IIT MADRAS
Indian Institute of Technology Madras

Technology Transfer Office
TTO – IPM Cell

Industrial Consultancy & Sponsored Research (IC&SR)

Dehydration Of Glycerol Over Silica-and Alumina-supported Cesium-exchanged Silicotungstic Acid Catalysts

IITM Technology Available for Licensing

Problem Statement

- Traditional methods of acrolein production via propylene oxidation **face economic challenges** with **increasing crude oil prices**.
- Dehydration of glycerol is a promising alternative, but existing catalysts suffer from drawbacks like **strong acidity leading to coke formation & limited thermal stability.**
- Frequent catalyst regeneration & replacement increase **process cost and environmental impact**, hindering sustainability of glycerol-to-acrolein conversion.
- Optimizing synthesis method and experimental setup are **crucial** for **advancing glycerol-to-acrolein conversion technology.**
- Hence, **developing a catalyst** that overcomes above mentioned issues for **efficient glycerol dehydration to acrolein** is needed.

Technology Category / Market

Chemistry & chemical Analysis | Energy, Energy Storage & Renewable Energy

Industry: Catalyst, Chemical manufacturing, Renewable energy production, Biofuel-biodiesel

Applications: Production of acrolein from glycerol, Sustainable chemical production, Biomass conversion to value-added chemicals

Market: The global catalyst market was valued at **$36 Bn in 2020**, it is projected to reach **$58 Bn by 2030**, growing at **4.9% CAGR** in the forecasted period from 2021 to 2030.

Technology

The instant disclosure outlines a **process** for the **dehydration of glycerol,** particularly process for preparing **cesium-exchanged silicotungstic acid catalysts supported on silica-&-alumina**.

FIG. 1 illustrates **XRD patterns** of **the catalysts,** providing visual insight into their structural characteristics.

Process Step

Catalyst Preparation

- Cs3H-SiW is synthesized by gradually adding an aqueous Cs2CO3 solution to an H4-SiW solution at room temperature with vigorous stirring.
- The resulting slurry is dried in a rotary evaporator at 60°C and then heated in air to 350°C at a rate of 10°C min–1, followed by calcination at 350°C for 4h
- Cs3H-SiW/SBA-15 and Cs3H-SiW/γ-Al2O3 catalysts are prepared similarly, with Cs2CO3 added dropwise to SBA-15 and γ-Al2O3, followed by the addition of H4SiW solution, stirring, drying, heating, calcination.

Characterization

- XRD patterns are obtained to analyze the structural properties of the cesium-exchanged silicotungstic acid and supported catalysts.

Analysis

- Loading of Cs3H-SiW into SBA-15 and γ-Al2O3 leads to a decrease in surface area & pore volume due to coverage & plugging of pores by large Keggin anions.

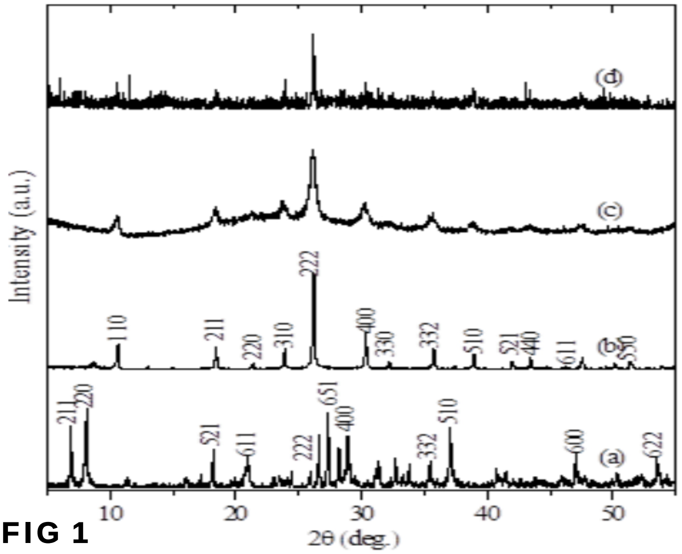


FIG 1

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 illustrates a graphical representation of NH3-TPD profiles of y- Al2O3 supported heteropoly acid catalysts

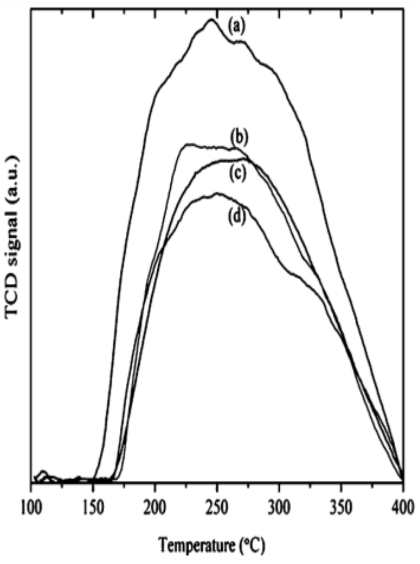
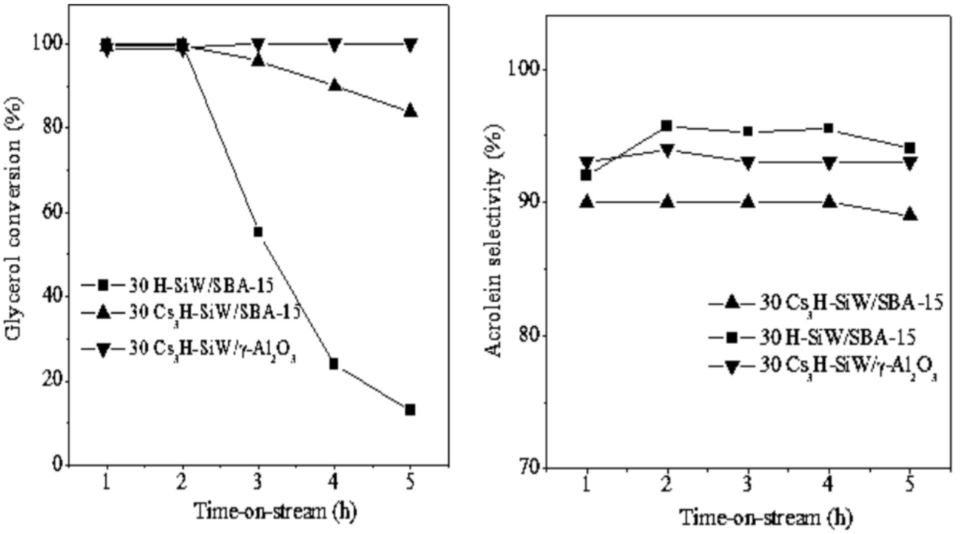


FIG. 3 illustrates a graphical representation of effect of time-on-stream over 30 wt. % Cs3H-SiW/SBA-15



Intellectual Property

IITM IDF No.: **1501** | IP No.: **367864 (Granted)**

Research Lab

Prof. Selvam P, NCCR & Dept of Chemistry

TRL (Technology Readiness Level)

TRL- 3: Proof of Concept Stage.

Key Features / Value Proposition

User perspective:-

- **Enhanced catalytic activity:** Faster reaction rates and increased productivity.
- **Improved product quality:** High-purity acrolein meeting industrial standards.
- **Simplified operation:** Catalyst stability and reusability reduce downtime and costs.
- **Environment Sustainability:** Utilizing renewable glycerol aligns with eco-friendly practices.

Industrial perspective:-

- **Cost-effective production:** Lower costs compared to traditional methods.
- **Process efficiency:** Maximizes yield and minimizes waste generation.
- **Market competitiveness:** Meets consumer demands for eco-friendly products.
- **Scalability:** Adaptable to varying production needs.

Technology perspective:-

- **Novel catalyst design:** Improved performance and selectivity.
- **Tailored synthesis method:** Uniform distribution of active sites enhances performance.
- **Comprehensive characterization**: Detailed analysis for optimization.
- **Innovation potential:** Supports ongoing research and development.

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