Study finds nitrite-driven anaerobic ethane oxidation in microbial cultures

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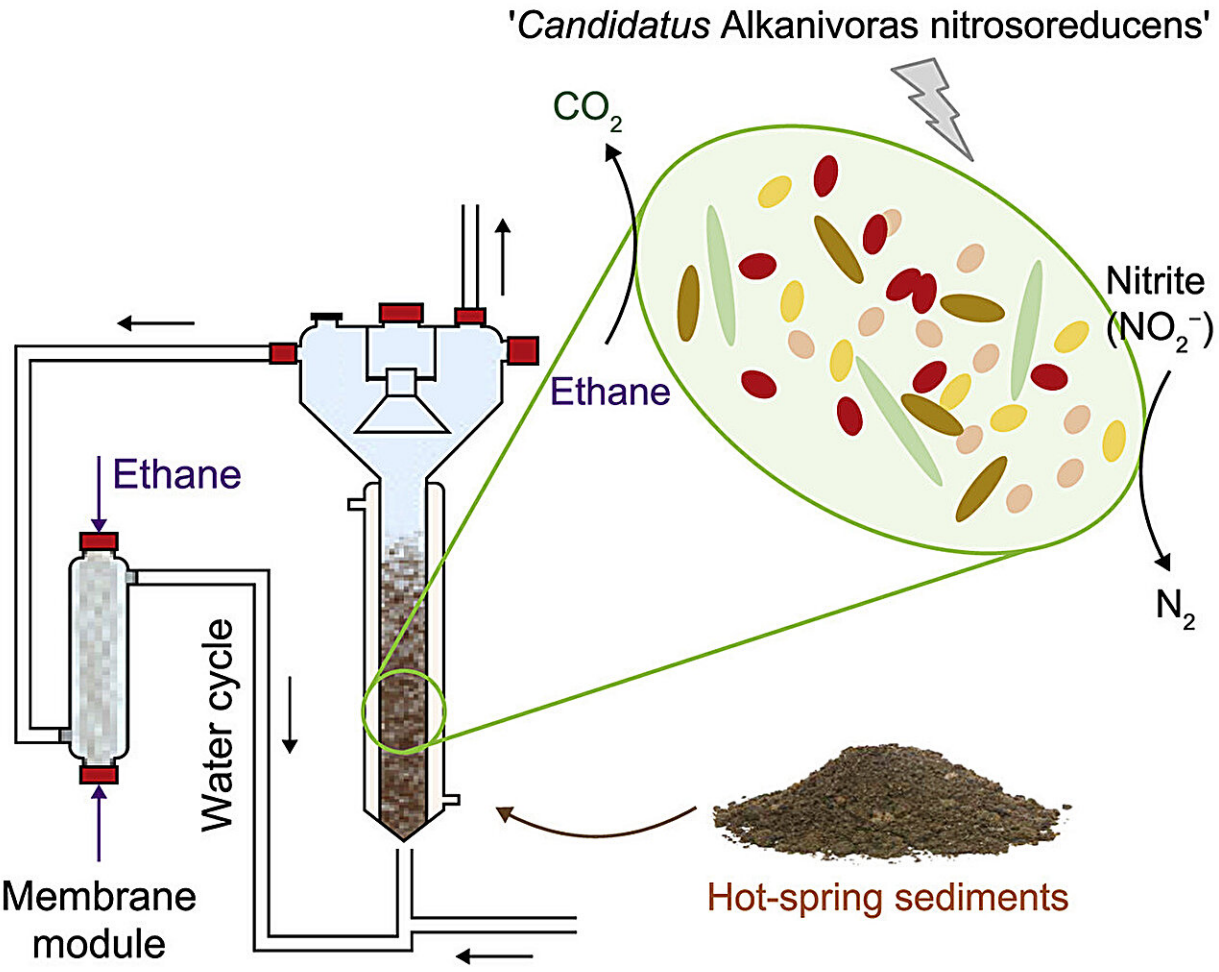

Graphical abstract. Credit: *Environmental Science and Ecotechnology* (2024).
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Ethane, an overlooked greenhouse gas, can be oxidized with electron acceptors like sulfate and nitrate. Despite nitrite being a more thermodynamically feasible electron acceptor, little is known about nitrite-driven anaerobic ethane oxidation.

In a study published in *Environmental Science and Ecotechnology*, a microbial culture capable of nitrite-driven anaerobic ethaneoxidation was enriched through long-term operation of a nitrite-and-ethane-fed bioreactor. During continuous operation, the nitrite removal rate and the theoretical ethane oxidation rate remained stable at approximately 25.0 mg NO_2^-N L^{-1} d^{-1} and 11.48 mg C_2H_6 L^{-1} d^{-1}, respectively.

Batch tests demonstrated that ethane is essential for nitrite removal in this microbial culture. Metabolic function analysis revealed that a species affiliated with a novel genus within the family Rhodocyclaceae, designated as Candidatus Alkanivoras nitrosoreducens, may perform the nitrite-driven anaerobic ethane oxidation. This novel genus is described in full in the paper.

Based on a meta-omic analysis, Ca. A. nitrosoreducens encoded and expressed a prospective fumarate addition pathway for anaerobic ethane oxidation and a complete denitrification pathway for nitrite reduction to N_2, although the genes for ethane conversion to ethyl-succinate (assAs) and succinate-CoA ligase (sucCD) required further identification.

Phylogenetic affiliation analysis showed a distant genetic relationship between Ca. A. nitrosoreducens and the previously reported Candidatus Alkanivorans nitratireducens that was capable of nitrate-driven anaerobic ethane oxidation, which suggests functional microbial differences in different natural environments.

This study offers new evidence of nitrite-driven anaerobic ethane oxidation occurring in enriched cultures from hot-spring sediment, and

describes a novel genus potentially involved in this process.

These findings advance our understanding of nitrite-driven anaerobic ethane oxidation, highlighting the previously overlooked impact of anaerobic ethane oxidation in natural ecosystems.

More information: Cheng-Cheng Dang et al, Nitrite-driven anaerobic ethane oxidation, *Environmental Science and Ecotechnology* (2024). DOI: 10.1016/j.ese.2024.100438

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