

Science News

from research organizations

'Green' synthesis of plastics from CO₂

Date: July 29, 2021

Source: Osaka City University

Summary: Using a CeO₂ catalyst, researchers develop an effective catalytic process for the direct synthesis of polycarbonate diols without the need for dehydrating agents. The high yield, high selective process has CO₂ blown at atmospheric pressure to evaporate excess water by-product allowing for a catalytic process that can be used with any substrate with a boiling point higher than water.

Share: [!\[\]\(17413706fd4997a1a4bdf85c6864eee1_img.jpg\)](#) [!\[\]\(f419710cbe076aa30a9c6c031b5cbe84_img.jpg\)](#) [!\[\]\(2726020a4107bdc9042b257034f90eb3_img.jpg\)](#) [!\[\]\(9459655bf14a84f4d775e8d814cca8c9_img.jpg\)](#) [!\[\]\(de47dbdca34225b222a4a87ac0e499b3_img.jpg\)](#)

FULL STORY

By combining a CeO₂ catalyst with atmospheric carbon dioxide, researchers from Osaka City University, Tohoku University, and Nippon Steel Corporation have developed an effective catalytic process for the direct synthesis of polycarbonate diols without using dehydrating agents. Their method, published in *Green Chemistry*, does not rely on toxic chemical feedstock like phosgene and carbon monoxide, making it the world's first high yield "green" reaction system.

There is a worldwide need to reduce carbon dioxide, one of the major greenhouse gases, and converting it into a useful chemical compound has attracted much attention in recent years. Various effective catalyst systems have been developed but they rely on toxic chemicals that churn out unmanageable by-products. Processes using substrates that are easily available and safe, with water as the only by-product, have emerged as an alternative. Yet, high levels of water by-product keep these processes from synthesizing enough polycarbonates.

"Most processes use a dehydrating agent to keep water levels low to overcome an equilibrium," said Masazumi Tamura of the Osaka City University, "but some of the issues to address are the high pressure of carbon dioxide needed, the recovery and regeneration of the dehydrating agent, and contamination of by-products generated by its use."

To bypass these issues, the research team developed a catalytic process that does not use a dehydrating agent. By focusing on the difference in boiling points between the chemical product/diol and water, the research team predicted a high carbon fixation yield by blowing in CO₂ at atmospheric pressure to evaporate excess water.

"It became clear that among the metal oxide catalysts we used," stated Keiichi Tomishige of Tohoku University, "CeO₂ showed the highest activity." This simple catalytic reaction system is the first ever to successfully synthesize polycarbonate diols from carbon dioxide and diols at atmospheric pressure. "This process, without the need of dehydrating agents, can chemically convert carbon dioxide using any substrate with a boiling point sufficiently higher than water," concluded Kenji Nakao of Nippon Steel Corporation, "and can be applied to the synthesis of carbonates, carbamates, and ureas, which are useful additives for lithium-ion batteries and/or raw materials for polymer synthesis."

Story Source:

Materials provided by **Osaka City University**. *Note: Content may be edited for style and length.*

Journal Reference:

1. Yu Gu, Masazumi Tamura, Yoshinao Nakagawa, Kenji Nakao, Kimihito Suzuki, Keiichi Tomishige. **Direct synthesis of polycarbonate diols from atmospheric flow CO₂ and diols without using dehydrating agents**. *Green Chemistry*, 2021; DOI: 10.1039/D1GC01172C

Cite This Page:

MLA	APA	Chicago
-----	-----	---------

Osaka City University. "'Green' synthesis of plastics from CO₂." ScienceDaily. ScienceDaily, 29 July 2021. <www.sciencedaily.com/releases/2021/07/210729143455.htm>.

RELATED STORIES

Tandem Catalytic System Efficiently Converts Carbon Dioxide to Methanol

July 24, 2020 — Chemists have used a tandem catalytic system to efficiently convert carbon dioxide to methanol. By encapsulating multiple catalysts involved in the tandem process in nanoporous materials called ...

Promising New Solar-Powered Path to Hydrogen Fuel Production

Aug. 1, 2019 — Engineers have utilized a single enzyme biomineralization process to create a catalyst that uses the energy of captured sunlight to split water molecules to produce hydrogen. The synthesis process is ...

Lightning Bolt Underwater

June 27, 2019 — Electrochemical cells help recycle CO₂. However, the catalytic surfaces get worn down in the process. Researchers are exploring how they might be regenerated at the push of a button using extreme ...

Jiggly Jell-O to Make Powerful New Hydrogen Fuel Catalyst

Dec. 15, 2018 — A cheap and effective new catalyst can generate hydrogen fuel from water just as efficiently as platinum, currently the best -- but also most expensive -- water-splitting catalyst out there. The ...

FROM AROUND THE WEB

ScienceDaily shares links with sites in the TrendMD network and earns revenue from third-party advertisers, where indicated.

Free Subscriptions

Get the latest science news with ScienceDaily's free email newsletters, updated daily and weekly. Or view hourly updated newsfeeds in your RSS reader:

 [Email Newsletters](#)

 [RSS Feeds](#)

Follow Us

Keep up to date with the latest news from ScienceDaily via social networks:

 [Facebook](#)

 [Twitter](#)

 [LinkedIn](#)

Have Feedback?

Tell us what you think of ScienceDaily -- we welcome both positive and negative comments. Have any problems using the site? Questions?

 [Leave Feedback](#)

 [Contact Us](#)

[About This Site](#) | [Staff](#) | [Reviews](#) | [Contribute](#) | [Advertise](#) | [Privacy Policy](#) | [Editorial Policy](#) | [Terms of Use](#)

Copyright 2021 ScienceDaily or by other parties, where indicated. All rights controlled by their respective owners. Content on this website is for information only. It is not intended to provide medical or other professional advice. Views expressed here do not necessarily reflect those of ScienceDaily, its staff, its contributors, or its partners.

Financial support for ScienceDaily comes from advertisements and referral programs, where indicated.