Heterologous Synthesis of Nitrogenase in E. coli

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BRIEF DESCRIPTION

A groundbreaking synthesis of simplified nitrogenase analogs in E. coli, facilitating nitrogen fixation in a non-diazotrophic organism.This synthesis provides the foundation for replacing fossil-fuel generated ammonia fertilizer with nitrogen fertilizer generated from a bacteria that is well-studied and already used in the biotech field.

SUGGESTED USES

Agriculture

FEATURES/BENEFITS

·Introduces nitrogen-fixing capabilities to non-diazotrophic organisms.

·Simplifies the transfer and expression of nitrogenase genes.

·Enables the modular synthesis and optimization of nitrogenase components.

·Facilitates the development of nitrogenase-based biotechnological applications.

·Promises advancements in agriculture, energy, and environmental management.

FULL DESCRIPTION

Biological nitrogen fixation (BNF) offers a natural means of supplying fixed nitrogen to crops. Catalyzed by a metallo-enzyme called nitrogenase, the BNF process converts N2 to NH3 at ambient conditions, circumventing the problems of fossil-fuel consumption and carbon-waste production associated with its industrial parallel while reducing the nitrogen-cycle perturbance and the surface/ground-water pollution caused by the excess application of commercial ammonia.However, BNF bacteria are difficult to grow and not suitable for all plant conditions.The expression of nitrogenase in an organism that can be cultured and mass-produced in a lab is a long-sought-after, yet non-trivial task given the necessity to introduce a large number (more than 20) of nitrogen fixation (nif) and related genes into a new host.Researchers have completed heterologous synthesis of two simplified nitrogenase analogs from Azotobacter vinelandii in E. coli. One analog consists of the reductase component (NifH) and, in place of the catalytic component (NifDK), a cofactor maturase (NifEN); whereas the other analog consists of only NifEN.Both systems mimic the nitrogenase enzyme in reducing N2 and incorporating the reduced N into the cellular mass.

STATE OF DEVELOPMENT

Lab results show successful synthesis of nitrogenase and incorporation of nitrogen into E. coli cells.Experiments are being performed to translate this same process in other soil bacteria.

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OTHER INFORMATION

CATEGORIZED AS

- **Agriculture & Animal Science**
  - Chemicals
  - Transgenics
- **Biotechnology**
  - Food

RELATED CASES

2024-999-0

OTHER INFORMATION

Provisional patent filed

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