

Introduction/Background

Elevator Pitch:

Industries like Aramco, SABIC, and ACWA Power face rising CO₂ emissions and need affordable solutions. Our Low-Cost Sabatier Reactor offers an efficient way to convert CO₂ into methane using a red mud catalyst with optimized heat recovery.

Problem statement:

How can we develop a cost-effective and scalable solution to convert CO₂ into methane, addressing environmental sustainability and industrial efficiency challenges?

Objective of The Project

To design and develop a cost-effective, scalable CO₂-to-methane conversion system using the Sabatier process, by optimizing a red mud catalyst and integrating efficient heat management and real-time automation, with the aim of achieving high methane yield, operational reliability.

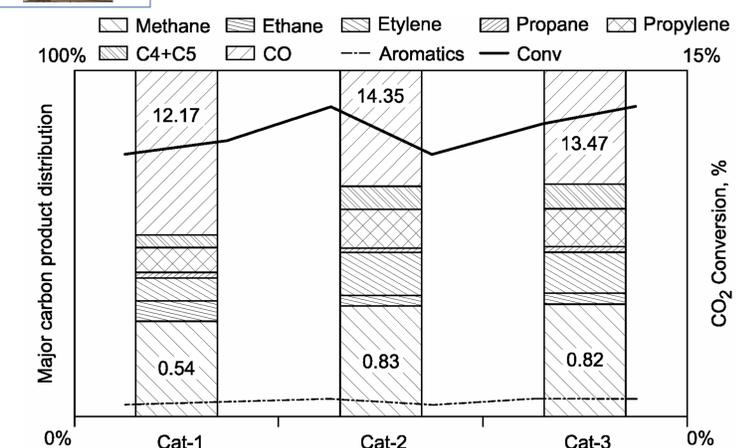
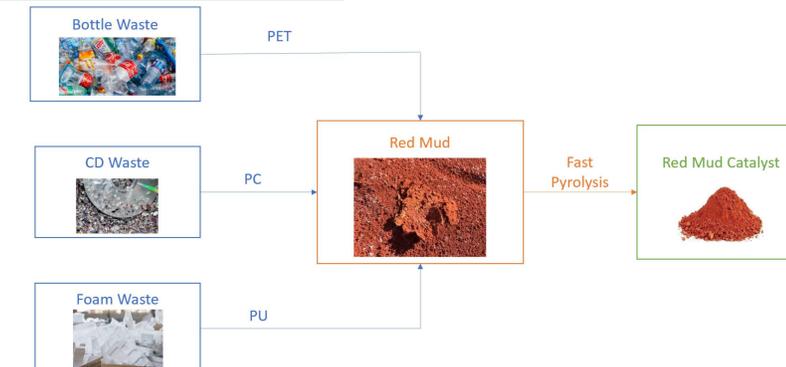
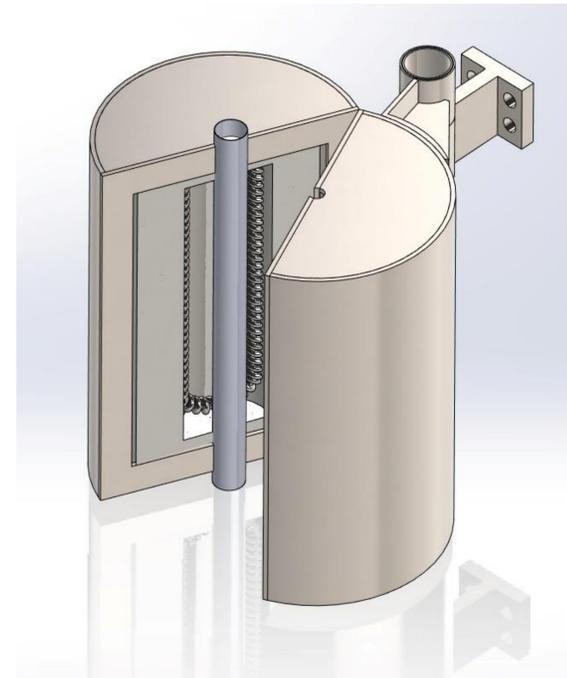
Constraints & Specifications

Constraints:

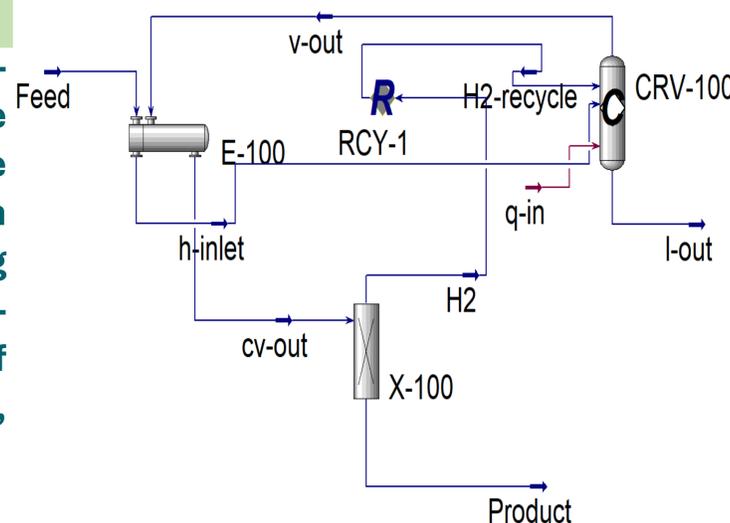
- Budget Limit
- Heat Management
- Power Supply Constraints

Specifications:

- Pressure 5–10 bar.
- Methanol Yield ≥ 85%.
- Temperature: 350 C
- System Size ≤ 0.5 m³.
- Data acquisition ≤ 0.1 seconds.
- Total system power consumption must be ≤ 5 kW.



Prototype Design



Testing/Validation

Catalyst:

Our catalyst is a sustainable, low-cost material made from red mud, recycled CD discs, foam waste, and plastic water bottles. It enables single-bed conversion of CO₂ to methane, turning industrial and household waste into a valuable solution for carbon utilization.

Conclusion

We developed a low-cost, single-bed system that converts CO₂ into methane using a catalyst made from red mud, CDs, foam, and plastic bottles. This sustainable solution turns waste into value and supports industrial carbon reduction efforts, alignment with Saudi Arabia's Vision 2030 sustainability goals.