



Novel Fuel Additives Chemical from Oil Palm Sap

PROJECT LEADER:

DR. MOHD HASBI BIN AB RAHIM

TEL: +609 549 2384

INDUSTRIAL SCIENCES & TECHNOLOGY

EMAIL: mohdhasbi@ump.edu.my

www.ump.edu.my

BACKGROUND

Production of **new fuel additives** chemical from **abundant, cheap and biorenewable polyol**. The catalytic process utilized green chemistry approach in which both the feedstock (polyol from oil palm sap) and solid catalytic material (red gypsum) originated from Malaysian industrial waste. The process is relatively simple and catalytic material can be reuse without regeneration process.

PROBLEMS & SOLUTIONS

Current Problems

- ❖ Fuel additives chemical derived from non-renewable source.
- ❖ Multi-stages and expensive process
- ❖ Under utilised palm oil biomass waste
- ❖ Uneconomical disposal of waste gypsum

Solutions

- ❖ Novel fuel additive chemical from renewable biomass feedstock
- ❖ Single-step and cheap process
- ❖ Local Malaysia technology
- ❖ Utilised oil palm sap from oil palm frond/trunk
- ❖ Utilising waste gypsum as reusable solid catalyst

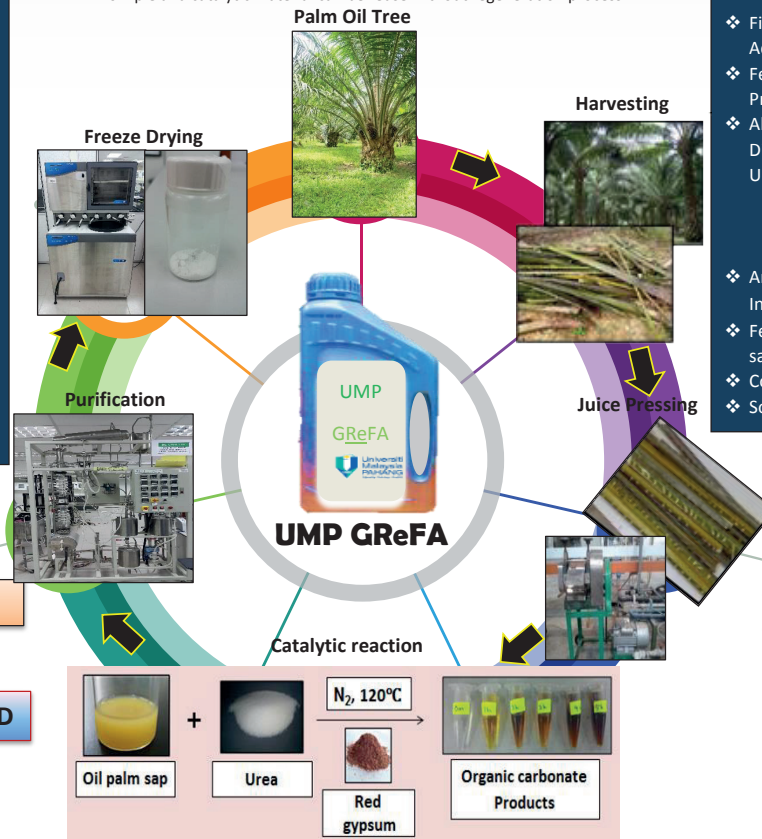
NOVELTY & ADVANTAGES

Novelty

- ❖ First Technology to Produce Fuel Additives Chemical from Oil Palm Sap
- ❖ Feasibility of Developed Catalytic Process for Any Source of Polyol/Sugars
- ❖ Ability to Produce Organic Carbonate Directly from Crude Oil Palm Sap and Untreated Waste Gypsum

Advantages

- ❖ An Alternative Method to Safely Utilize Industrial Waste
- ❖ Feedstock and product are intrinsically safe
- ❖ Cost Effective Process
- ❖ Solvent-Free Process



Industrial Collaborators

ARTISTIC SDN BHD

TIOXIDE (MALAYSIA) SDN BHD

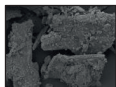
Patent

Patent Filed: 1. UI2015703693

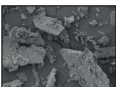
2. PI2014002079

Characteristics of Fresh and Spent Waste

FESEM



Fresh catalyst

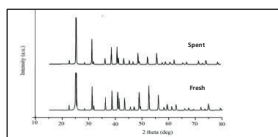


Spent Catalyst

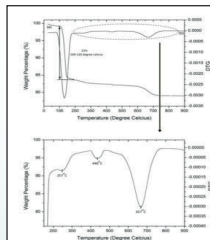
XRF

Elements	Percentage (%)
Ca	41.83
Fe	27.98
S	22.53
Ti	4.81
Mn	0.76
Si	0.73
Mg	0.51
Al	0.34
P	0.22
Zr	0.08
K, Zn, Cr, Sr	0.04
Nb	0.02
Pb, Cu	0.01
Total	100

XRD

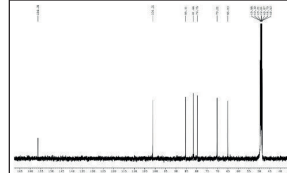


TGA

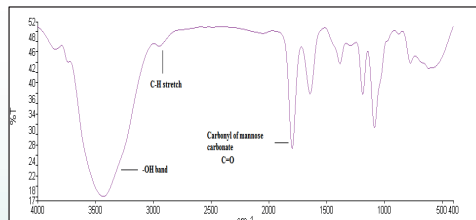


Product Confirmation

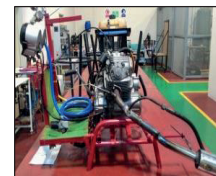
¹³C NMR



ATR-FTIR



Fuel Testing



•Bomb Calorimeter

ASTM D240

• Engine Testing:

ASTM D 2699

ASTM D 323

ASTM D 340

Promising bio-based fuel additive:

- ✓ Improve fuel combustion due to higher oxygen content
- ✓ Reduce harmful exhaust emissions
- ✓ Minimize internal engine corrosion
- ✓ Low blending Reid Vapour Pressure (RVP)

MARKETABILITY

- ✓ Fuel additives global market: RM 29.5 Billion by 2019, *The Global Fuel Additives Market 2014-2019: Trends, Forecast, and Opportunity Analysis (NEW YORK, May 13, 2015)*
- ✓ Global production of oil palm fronds: 250 Million metric tonnes in 2015, *Int J Hydrogen Energy, 2015*
- ✓ 16.8 Million oil palm tree are felled yearly, *Oil palm trunk has potential, The Star Online January 5, 2013*

ACHIEVEMENTS

- **Gold medal** in Creation, Innovation Technology, Research Exposition (CITREx 2015)
- **Gold medal** in International Conference and Exposition on Inventions by Institutions of Higher Learning (PECIPTA, 2016)
- Applied Catalysis A: General 502 (2015)