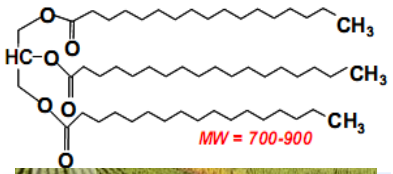
CSIR-IIP process for Renewable ATF



Step-1
Pre-treaterment
Removal of Na, P, K, Ca, Fe, Mg

Step-2
Reaction and distillation

+ Gas Oil

Vegetable Oil

Make up Hydrogen

Reactor

Acid Gas Removal

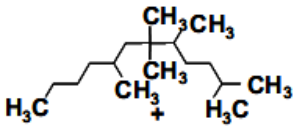
CO_2

Propane & Light Ends

Separator

H_2O

Naptha or Jet



Deoxygenation/Selective Cracking/Isomerization

Diesel Product

Step-1
Pre-treatment of feedstock

Step 1

7.5 MTPA
oil
(Rs 60/lt)

Step 2

1.019 MLPA acid,
(Rs 0.062/lt)

ACID ADDTION

Step 3

326 MLPA
water
(Rs 0.4/lt)

Raw feedstock to
Batch reactor for
metal removal

WATER ADDTION

Electric power for heating
(Rs 0.2/l)

CSTR

80% OF RAW FEED

6 MTPA(Rs61/lt)

Lower layer (20 % rejection)

Upper layer (pre-treated Jatropha)

Catalyst & Process Highlights

Single Step Novel Process and Catalyst (Non noble metal)

(1) Hydro-deoxygenation

(2) Hydro-cracking

(3) Hydro-isomerisation

(4) Aromatization

(5) Cyclization

(6) Hydrogenation

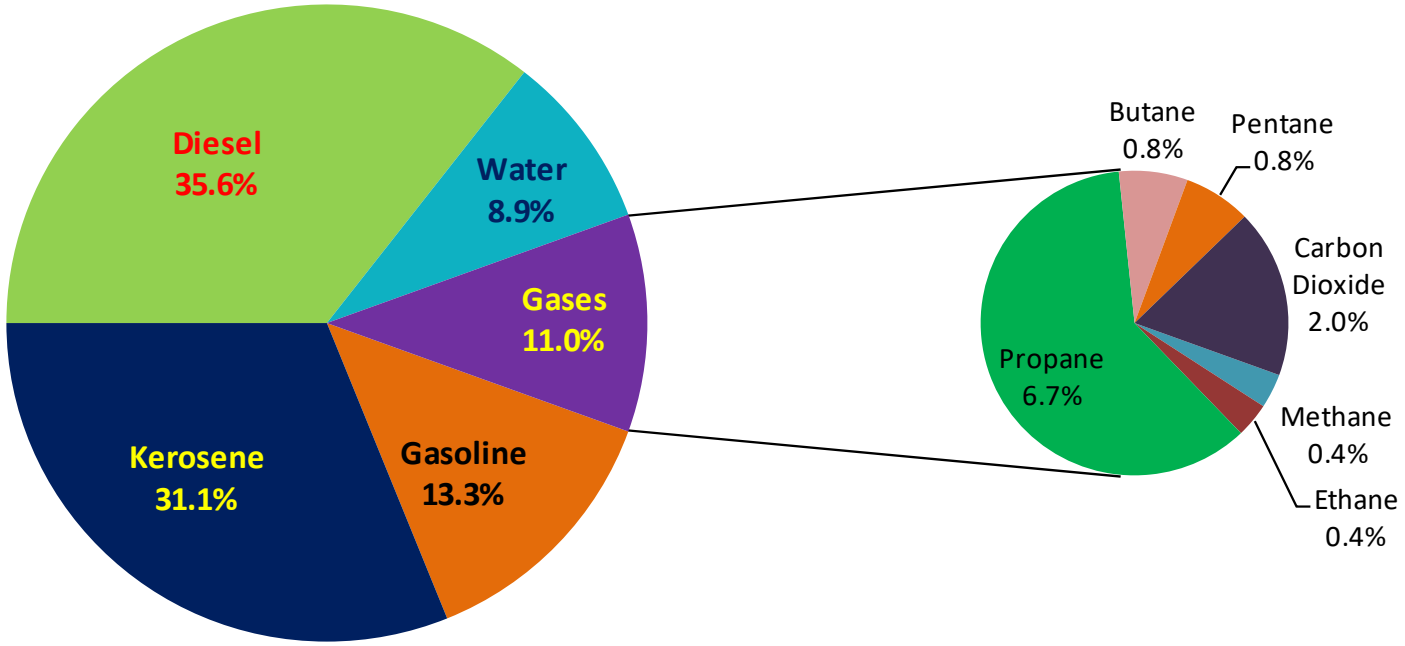
Catalyst features

•Support with **optimized acidity** for desirable **cracking and isomerisation ability** to maximize the kerosene yield

•Sulfided base-metal (**non-noble) catalyst** on the support (**lower in cost as** compared to competing technologies)

US 2017 / 0253808 A1, US 2018 /0010052 A1, WO 2014049621 A1, WO2016038633A1

Product Pattern



Hydrogen Consumption---3-5% of Liquid feed

Kerosene (Bio-ATF)---Main product

Diesel and Gasoline--- High cetane diesel-Cetane Improver,
Gasoline for reforming / 100 LL Avgas

Gases----------Useful for LPG recovery and Fuel gas

CSIR-IIP BIOJET VS COMMERCIALLY AVAILABLE BIO-ATF

New Technology **2017-19**

CSIR-IIP

Hydrodeoxygenation Hydrocracking, cyclization & Hydroisomerization (HC catalyst)

↓

C9-C15 Kerosene range iso-, n-paraffins, cycloparaffins,aromatics

2006-16

Commercial Technologies

Hydrodeoxygenation (HT catalyst)
C15-C18 n-paraffins

↓

Mild Hydrocracking & Hydroisomerization (Pt catalyst) *to meet freeze point*

↓

C9-C15 Kerosene range iso-, n-paraffins

Process/ Property	100% CSIR-IIP's Bio-Jet	50:50 Jet A1: CSIR-IIP's Bio-Jet	100% Internationally available Bio-Jet	50:50 Jet A 1: Internationally Available Bio-Jet
	• **Single-Reactor Process** • **Single Catalyst** Multifunctional, Low-cost: (1) Deoxygenations (2) Isomerization (3) Selective cracking (4) Desired aromatics		• **Two-Reactor Process:** • **Two Catalyst System (Incl. Precious metal)** (1) Deoxygenations (2) Isomerization & Selective cracking • **Aromatic Addition** **(Extra Step in Supply Chain)**	
Flash Point, °C	49	42.5	45	44.0
Freeze Point °C	-63	-58	-57	-58
Total Aromatics, vol%	12.8	15.7	<.03	9.5
Density (15°C), kg/m³	781.3	793.1	766.6	784.7

Reduced Capex and Opex; Patent Estate Established

Thank You Very Much