

ACHIEVEMENTS

Backpack-Sized Biodiesel System Offers New Model for Energy Resilience

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「能源界超商咖啡機」：微反應器連續式生質柴油生產系統

分散式生產優勢與技術核心

- 廢食用油或植物油 (cooked oil / vegetable oil)
- 醇類 (Alcohols)
- 分散式能源供應
- 戰備燃料來源
- 全自動連續式製程



生質柴油 (FAME) 甘油 (Glycerol)

創新分離技術，無須能耗即可穩定分離產物。也可使用非食用油進行生產，不與民爭糧。

綠色效能、永續指標與佈署藍圖



↑91.14% 高產產率 36% 節水量與低碳足跡

酸價(0.214-mg KOH/g) 遠低於CNS15072國家標準。

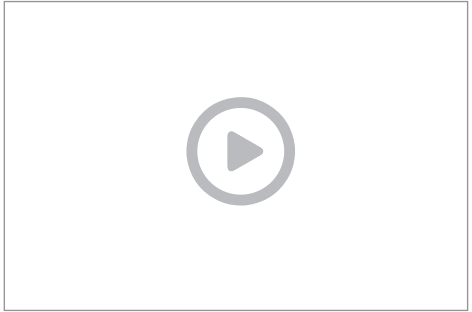
生命週期評估(LCA)證實，大幅減少水資源浪費並降低碳排。

生命週期評估 (LCA) 比較		
	連續式微反應系統 (SC-1)	傳統批次系統 (SC-2)
總電力消耗 (每公斤)	✓ 1.316 kWh	3.35 kWh
用水量 (每公斤)	✓ 0.18 m ³	0.28 m ³
全球暖化潛勢 (CO ₂ eq.)	✓ 7.79 kg	8.05 kg

The "Helix Wire Liquid-Liquid Phase Separator" system.

As global energy instability intensifies, researchers at National Taiwan University have developed a portable biodiesel fuel production system compact enough to fit inside a backpack — a breakthrough that could significantly accelerate emergency energy access in disaster zones and remote regions.

Led by Prof. Ya-Yu Chiang at National Taiwan University's (NTU) Department of Mechanical Engineering, the research team created what they describe as an "Energy Espresso Machine": a rapid-deployment system capable of producing high-quality biodiesel from waste oil and non-edible crops. The project, spotlighted as the cover story of *Green Chemistry* in November 2025, was developed in collaboration with Prof. Yi-Chun Chen's team at National Chung Hsing University (NCHU) and Prof. Penjit Srinophakun's team at Kasetsart University (KU) in Thailand.



Introducing the Portable Fuel-Power Backpack.

The heart of the technology is the world's first "Helix Wire Liquid-Liquid Phase Separator," which enables continuous purification of viscous liquids in micro-scale environments. Using precise Laplace pressure control, the system produces a biodiesel yield of 91.14 percent, with fuel quality surpassing Taiwan's CNS 15072 standards and compatible with existing diesel engines.

Sustainability is hardcoded into the system's design. Detailed Life Cycle Assessments (LCA) demonstrate that this continuous-flow process conserves 35 percent more water and maintains a significantly lower carbon footprint than conventional batch manufacturing methods. In partnership with NCHU, the researchers also converted crude glycerin byproducts into flexible polyurethane foam, further advancing the circular economy approach.

Prof. Chiang remarked that the system was designed to strengthen decentralized energy resilience, particularly for off-grid communities, remote islands, and emergency response scenarios where fuel access may be disrupted.



The demonstration of a portable Fuel-Power Backpack system.



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