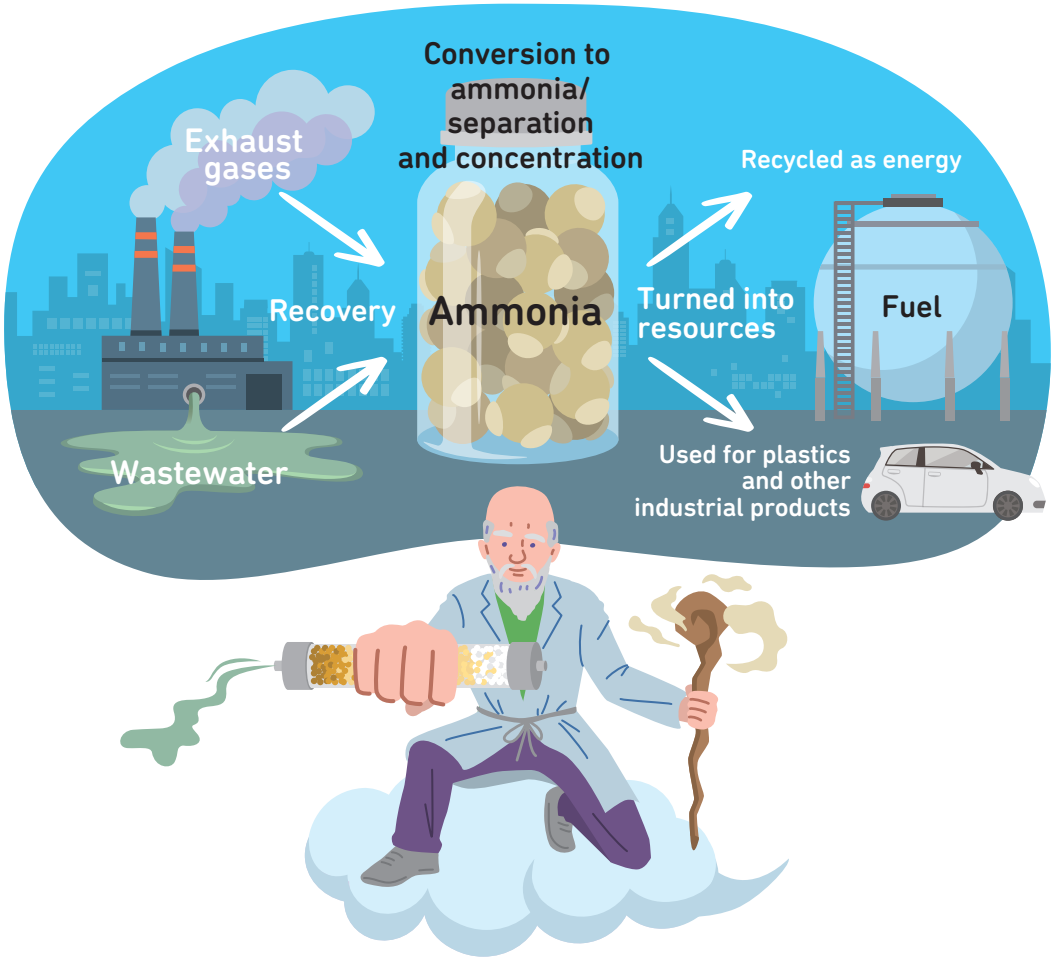
10 PROJECT

Turning Problems Into Resources With Technology That Recycles Nitrogen

Nitrogen Recycling Technology Can Keep Us Within Our Planetary Boundary

Global environmental degradation is the price humans have been paying in exchange for prosperity, and pollution from nitrogen waste in particular may be reaching the limit of what the Earth can handle, known as the planetary boundary. Ammonia is a nitrogen compound that we need in daily life for things like chemical fertilizers, but when released in exhaust or wastewater, it causes environmental problems. Processing this waste requires tremendous amounts of energy. If we want to restore the environment with no impact on industrial activity, we need ***nitrogen management*** systems that convert this waste into ammonia resources through nitrogen recycling technology.



Hokusai's Favorite, Prussian Blue, Is the Key to Ammonia Adsorption

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Katsushika Hokusai's "Thirty-Six Views of Mount Fuji" are prints known worldwide as classic examples of ukiyo-e culture. The Prussian blue pigment he used is still widely used today. We discovered that this pigment is an optimal substance for adsorption of ammonia. Tests confirmed there is no decrease in the pigment's adsorptive capacity even with frequent use, and that the adsorbed ammonia can even be extracted and recycled as a resource. Based on these promising results, we have produced a plan for practical application, and expectations are high for a future colored with Prussian blue.

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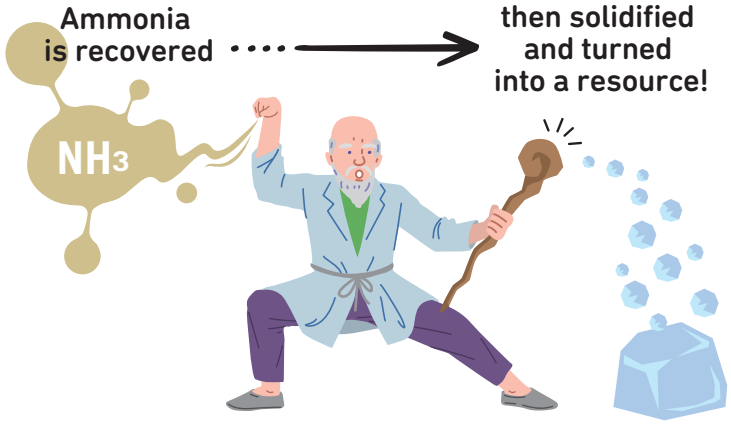
>> The Road to Nitrogen Resource Recycling

Altering the composition of Prussian blue at the atomic level creates separate adsorbents for exhaust gases and wastewater, allowing selective recovery of ammonia. But recovery is not the final step. Technology is required to convert the nitrogen waste products into a form that can be tapped for ammonia resources. We have been working to develop NTA (NOx to Ammonia) technology which uses a catalyst in exhaust gas to detoxify nitrogen waste such as NOx and convert it into ammonia, along with technology that uses biological reactions in wastewater to convert ammonium ions into ammonia.

>> Technology Brings Hope

The ammonia converted from nitrogen waste is separated and concentrated using membranes and adsorbents. This concentrated ammonia can then be used as a raw material for plastics and fuels. Fuel made from ammonia is carbon-free and does not emit CO_2, so is an energy resource that addresses a major social need. We believe that by combining the conversion, separation, and concentration processes in factory production systems we will succeed in creating a society that recycles nitrogen waste into a resource and helps protect the earth from environmental pollution.



KEYWORD

Nitrogen Management

As global environmental pollution from nitrogen waste worsens, the 2022 United Nations Environment Assembly confirmed the need for sustainable nitrogen management to investigate and review the state of air, water, and soil pollution.

FUTURE VISION

2025 Market Already-Completed Products

We will initially focus on technological development in the laboratory. We will continue to conduct trial-and-error experiments with the aim of finding practical applications, and begin selling some ammonium adsorbent to factories for reuse of wastewater.

2027 One Step From Practical Application

We will start pilot tests in collaboration with businesses. Focused on achieving a nitrogen recycling society, we will try to overcome hurdles as they arise and develop systems for wastewater reuse at large factories and sewage treatment plants.

2029 Achieving a Nitrogen Recycling Society

Using a pilot plant, we will demonstrate that the series of processes from nitrogen waste recovery to recycling it as a resource can work together in a system. Real-world social implementation will be on the horizon.

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, Kirin Holdings Co., Ltd., Astom Corporation, Toyobo MC Corporation, Fuso Corporation

Project Introduction Video https://www.youtube.com/watch?v=do3o39UaZFA&list=PLZH3AKTCrVsVm3UN1x40WW_QK-cEXaoo3