Innovative Circular Technologies for Harmful Nitrogen Compounds/To Solve Planetary Boundary Issues

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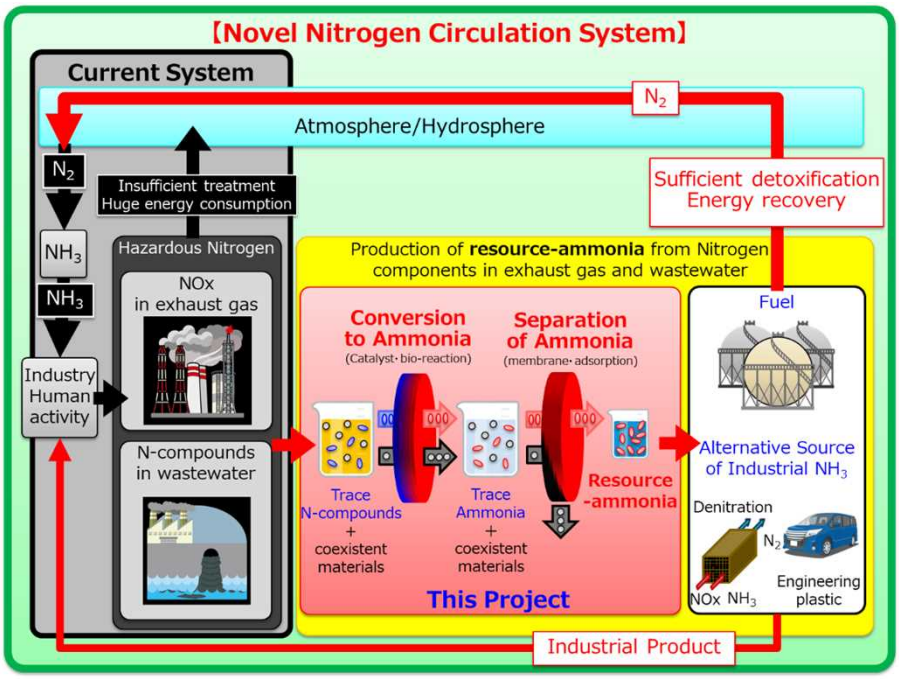
Summary

We develop a novel nitrogen circulation system for the detoxification and recycling of the harmful nitrogen compounds in the exhaust gas and wastewater. In planetary boundaries discussions, nitrogen pollutants are pointed to be far beyond of allowable limits, more than CO_2 and phosphorus, and pose a serious environmental threat. In this project, in order to establish methods for reducing nitrogen compound emissions without limiting the use of ammonia, NOx in exhaust gas and nitrogen compounds in wastewater will be converted into ammonia resource. This technology will greatly reduce both the environmental emission of nitrogen compounds and the energy consumption required for their detoxification.

For the exhaust gas, we develop NTA (NOx To Ammonia) conversion technology that converts NOx into NH_3, a valuable resource. Achieving an ammonia conversion of 50% makes it stoichiometrically possible to remove residual NOx by selective catalytic reduction, by which NOx can be almost completely removed, and the surplus NH_3 can be utilized on many other purposes. Regarding the wastewater, for recovering both NH_4^+ and organic nitrogen, we develop the NH_4^+ conversion system together with the energy-saving NH_4^+ separation and concentration system.



KPI

FY2022	FY2024	FY2029
A. Test production of a gaseous NTA reactor with high efficiency. B. Construction of microbial communities for ammonia conversion from wastewater, and design of an ammonia concentration system in aqueous phase.	A.Basic design of the NTA system with the pilot scale. B. Bench plant test at the 0.5 m^3/d scale for the recovery of the resource ammonia from nitrogen compounds in wastewater.	A.Pilot plant test for gaseous NTA system, at the scales of a few Nm^3/d with >95% conversion at 200 ˚C. B. Pilot plant test for ammonia recovery from wastewater at the scales of 5-15m^3/d.

Implementation

National Institute of Advanced Industrial Science and Technology (AIST), The University of Tokyo, Waseda University, Tokyo University of Agriculture and Technology, Kobe University, Osaka University, Yamaguchi University, Kyowa Hakko Bio Co., Ltd., ASTOM Corporation, Toyobo MC Corp., FUSO Corporation, UBE Corporation (completed in FY2022).