A Metallomicellar Catalyst for Sulfoxidation Reactions in Aqueous Medium and Desulfurization of Model Diesel under Aerobic Conditions

IITM Technology Available for Licensing

Problem Statement

- Current methods for **sulfoxide synthesis and diesel desulfurization** is challenging due to often production of **harmful undesired by-products andincomplete sulfur removal**.
- Current process depend on hazardous reagent, **posing environmental and human health safety risk.**
- Scaling up these **processes faces hurdles** in finding suitable catalyst & equipment.
- **Cost and Accessibility** of materials **limits the method adoption.**
- Hence, an inventive **method** for **synthesizing surfactant-based metallomicellar catalysts** for **sulfoxidation reactions and oxidative desulfurization of model diesel under aerobic conditions.**

Technology Category / Market

Categories: Chemistry & Chemical Analysis

Industry: Catalyst Manufacturing

Application: Sulfoxide Synthesis, Diesel Desulfurization, Specialty Chemical, Petroleum Refining, Environmental Solutions, Green Chemistry, Catalyst Manufacturing,

Market: The global specialty chemicals market size was valued at **US $641 Billion in 2021** and is predicted to reach **US $883 Billion by 2028** with **7% CAGR** from **2021-2028**.

TRL (Technology Readiness Level)

TRL – 3; Proof of Concept

Intellectual Property

IITM IDF No.: **2452** | IP No.: **472900 (Granted)**

Technology

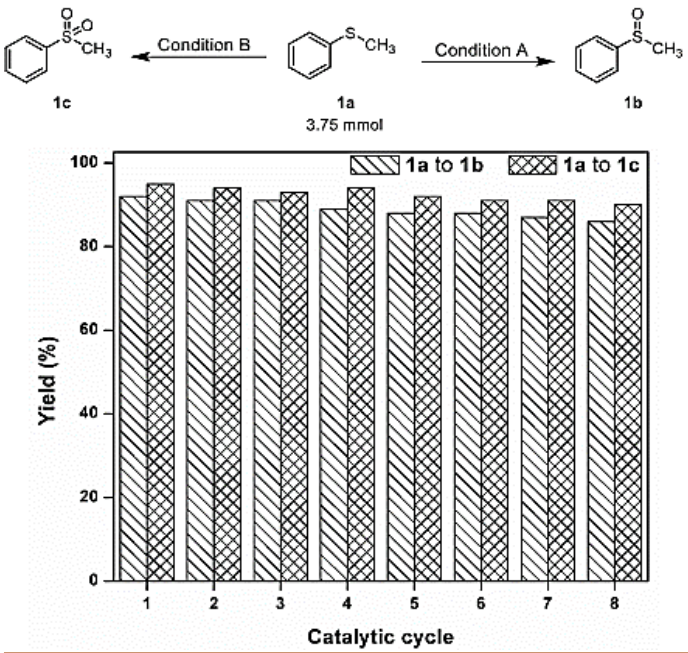
The present patent disclosure provides a newly developed **surfactant-based molybdenum catalyst [$(C_{19}H_{42}N)[MoO(O_2)_2(C_6H_4NO_3)]$] (Formula Mo1)**, for controlled and chemoselective oxidation of organic sulfides to their corresponding sulfoxides and sulfones.

Method

The **method** for preparing cetyltrimethylammonium **(CTA) based oxomolybdenum Catalyst** comprises following steps:

1. **Dissolving molybdate salt** in a water, **maintain** the **acidic pH** to obtain solution;
2. **Adding hydrogen peroxide** to the solution obtained in step I) **to form solution A**;
3. **Adding picolinic acid N-oxide** to an aqueous solution of cetyltrimethylammonium (CTA) hydroxide **to obtain a solution B**;
4. **Adding a solution A into solution B** followed by maintaining the **acidic pH** and **temperature at 0 to 5 °C** to obtain cetyltrimethylammonium (**CTA**) based **oxomolybdenum catalyst**.

FIG 3: Represents aqueous phase recyclability of the metallomicellar catalyst **Mo1**.



Research Lab

Prof. Dillip Kumar Chand, Dept. of Chemistry

CONTACT US
Dr. Dara Ajay, Head
Technology Transfer Office,
IPM Cell- IC&SR, IIT Madras

IITM TTO Website:
https://ipm.icsr.in/ipm/

Email: smipm-icsr@icsrpis.iitm.ac.in
sm-marketing@imail.iitm.ac.in
Phone: +91-44-2257 9756/ 9719

IIT MADRAS
Indian Institute of Technology Madras

Technology Transfer Office
TTO – IPM Cell

Industrial Consultancy & Sponsored Research (IC&SR)

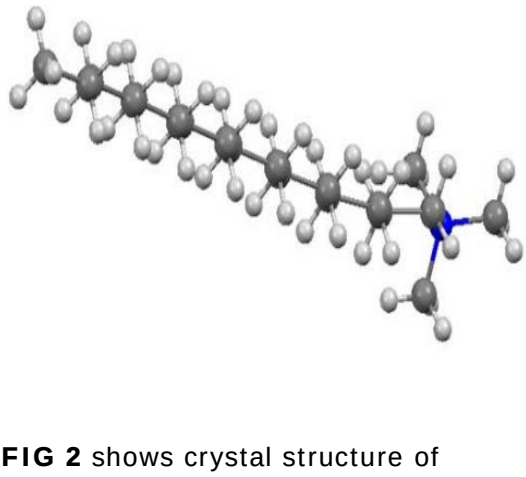
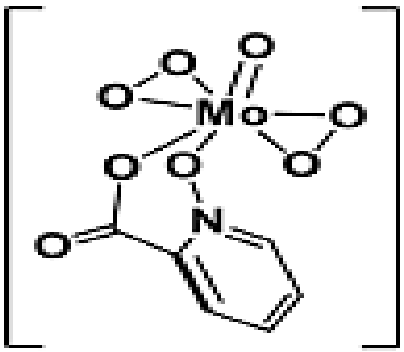


FIG 2 shows crystal structure of metallomicellar complex **(C19H42N)[MoO(O2)2(C6H4NO3)]·CHCl3,** Mo1·CHCl3 shown in ball and stick model.



Formula Mo1: $[(C_{19}H_{42}N)[MoO(O_2)_2(C_6H_4NO_3)]$

Key Features / Value Proposition

User Perspective:

- The **catalyst simplifies sulfoxide and sulfone synthesis**, ensuring **high efficiency** in **converting sulfides into valuable products**.
- The catalyst's **precise control over oxidation**, **minimizing unwanted by-products**.
- Operating in an aqueous medium under oxygen atmosphere, the catalyst **eliminates complex conditions and enhances user safety**.
- **Catalyst can be used as various substrates**, including those with sensitive functional groups.

Industrial Perspective:

- The **catalyst's scalable synthesis** and **compatibility** with common substrates **streamline production and reduce costs.**
- **Offering a greener alternative to traditional methods**, the catalyst aligns with **sustainability goals and regulatory standards**.
- **With high selectivity**, the catalyst ensures **consistent product quality, minimizing variations in industrial operations.**
- Compatible with existing processes, the catalyst seamlessly **integrates into industrial settings.**

Technical Perspective:

- The catalyst's **unique composition** enables **efficient catalytic activity** and **selectivity**, offering insights into **structure-function relationships**.
- The precise synthesis method ensures **reproducibility and scalability** for industrial production.
- **Various analytical techniques** provide insights into the catalyst's structure and properties, aiding optimization.
- Applied in **oxidative desulfurization of model diesel**, the catalyst **addresses industrial challenges related to sulfur removal from fuels.**

CONTACT US
Dr. Dara Ajay, Head
Technology Transfer Office,
IPM Cell- IC&SR, IIT Madras

IITM TTO Website:
https://ipm.icsr.in/ipm/

Email: smipm-icsr@icsrpis.iitm.ac.in
sm-marketing@imail.iitm.ac.in
Phone: +91-44-2257 9756/ 9719