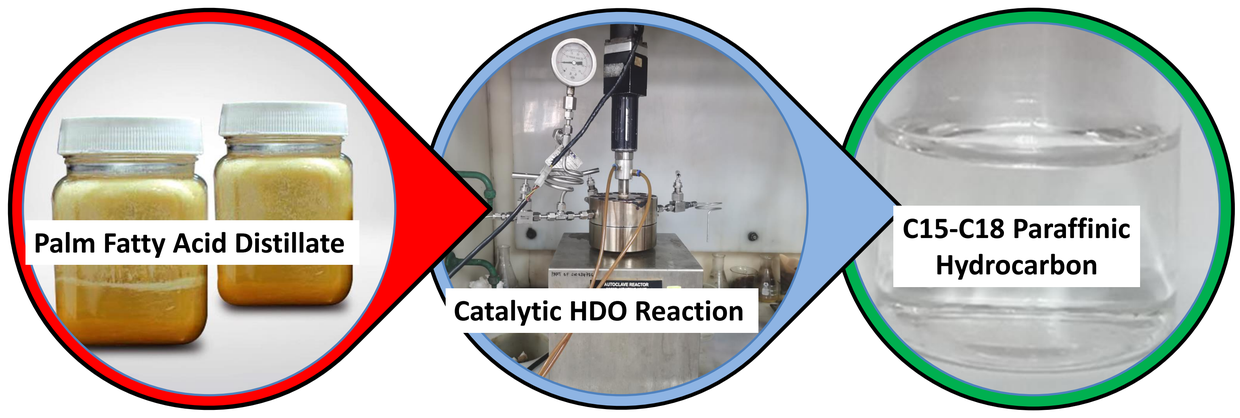
Heterogenous Catalyst for Preparing Green Diesel by
Hydrodeoxygenation (HDO) Reaction of Fatty Acids Feedstock

PATENT NO. PI 2022007531



This invention relates to a method of developing a highly stable and efficient heterogeneous catalyst to convert vegetable oils, animal fats, waste cooking oil, and fatty acids feedstock into a green-diesel range paraffinic hydrocarbons product via hydrodeoxygenation (HDO) reaction.

CURRENT ISSUES

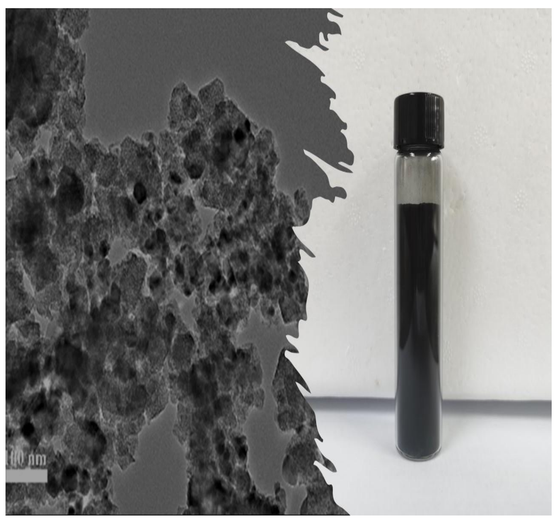
- Growing demand and hiking feedstock prices are forecasted as major obstacles in biofuel development to reduce the dependency on conventional fossil fuels.
- Low qualify of contemporary biofuels such as biodiesel(fatty acid methyl ester) that consists of a significant amount of oxygen content led to substandard fuel properties including poor combustion and fluidity along with lower energy content which limits the fuel blending ratios.
- The inefficiency of homogenous catalyst usage in conventional biodiesel syntheses such as leaching, poor reusability, and complex product separation remained a challenge in biofuel production.

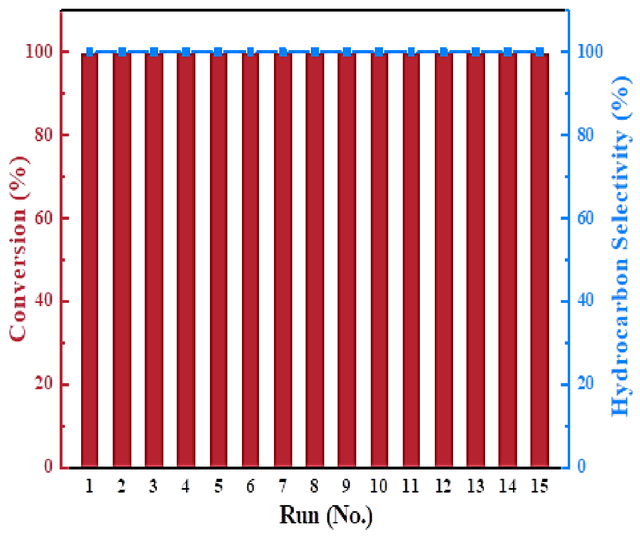
INVENTIVENESS & NOVELTY

The developed technology offers a highly efficient heterogeneous catalyst system that works flawlessly converting different types of waste fatty acid feedstocks to paraffinic hydrocarbon in the green diesel ranged biofuel.

- ✓ Uniform porosity derived from pyrolyzed MIL-101 support enhance the dopant interaction and reduce particle leaching and agglomeration.
- ✓ Excellent catalytic activity was achieved with conversion and hydrocarbon selectivity of 100%.
- ✓ The developed catalyst system shows a remarkable recyclability capacity of more than 15 cycles without any sign of deactivation and notable leaching.

CATALYTIC REACTION & STABILITY TEST





Ni DOPED PYROLIZED-MIL-101 CATALYST & CATALYTIC HDO REACTION USING PALMITIC ACID (STABILITY TEST)

COMPARATIVE OF THE DEVELOPED HETEROGENOUS CATALYST SYSTEM IN HDO REACTION

	Ni/P-MIL-101	La/HZSM5	MoO_2/CNTs
Diesel yield	100%	97%	92.2%
Temperature	400 ℃	400℃	300℃
Time	1 hour	2 hours	4 hours
Pressure	10 bars	50 bars	40 bars
Reliability	More than 15 times	4 times	5 times
Year	**Our work**	2022	2020

APPLICATION & IMPACT

The developed heterogeneous catalyst exhibits high robustness for various types of feedstocks with excellent catalytic activity and stability in the HDO reaction. It provides an opportunity to utilize waste feedstocks that are abundant in Malaysia such as Palm Fatty Acid Distillate (PFAD) or Waste Cooking Oil (WCO) to produce value-added biofuel.

The produced high-graded green diesel is suitable for blending in transportation fuel at higher ratios without compromising overall engine performance. Besides, this efficient novel catalyst is appropriate for industrial-scale application in biofuel production mainly from the palm oil industry which produces a huge amount of PFAD waste from their oil processing mill.

- ❖ Efficient heterogeneous catalyst for green diesel production.
- ❖ Highly robust for different types of fatty acid feedstock.
- ❖ Excellent catalytic activity (100% product selectivity) and recyclability capacity (> 15 cycles).
- ❖ Produce high-grade biofuel (green diesel) suitable for fuel blending. (Green diesel > Conventional Biodiesel).

MARKET POTENTIAL

1. **Energy Sector-** Biofuel blending in conventional transportation fuel is supported by government policies and opens a new market potential for Oil & Gas companies such as PETRONAS and Shell.
2. **Palm Oil Industries** – Green diesel productions from oil mill's byproducts (PFAD) increase the nation's revenue from the agricultural sector such as FELDA, SOPB, and KLK Oleochemicals.

TRL : 3

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