綠色生物柴油催化劑
Catalyst for Green Biodiesel Production from Unrefined Feedstock

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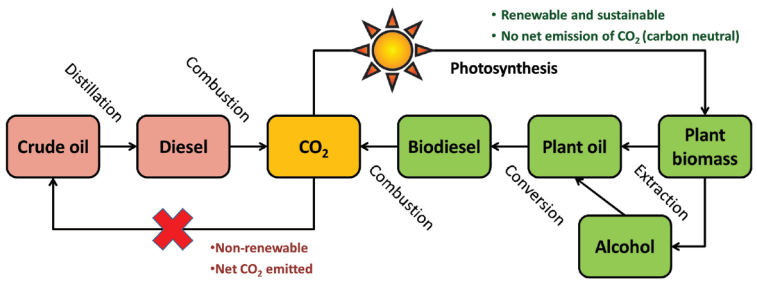
能將廢油以單一環保工序轉化成生物柴油的長效催化劑
A durable catalyst developed for green biodiesel production from low grade feedstock through one-step catalysis

以植物油製成的生物柴油是可再生能源之一，唯因生產過程複雜及成本高昂，一直未被廣泛採用。由於傳統液體催化劑只能把高純度的植物油轉化為生物柴油，故此原油及廢油必須加入強酸或強鹼進行淨化，方可用作生物柴油的原料。而由此轉化的生物柴油必須以大量清水去除強酸及強鹼，因而產生大量污水。有見及此，理大的研究團隊研發出一種有高活性及長壽的新型綠色生物柴油固體催化劑。它的特點是能於較低溫及較低壓的環境下，把未經淨化的廢油變為柴油，而且過程中不會產生污水，遂令生產能耗及成本大幅減少。



生物柴油的來源及其優點
Origin of biodiesel and its advantages over fossil fuel

專利申請編號及國家: :62/138,963 (美國), 15/078,558(美國) and PCT/IB2016/051653 (PCT)

特色與優點

- 以單一環保工序將廢油轉化成生物柴油
- 免卻清水洗滌程序，故不會產生污水
- 可在較低的溫度和壓力下進行合成，從而降低能耗及成本
- 壽命長，可重用率高

應　用

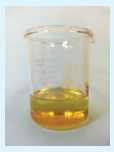
此催化劑乃專為含高量游離脂肪酸和水的廢油而設計，其單一生產工序免卻洗滌提純的步驟，從而合成更環保的生物柴油。為進一步增加可持續性，生產原料中有毒的甲醇可以乙醇或丙醇替代。

獎　項

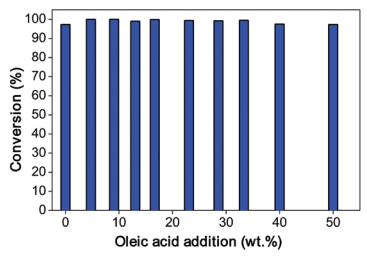
- 第43屆瑞士日內瓦國際發明展 - 金獎 (2015年4月)
- 第43屆瑞士日內瓦國際發明展 - 泰國國家研究評議會國際最佳發明特別大獎 (2015年4月)

新研發的催化劑
The newly developed catalyst

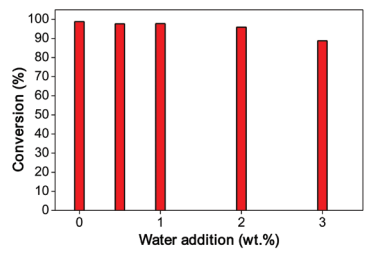
傳統的液體催化劑不能直接使用在廢油的生物柴油反應中
Biodiesel made from free fatty acid rich oil using traditional biodiesel catalyst with soap and gum formation



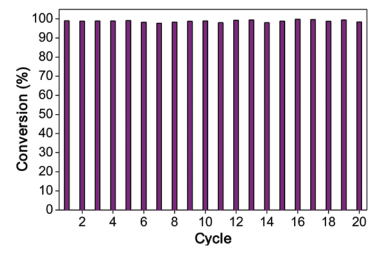
新型的固體催化劑能直接使用在廢油的生物柴油反應中
Biodiesel made from free fatty acid rich oil using one-step solid catalyzed reaction without forming soap and gum



新型催化劑對游離脂肪酸的相容性
Graph showing the new catalyst's excellent compatibility towards free fatty acid present in the oil



新型催化劑對水的高相容性
Graph showing the new catalyst's excellent compatibility towards water present in the oil



新型催化劑對廢油的耐久性
Graph showing the new catalyst's excellent durability towards biodiesel synthesis of unrefined low grade oil

Alcohol	Conversion (%)	
	Without FFA addition	With FFA addition
Methanol	97.3	98.6
Ethanol	84.1	90.1
1-Propanol	70.5	82.0
1-Butanol	65.5	76.5

催化劑對各種醇類化合物的催化性能
The catalytic performance of the one-step simultaneous biodiesel synthesis of the catalyst towards various alcohols

Biodiesel is a renewable liquid fuel originated from biomass, but it is not widely used because of its complicated production process and high cost. Since conventional liquid catalyst can only convert plant oil in its purest form into biodiesel, raw plant oil must be purified by adding strong acid or alkali before it can be used. To remove the added acid/alkali, the biodiesel must undergo a purification procedure which generates a huge amount of waste water. Therefore, PolyU has developed a new class of solid catalyst for biodiesel production. This new catalyst has excellent adaptability to low grade unrefined feedstock like waste cooking oil, and no waste water is created during the production process. In addition, it operates at significantly lower temperatures and pressures due to its high catalytic activity, which can reduce cost and energy consumption.

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Special Features and Advantages

- One-step biodiesel production from low grade unrefined feedstock
- No washing with fresh water required for biodiesel produced
- Operates at low temperatures and pressures which can reduce cost and energy consumption
- The catalyst demonstrates excellent reusability and robustness

Applications

This new catalyst is designed for one-step energy saving biodiesel synthesis from low grade unrefined feedstock containing high free fatty acid and water content with no post-production washing required. Toxic methanol used can also be replaced by ethanol or propanol which makes the process more sustainable.

Awards

- Gold Medal - 43rd International Exhibition of Inventions of Geneva, Switzerland (April 2015)
- Thailand Award for Best International Invention from The National Research Council of Thailand - 43rd International Exhibition of Inventions of Geneva, Switzerland (April 2015)

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