

## Industrial Consultancy & Sponsored Research (IC&SR)

### ENVIRONMENTALLY FRIENDLY CATALYTIC DEPOLYMERIZATION FOCUSING ON MANAGING PLASTIC WASTE AT SOURCE

#### IITM Technology Available for Licensing

#### PROBLEM STATEMENT

- In the present era, Plastic waste has become a major element in garbage and most of the plastic waste does not decompose naturally in garbage dumps and create toxic smoke after burning, which causes serious environmental problems, and need to be recycled.
- In the patent or non patent literature survey, it is noted that pyrolysis process used to convert plastic waste into wax/oil product which is **costlier process** due to the use of **costly commercial grade catalyst** including other issues.
- Hence, there is a need for improved solution.

#### INTELLECTUAL PROPERTY

IITM IDF Ref. 1751; IN Patent No: 473578

#### TECHNOLOGY CATEGORY/ MARKET

**Technology:**; Catalysts depolymerization process focusing on managing plastic waste at source; **Industry:** Environment Engineering, **Applications:** Waste management, Catalysts, Sensors;

**Market:** The global plastic waste management market is projected to grow at a **CAGR** of **3.40%** during **2023-2029**.

#### TRL (TECHNOLOGY READINESS LEVEL)

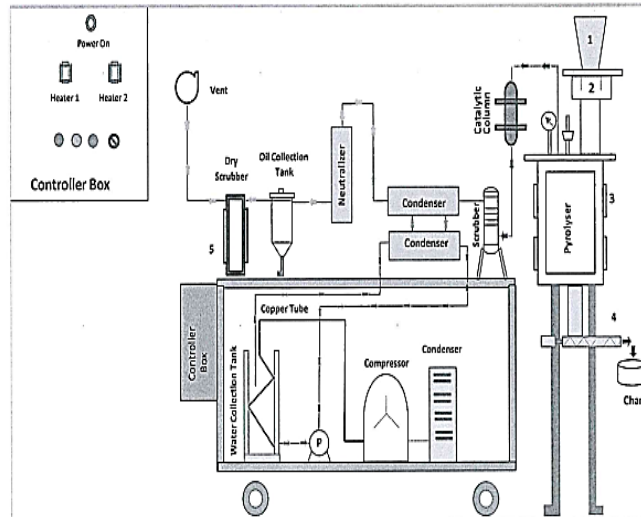
TRL-4, Proof of Concept ready, tested in lab.

#### TECHNOLOGY

- The present invention describes an **environmentally friendly catalytic depolymerization process** for focusing on managing **plastic waste** at source.
- The process comprising a few steps described hereinbelow:
- First step explains about using a **depolymerization technique** at temperature in the range of **400 °C to 500 °C** in a **pyrolysis unit** consisting of a **pyrolysis chamber** made of annular cylinders.

- Said **pyrolysis chamber** is configured with **annular cylinders** to break down the long chain polymers into short chain branched alkanes and aromatics as fuel oil.
- The **annular cylinders** of the **pyrolysis unit** provide the required space for **uniform heating of plastics** at the inside chamber using electrical energy.
- The **process** further comprising using at least **one waste material** from various industries as catalyst material at the pyrolysis unit to maintain temperature uniformity and **enhance fuel oil yield**. (Refer FIG. 1)

Figure for pyrolysis unit in line diagram



Components: 1. Hopper, 2. Pre-Processor, 3. Electrical Heater, 4. Screw feeder, 5.

Electrical Heater

**Fig.1: Illustrates the Line diagram of processes in pyrolysis reactor;**

#### RESEARCH LAB

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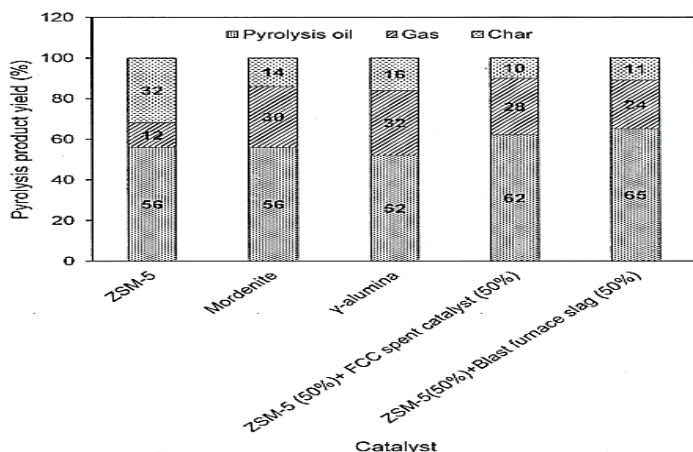
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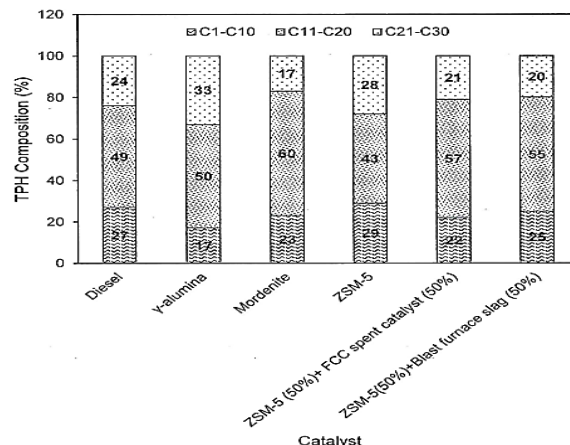
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### Images



**Fig.2: Illustrates the pyrolysis product yield with different catalysts;**



**Fig.3: Illustrates total petroleum Hydrocarbons (TPH) composition of obtained pyrolysis oil**

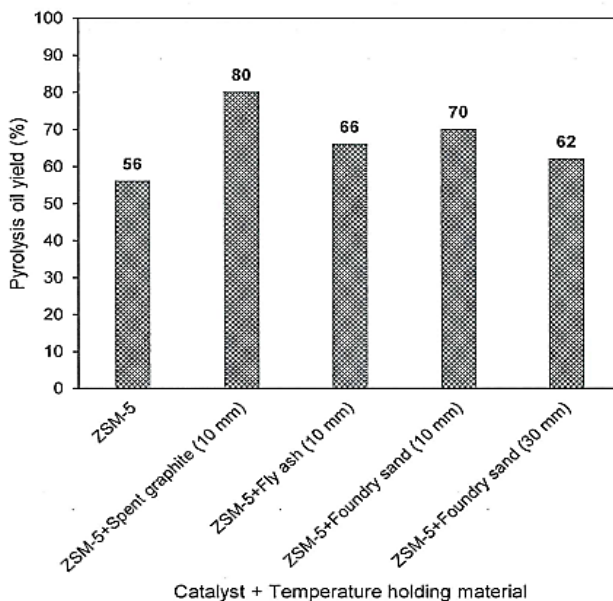
### KEY FEATURES / VALUE PROPOSITION

#### ❖ Technical Perspective:

- The utilized waste generated from different process & manufacturing industries, comprises of **waste graphite** (forging industry), **brake wire powder** (automobile industry), **foundry sand** (foundries), **furnace slag** (iron and steel industries), **pyrolyzed slag** (pyrolysis plant), **fly ash** (thermal power plants), etc.
- The waste material as catalyst facilitates not only **increases the plastic polymer cracking** but also **reduces the operating cost** of the plan in the long run.
- The **pyrolysis process** was **optimized** based on the combination of temperature holding material, catalyst, different contact pattern (insitu, ex situ) of catalyst with **waste plastic** and **its vapour** plays a major role in the **final product quality**.
- Metal doped zeolites, pyrolysis plant slag, spent catalysts** from oil refining industries as catalysts for depolymerizing **waste plastics** in pyrolysis unit.

#### ❖ Industrial Perspective:

- Cost-effective** process.
- The reusability of **Plastic waste** from **industry** used as raw material makes the invention eco-friendly.



**Fig. 4: Illustrates graphical effect of temperature holding material on the pyrolysis oil yield**

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