Energy Efficient Process for the Separation of Oil from Oil Storage Tank Bottom Sludge

IITM Technology Available for Licensing

Problem Statement

- In the present era, Thermal separation is an effective method of treating oil sludges; and microwave application in oil sludge treatment provides many advantageous features including some disadvantages.
- A few prior arts both patent literatures and non-patent literatures have been discussed herein, wherein the issues occurred in the prior arts methods consists of **long time taking** to clear the oil sludge, required **more operational cost** including **tedious process** and produce **low yield** oil & gas.
- However, said prior arts do not disclosed the recovery of oil either from sludge using spent catalyst or from oily sludge including other associated process.
- Hence, there is a need to mitigate above challenges & provide **efficient solution**.

Technology Category/ Market

Technology: Apparatus for measurement of tribological quantities;
Industry: Oil Plant, Manufacturing/Chemical;
Applications: Waste Management, Catalyst;
Market: The global oil & gas separation equipment market is projected to **$11.37B** by **2030**, at a **CAGR** of **4.7%** during 2022-**2030**.

Intellectual Property

IITM IDF Ref.:1808; IN Patent No. 450530

TRL (Technology Readiness Level)

TRL- 4: Technology validated in Lab

Research Lab

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Dept. of Civil Engineering.

Technology

- Patent subject matter discloses a compact microwave pyrolysis-based **process** for cleaning different oil sludge from tank bottom.

Technology

- Discussed said energy efficient process/method & system for the separation of oil from oil storage tank bottom sludge.
- Said method comprises steps of

1

- **Preheating the oily sludge** by preheating means, & **vacuum drying** to get a **mixture of oily sludge & susceptor material**;

2

- **Thermal conversion** of **oily sludge** & **susceptor material** by thermal conversion means in **microwave assisted heating** into a mixture of oily sludge and susceptor material.

3

- **Vapour** generated from the thermal conversion means are **condensed** in a **three-stage condenser** & **non-condensable gases** are **thermally oxidized.**

- Further the energy efficient **system** comprises of **preheating means, vacuum dryer, thermal conversion means, microwave assisted heater, condensing means.**

Image

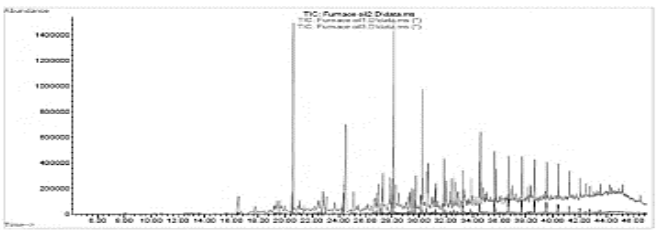
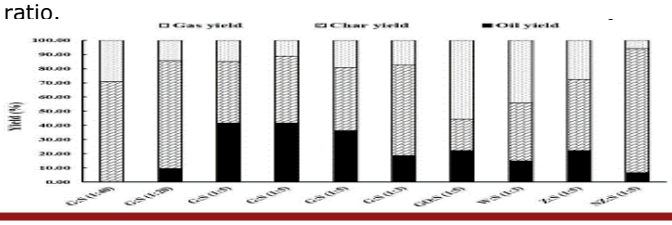


Fig.1A(above):depicts graphical representation of the GC-MS overlay of different batch of oil sludge sample; **Fig.1B**(below): depicts graphical representation od OIL, Gas & char wt% yield for different susceptor & different ratio.



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Industrial Consultancy & Sponsored Research (IC&SR)

Image

FIG.2: depicts a graphical representation of temperature profile for different oil sludge:graphite ratio at 450W;

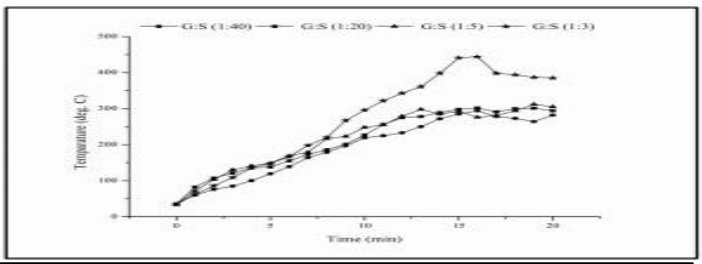
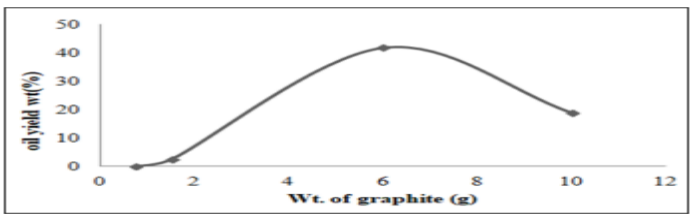


FIG. 3 depicts a graphical representation illustrating the oil yield for varying weight of graphite as susceptor in the oil sludge:graphitemix;



Experimental Results

Table.1 Illustrates the test results of working prototype. Data includes the characterization of tank bottom sludge and GC MS analysis of petroleum hydrocarbon finger printing.

S.No.	Characteristics	Values
1	pH	6.5-7.2
2	Moisture and VH content (g/kg)	114.4-150.5
3.	Viscosity (Pays)	380
4.	**Elemental composition (%)**	
	Carbon	60
	Hydrogen	25
	Nitrogen	4.5
	Sulphur	4.39
5.	**Chemical composition of tank bottom sludge (%)**	
	nC7–C10 compounds Nonane and Decane	5-10
	nC11—C20 compounds Undecane — nonadecane	40-60
	nC21—C30 compounds Eicosane— nonacosane	20-40
	Aromatics Benzene, Naphthalene	10-20

Key Features / Value Proposition

❖ *Technical Perspective:*

- Claimed method is used for the **reuse of the waste** from **refineries** as susceptor for the removal & **recovery of oil** from sludge.
- Utilizes the refinery waste as susceptor which serves the **dual purpose** of **catalyst waste disposal & oil sludge treatment**.
- Said method & system **reduces** the **reaction temperature** & **heat input**, results in **saving energy**, & which is **environment friendly.**
- Present invention includes **microwave pyrolysis; refinery waste susceptors; spent catalyst; spent graphite** that **cracks** the oily sludge **at low temperature** in the range of **300-450°C,** & oil & gas yield **incresed**.
- Facilitates a more **robust & improved system** for recovering **higher oil percentage** and **very less coke yield.**
- The characterization of tank bottom sludge viz., pH, moisture and VH content & the viscosity of oil spill sludge, elemental composition and GC-MS analysis of Petroleum hydrocarbon finger printing are given in **Table.1**.

❖ *Industrial Perspective:*

1. Less **time consumption**, operational cost **minimized** & **improves** the yield & **quality** of the **fuel oil resulting** in **lower emissions**.
2. The system **manages** the **waste locally** & there is **reduced time taking for treatment** & less **cost spent** on logistics.

❖ *User Perspective:*

1. Ensures **more reliable, eco-friendly & energy efficient process and system.**

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