Study offers strategy for green synthesis of 15N-amino acids

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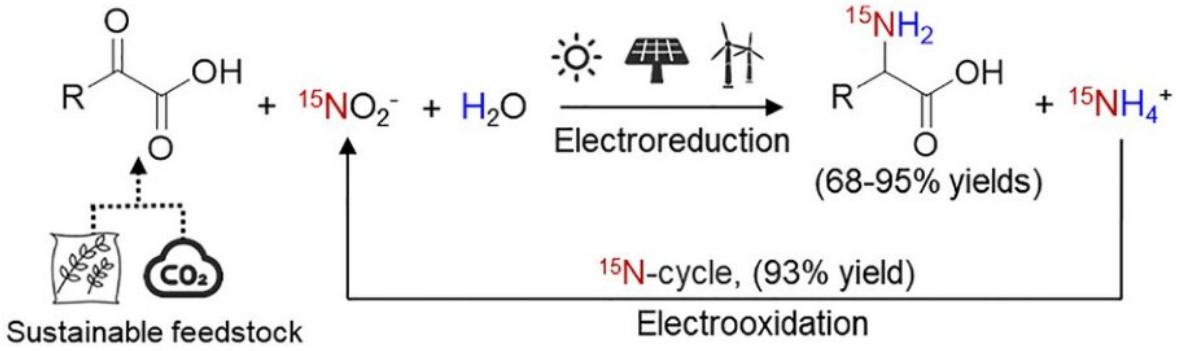

A sustainable way to synthesize ^{15}N-amino acids from readily available ^{15}N-nitrite ($^{15}NO_2$) and biomass-derived ketonic acids under ambient conditions driven by renewable electricity. Credit: ©Science China Press

^{15}N isotope-labeled amino acids (^{15}N-amino acids) provide a safe and effective tracer tool for studying the synthesis of natural products, protein metabolism, and disease diagnosis and treatment in living organisms. In addition, it is an important synthetic block for the synthesis of ^{15}N-labeled drugs.

Currently, ^{15}N-labeled amino acids are generally synthesized by microbial fermentation and chemical reduction amination of ketoacids, but these methods usually require complex steps, high temperature

conditions or the use of toxic cyanide, causing energy and environmental problems. Therefore, it is of great importance to develop a green and mild method for the synthesis of ^{15}N-amino acids.

Recently, Zhang's group reported an electrochemical method to synthesize ^{15}N-amino acids from ^{15}N-nitrite and ketonic acids over a commercial nickel foam (NF) cathode in an aqueous solution under ambient conditions. ^{15}N-alanine with a 93% yield was achieved. Impressively, ^{15}N-ammonium, the major byproduct, could be electrooxidized to ^{15}N-nitrite with a yield of 93%, realizing the recycling property and atomic economy of ^{15}N-nitrite. The research is published in the journal *Science China Chemistry*.

A ^{15}N-nitrite→$^{15}NH_2OH$→^{15}N-oxime→^{15}N-amino acid pathway was revealed by a series of control experiments, in situ attenuated total reflection Fourier transform infrared (in situ A TR-SEIRAS) spectroscopy, and online differential electrochemical mass spectrometry (DEMS).

Furthermore, the method was suitable for synthesizing six ^{15}N-amino acids with 68%–95% yields, demonstrating the good universality of this method. A hepatitis treatment drug, ^{15}N-tiopronin, was synthesized using ^{15}N-glycine, highlighting the utility of this method.

The study not only offers a strategy for the room-temperature and green synthesis of ^{15}N-amino acids but also opens a sustainable avenue to construct ^{15}N-labeled compounds.

More information: Yongmeng Wu et al, Electrosynthesis of 15N-labeled amino acids from 15N-nitrite and ketonic acids, *Science China Chemistry* (2023). DOI: 10.1007/s11426-023-1613-x

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