

Technology

Improved electrode catalysis for green urea production

□ nicolaskross • 7 hours ago



Scientists have developed low-energy methods for making the major compounds in fertilizers. This is an advance that can lead to more sustainable agriculture.

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Breakthrough progress has been made by a team of international scientists led by Nanyang Technological University (NTU Singapore). Their method

produces urea, an essential compound in mass-produced fertilizers.

According to NTU, the Haber-Bosch process used to make urea consumes a lot of energy and requires a temperature of 500 ° C. °C and 200 times the sea level pressure. This process is said to produce significant CO₂ It is an annual emission and contributes about 2% of the world's energy.

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The team sought a more sustainable and energy-efficient way to significantly improve the electrode catalyst, an existing alternative approach to urea production.

Using the nanomaterial indium hydroxide as a catalyst, researchers have previously reported using electrode catalysts by reacting nitrates with carbon dioxide, especially by causing chemical reactions in a "highly selective" way. We have found that it forms urea five times more efficiently than the attempts made. ..

In a statement, co-lead author Professor Alex Yan of the NTU School of Materials Science and Engineering (MSE) said: By choosing a better catalyst, nitrate ions and carbon dioxide molecules are optimally located, promoting the formation of urea and at the same time suppressing the production of unwanted by-products such as hydrogen, resulting in higher efficiency. It has improved and the yield of urea has improved. "

The survey results are published in *Natural sustainability* The alternative urea production method is patented by NTU.

This new way of producing urea may stimulate future designs of sustainable chemical approaches and contribute to "more environmentally friendly" agricultural practices to feed the world's growing population, the researchers say. rice field.

Process improvements can lead to more sustainable agricultural practices (Image by kangbch on Pinterest)

As a proof of concept, scientists tested the efficiency of the lab-developed method and found that this approach achieved a urea yield of 53.4 percent, which competes with current Haber-Bosch industrial methods.

Haber Bosch, a two-step thermal process, relies on fossil fuels and can only occur under certain high and high pressure conditions. First, nitrogen and hydrogen are combined to make ammonia. Next, carbon dioxide is combined to make urea. By comparison, the new NTU approach is more environmentally friendly and simpler. It uses nitrates (compounds with bonds that require less energy to cleave), carbon dioxide, and hydrogen to directly cause the formation of urea at room temperature.

The research team claims that the new method is simple enough to be adopted on a large or small scale. The electrocatalyst device is easy for farmers to operate to produce their own urea for fertilizer. This method may one day be fully renewable energy powered.

This method uses the nanomaterial indium hydroxide as a catalyst to react nitrates with carbon dioxide, allowing urea to be produced five times more efficiently than previously reported attempts (Image: NTU Singapore).

Dr. Lyu Chade, Research Fellow of NTU School at MSE, the lead author of the study, said:

In the future, the research team is aiming for higher yield results and improved catalyst selectivity. They are also planning to create a prototype device to demonstrate scaled-up urea production.

The international research team includes researchers from the University of Texas at Austin, the University of Science and Technology of China, and the Harbin Institute of Technology (China).

<https://www.theengineer.co.uk/urea-fertiliser-ntu/> Improved electrode catalysis for green urea production