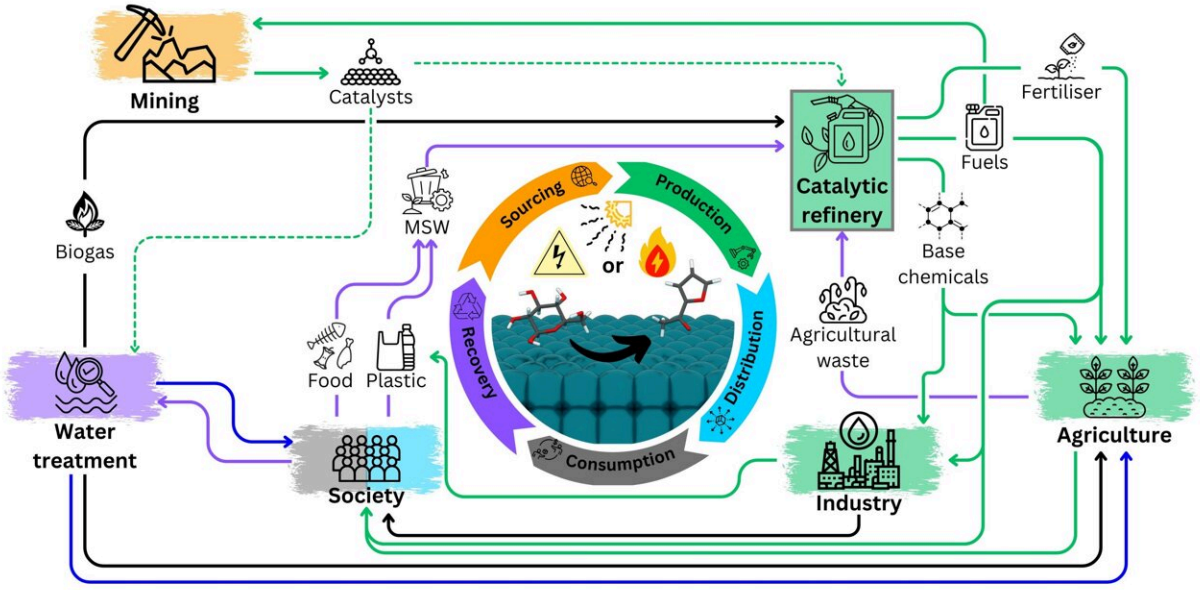
With the help of catalysts the chemical industry can be revolutionized and create a circular economy, say researchers

May 17 2024



Sustainable resource management in the circular economy with emphasis on resource recovery and waste reduction. Credit: Elsevier

The chemical industry is a cornerstone of global development, driving innovation, and providing essential products that support our modern way of life.

However, its reliance on unsustainable fossil resources has posed

significant threats to global ecosystems through climate change and chemical pollution.

A commentary, 'Catalysis at the Intersection of Sustainable Chemistry and a Circular Economy', published in *One Earth* co-authored by Griffith University researchers puts forth a transformative solution: catalysis to leverage sustainable waste resources, ushering the industry from a linear to a circular economy.

"If we look at recent statistics, the chemical industry contributes a staggering US$5.7 trillion to the global economy and sustains 150 million jobs worldwide, excluding refined fossil fuels," said Professor Karen Wilson, one of the lead authors and Director of Griffith's Center for Catalysis and Clean Energy.

"But it remains the largest industrial energy consumer and the third-largest emitter of direct CO_2 emissions globally."

In 2022, the industry emitted 935 million metric tons of CO_2 during primary chemicals production. Moreover, its operations have led to significant water contamination and the release of toxic chemicals into the environment, perpetuating a cycle of ecological harm.

Co-lead author Professor Adam Lee, also based at Griffith, said, "Catalytic processes could minimize reliance on finite fossil fuels and curb CO_2 emissions significantly by harnessing agricultural, municipal, and plastic waste as feedstocks.

"This feedstock transition not only mitigates environmental damage but also addresses vulnerabilities in the industry's supply chain, which are susceptible to geopolitical and natural disruptions."

Professor Wilson added, "Catalysis has historically played a key role in

transforming fossil resources into essential fuels and products, and now offers a beacon of hope for revolutionizing the chemical industry and promoting a circular economy."

However, the authors acknowledge that this vision demands concerted innovation in catalyst formulation and process integration.

"Prioritizing Earth-abundant elements over precious metals will unlock sustainable catalytic systems for the efficient conversion of organic waste into benign and recyclable products," Professor Wilson said.

"Already, pioneering initiatives such as the co-location of different industries in Kalundborg, Denmark to foster symbiosis have demonstrated new collaborative models to improve resource efficiency and waste reduction."

"Catalysis offers a pathway towards sustainability, enabling us to transform waste into valuable resources and pave the way for a circular economy," Professor Lee added.

In the *One Earth* commentary, the team explored sources of catalysis for sustainable and circular chemical processes through the following lenses:

- Catalysis to enable waste biomass utilization
- Catalysis for circular polymers
- Catalysis to remediate chemical pollution

More information: Catalysis at the Intersection of Sustainable Chemistry and a Circular Economy, *One Earth* (2024). DOI: 10.1016/j.oneear.2024.04.018. www.cell.com/one-earth/fulltex … 2590-3322(24)00208-2

Provided by Griffith University