bulk phase and within porous media. The bulk gas-oil interactions were investigated using a visual Pressure Volume Temperature (PVT) cell.

In contrast, the gas-oil interaction within the porous media was investigated using a coreflooding experimental approach. The proposed investigation is designed to evaluate the influence of the permeability on the gas-oil interactions and the effect of the physical state of the injected fluid —liquid, gas, or supercritical — on the gas miscibility in oil. Since viscosity reduction and oil swelling are the primary mechanisms for miscible gas Enhanced Oil Recovery (EOR), this study focuses on the efficiency of different injected gases and the physical state of CO_2 on the swelling factor, saturation pressure alternation, and viscosity reduction. The swelling factor and saturation pressure curves were measured when different molecular percentages of gas above the minimum miscible pressure were mixed with oil. The viscosity reduction effect was calculated by comparing the viscosity of the oil produced from the coreflooding experiment to the viscosity of the original oil. The oil minimum miscible pressure (MMP) of each considered gas in the oil sample was determined based on the oil composition determined by Gas Chromatography (GC) analysis.

The results showed that the CO_2/CH_4 mixture outperformed CO_2 liquid, supercritical, and CH_4 in coreflooding experiments. Additionally, the coreflooding experiments proved liquid CO_2 (Cold) performed better in improving oil recovery than

supercritical CO_2. However, the bulk PVT analysis revealed a higher swelling factor for supercritical than liquid CO_2, which suggests supercritical CO_2 outperforms other gases, including cold CO_2. In contrast, the viscosity of the produced oil when supercritical CO_2 was injected was lower than that of all other gases. The observed variation in CO_2 performance indicates the significant role of CO_2 physical state of CO_2 in the oil extraction mechanism. The conclusion of this study provides a better understanding of the performance of different gas injection strategies in conventional reservoirs, which brings insights into optimizing gas injection into depleted oil reservoirs that contain dead oil.

Keywords: fluid dynamics, gas injection method, geochemistry, geologist, pvt measurement, geological subdiscipline, equation of state, co 2, climate change, ch 4

資料來源：https://doi.org/10.2523/IPTC-24523-MS

Integrated Aerodynamic and Mechanical Design of a Large-Scale Axial Turbine Operating With A Supercritical Carbon Dioxide Mixture

使用超臨界二氧化碳混合物運行的大型軸流式渦輪機的氣動和機械整合設計

By **Abdelrahman Abdeldayem, Andrea Paggini, Tommaso Diurno, Claudio Orazi, Martin White, Marco Ruggiero, Abdulnaser Sayma**

Energy, Sustainability and Net-zero Research Centre, School of Science and Technology, City, University of London, London EC1V 0HB, UK

Abstract

In this paper, the design of a large-scale axial turbine operating with supercritical carbon dioxide (sCO2) blended with sulfur dioxide (SO2) is presented considering aerodynamic and mechanical design aspects as well as the integration of the whole turbine assembly. The turbine shaft power is 130 MW, designed for a 100 MWe concentrated-solar power plant with turbine inlet conditions of 239.1 bar and 700 °C, total-to-static pressure ratio of 2.94, and mass-flow rate of 822 kg/s. The aerodynamic flow path, obtained in a previous study, is first summarized before the aerodynamic performance of the turbine is evaluated using both steady-state and unsteady three-dimensional numerical models. Whole-annulus unsteady simulations are performed for the last turbine stage and the exhaust section to assess the unsteady loads on the rotor due to downstream pressure field distortion and to assess the aerodynamic losses within the diffuser and exhaust section. The potential low engine order excitation at the last rotor stage natural frequency modes due to downstream pressure distortion is assessed. The design of the turbine assembly is constrained by current manufacturing capabilities and the properties of the proposed working fluid. High-level flow-path design parameters, such as pitch diameter and number of stages, are established considering a trade-off between weight and footprint, turbine efficiency, and rotordynamics. Rotordynamic stability is assessed considering the high fluid density and related cross coupling effects. Finally, shaft end sizing, cooling system design, and the integration of dry gas seals are discussed.

Keywords: axial turbine, sCO_2 mixtures, exhaust section, rotordynamics, thermal analysis, aeromechanical integration

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Loss Analysis in Radial Inflow Turbines for Supercritical CO_2 Mixtures

超臨界 CO_2 混合物於徑向流渦輪機的損失分析

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Abstract

Recent studies suggest that CO_2 mixtures can reduce the costs of concentrated solar power plants. Radial inflow turbines (RIT) are considered suitable for small to medium-sized CO_2 power plants (100 kW to 10 MW) due to aerodynamic and cost factors. This paper quantifies the impact of CO_2 doping on RIT design by comparing 1D mean-line designs and aerodynamic losses of pure CO_2 RITs with three CO_2 mixtures: titanium tetrachloride ($TiCl_4$), sulfur dioxide (SO_2), and hexafluorobenzene (C_6F_6). Results show that turbine designs share similar rotor shapes and velocity diagrams for all working fluids. However, factors like clearance-to-blade height ratio, turbine pressure ratio, and fluid viscosity cause differences in turbine efficiency. When normalized for these factors, differences in total-to-static efficiency become less than 0.1%. However, imposing rotational speed limits reveals greater differences in turbine designs and efficiencies. The imposition of rotational speed limits reduces total-to-static efficiency across all fluids, with a maximum 15% reduction in 0.1 MW CO_2 compared to a 3% reduction in CO_2/$TiCl_4$ turbines of the same power. Among the studied mixtures, CO_2/$TiCl_4$ turbines achieve the highest efficiency, followed by CO_2/C_6F_6 and CO_2/SO_2. For example, 100 kW turbines achieve total-to-static efficiencies of 80.0%, 77.4%, 78.1%, and 75.5% for CO_2/$TiCl_4$, CO_2/C_6F_6, CO_2/SO_2, and pure CO_2, respectively. In 10 MW turbines, efficiencies are 87.8%, 87.3%, 87.5%, and 87.2% in the same order.

Keywords: radial inflow turbine, CO2 mixtures, transcritical CO2 cycles, turbine aerodynamic design, loss analysis

資料來源：https://doi.org/10.1115/1.4064193

Performance Prediction and Heating Parameter Optimization of Organic-Rich Shale In Situ Conversion Based on Numerical Simulation and Artificial Intelligence Algorithms

基於數值模擬和人工智慧演算法的富有機質頁岩原位轉化性能預測與加熱參數優化

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Abstract

In situ conversion technology is a green and effective way to realize the development of organic-rich shale. Supercritical CO2 can be used as a good heating medium for shale in situ conversion. Numerical simulation is an important means to explore the shale in situ conversion process, but it requires a lot of time and computational cost for in situ conversion simulation under different working conditions. Therefore, a computational framework for rapid prediction of shale in situ conversion development performance and heating parameter optimization is proposed by coupling artificial neural network (ANN) and particle swarm optimization (PSO). The results indicated that kerogen pyrolysis and hydrocarbon product release mainly occurred within 2 years of shale in situ conversion. The production curves of pyrolysis hydrocarbon obviously slowed after in situ conversion for 2 years. The database was constructed by a large number of in situ conversion simulations, and Pearson correlation analysis and the random forest method were adopted to obtain seven main controlling factors affecting reservoir temperature and hydrocarbon production. The determination coefficient of the obtained ANN-based prediction models is higher than 97%, and the mean square error (MSE) is lower than 0.3%. The basic reservoir case can choose to inject 350–450 °C supercritical CO2 (Sc-CO2) fluid with a rate of 600 m3/day to obtain a more promising development effect. The heating parameter optimization for three typical reservoir cases using PSO was performed, and reasonable injection temperature and injection rate were obtained. It realized accurate development prediction and rapid heating parameter optimization, which helps the effective application of shale in situ conversion development design.

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Supercritical CO_2 extraction of lavender flower with antioxidant activity: Laboratory to a large scale optimization process

以超臨界二氧化碳萃取薰衣草花抗氧化活性成分：從實驗室到量產優化過程

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Abstract

Background

The volatile compounds that comprise lavender essential oils, including linalool and linalyl acetate, have demonstrative therapeutic properties. The supercritical CO_2 extraction ($scCO_2$) has demonstrated efficiency and selectivity for the extraction of essential oils from vegetable matrices.

Methods

The solubility of lavender essential oil in $scCO_2$ was determined using a high-pressure variable-volume and modeled by semiempirical models. Supercritical extraction was carried out at a pressure of 180, 250 and 300 bar and a temperature of 40–60 °C, with and without cosolvents. kinetic curve has been modeled by broken and intact cells model developed by Sovová. The composition of the extracts was evaluated through GC–MS and their antioxidant activity by the DPPH method.

Findings

The highest values of oil solubility and extraction yield were obtained at 250 bar and 60 °C. Furthermore, the extraction yield increases significantly with the addition of ethanol as a co-solvent (0.2 % v/v). A complete set of equilibrium data and kinetic parameters has been reported on a large scale for the first time. The dominant components identified in the extract were linalool and linalyl acetate, and the extracts showed very satisfactory results for antioxidant capacity. Compared with traditional methods like Soxhlet extraction, the supercritical extracts were determined to be more interesting for the formulation of nutraceutical products or biomedical applications.

Keywords: Lavender essential oil, Supercritical CO_2, Solubility, Antioxidant, Large scale extraction

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