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https://www.mitsuichemicals.com MITSUI CHEMICALS,INC.

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Mitsui Chemicals, Inc.

Mitsui Chemicals Group Starts Developing Recycling Technology for High-Purity Phosphorus Materials

R&D project for domestic recycling of the scarce resource crucial to manufacturing industry selected for NEDO's Feasibility Study Program

Mitsui Chemicals, Inc. (Tokyo: 4183; President & CEO: HASHIMOTO Osamu) today announced that, along with its wholly owned subsidiary Shimonoseki Mitsui Chemicals, Inc. (Shimonoseki, Yamaguchi; President: YOKAWA Naokazu), it has begun developing the recycling technology required to produce high-purity phosphorus materials in Japan. The aim of this endeavor is to recover phosphoric acid from underused phosphorus resources and turn it into high-value-added products in the form of high-purity phosphorus materials for reuse in manufacturing industry.

These development efforts are part of a jointly proposed project involving the National Institute of Advanced Industrial Science and Technology (AIST), Yoneyama Chemical Industry Co., Ltd. and Saga University that has been selected by the New Energy and Industrial Technology Development Organization (NEDO) for the Feasibility Study Program on Creation of New Industries and Innovative Technologies*, following an open call for proposals.

■ Background to the R&D

High-purity phosphorus materials are essential to the formation of zero-carbon industries and societies, due to their utilization in such items as electric vehicle batteries, semiconductors and batteries for storing power generated from renewable energy. Made from phosphate ore, yellow phosphorus is a raw material common to the manufacture of these items. However, the technique still used today to produce yellow phosphorus was developed in the latter half of the 19th century and imposes a substantial burden on the environment.

Japan is entirely reliant on imports to cover its phosphate ore and yellow phosphorus usage needs. Given that securing a stable supply of phosphorus resources also comes with economic security risks, phosphorus has been identified by the Japanese government as a specified critical product.

This research project aims to reuse underused phosphorus resources – phosphorus-containing waste and by-products from Japanese manufacturing industry – as high-value-added products by recycling these resources into high-purity phosphorus materials. To this end, the project seeks to establish technologies that will enable the recovered phosphorus to be refined at the atomic and molecular level, and to be reused in a wide range of manufacturing fields.

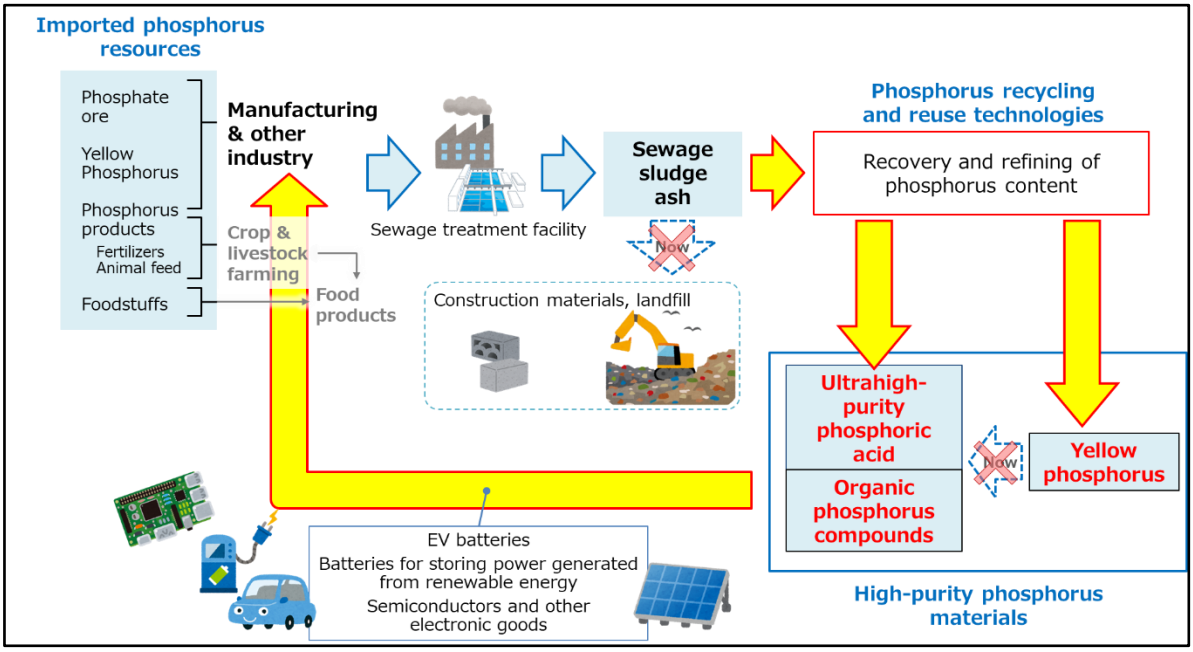


Illustration of the technology development project for the recycling of high-purity phosphorus materials

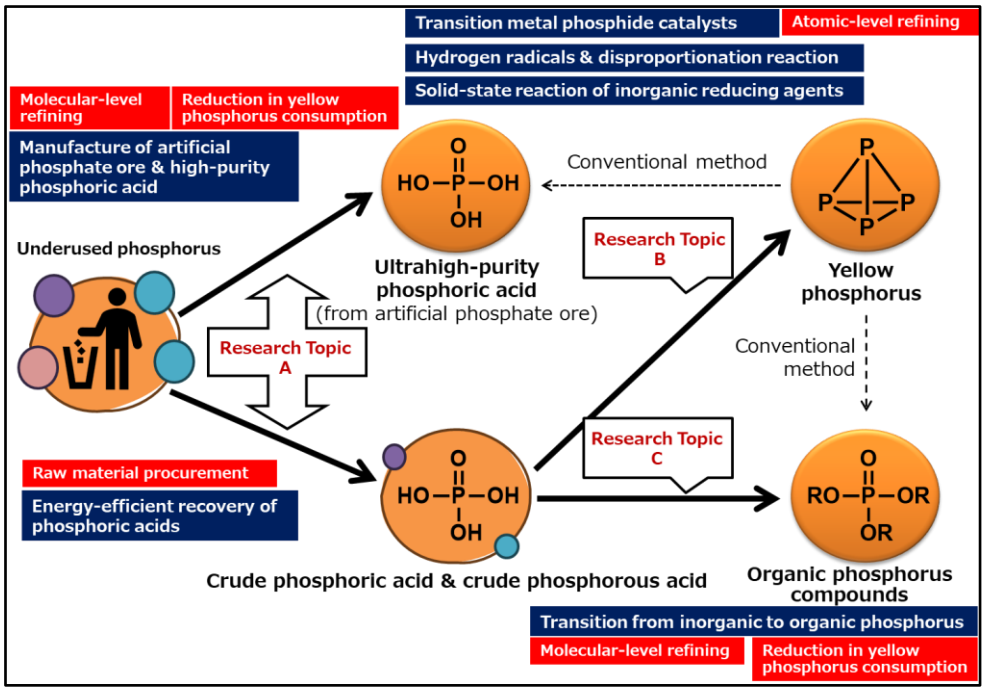
■ R&D specifics, implementation setup and value of social implementation

Shimonoseki Mitsui Chemicals is Japan's only company producing phosphoric acid via the wet process, while Mitsui Chemicals excels in catalytic chemistry. Along with partners including institutions that have a knowledge of phosphoric acid or associated technical capabilities, these two companies intend to further the development of technology that will lead to the expansion of recycling applications for recovered phosphorus, whose use until now has mainly been restricted to fertilizers for the agricultural sector.

R&D theme: Phosphorus recovery and recycling toward material industry
1. Development of technology seeds for the recovery of phosphoric acid from underused resources and its refining at the molecular level to produce ultrahigh-purity grades (Research Topic A)
2. Development of technology for the refining of phosphorus at the atomic level to produce ultrahigh-purity grades (Research Topic B)
3. Development of technology for producing ultrahigh-purity organophosphorus compounds (Research Topic C)

Company/institution implementing research	Research topic	
Shimonoseki Mitsui Chemicals, Inc. https://www.shimonoseki-mci.co.jp/	A-1	Development of methods for manufacturing artificial phosphate ore and ultrahigh-purity phosphoric acid using sewage sludge ash
National Institute of Advanced Industrial Science and Technology (AIST) https://www.aist.go.jp/index_en.html	A-2	Development of processes for refining phosphorus-containing waste to manufacture crude phosphoric acid and crude phosphorous acid
Mitsui Chemicals, Inc. (Recommissioned) Muroran Institute of Technology https://muroran-it.ac.jp/en/	B-1	Development of technology for manufacturing phosphorous acid by means of the catalytic reduction of phosphoric acid using hydrogen
Yoneyama Chemical Industry Co., Ltd. https://www.yoneyama-chem.co.jp/en/ (Recommissioned) National Institute of Technology, Kagawa College https://www.kagawa-nct.ac.jp/abroad/	B-2	Technology for manufacturing yellow phosphorus by means of the reduction of phosphoric acid to phosphorous acid using hydrogen radicals, along with a disproportionation reaction

AIST	B-3	Process technology for continuous reaction of condensed phosphoric acid, etc. using a reducing agent
AIST	C-1	Refining technology for the synthesis of phosphoric acid and phosphorous acid esters for use as key reactants for silicon compounds
Saga University https://www.saga-u.ac.jp/en/	C-2	Efficient production of high-purity phosphorus materials by means of the esterification of organic phosphoric acid



Development of technology for recycling underused phosphorus resources into high-purity phosphorus materials: Solutions and methods

*NEDO: Decision on the Implementation Setup for the FY2024 NEDO Feasibility Study Program/Feasibility Study Program on New Technology (Japanese version only)