

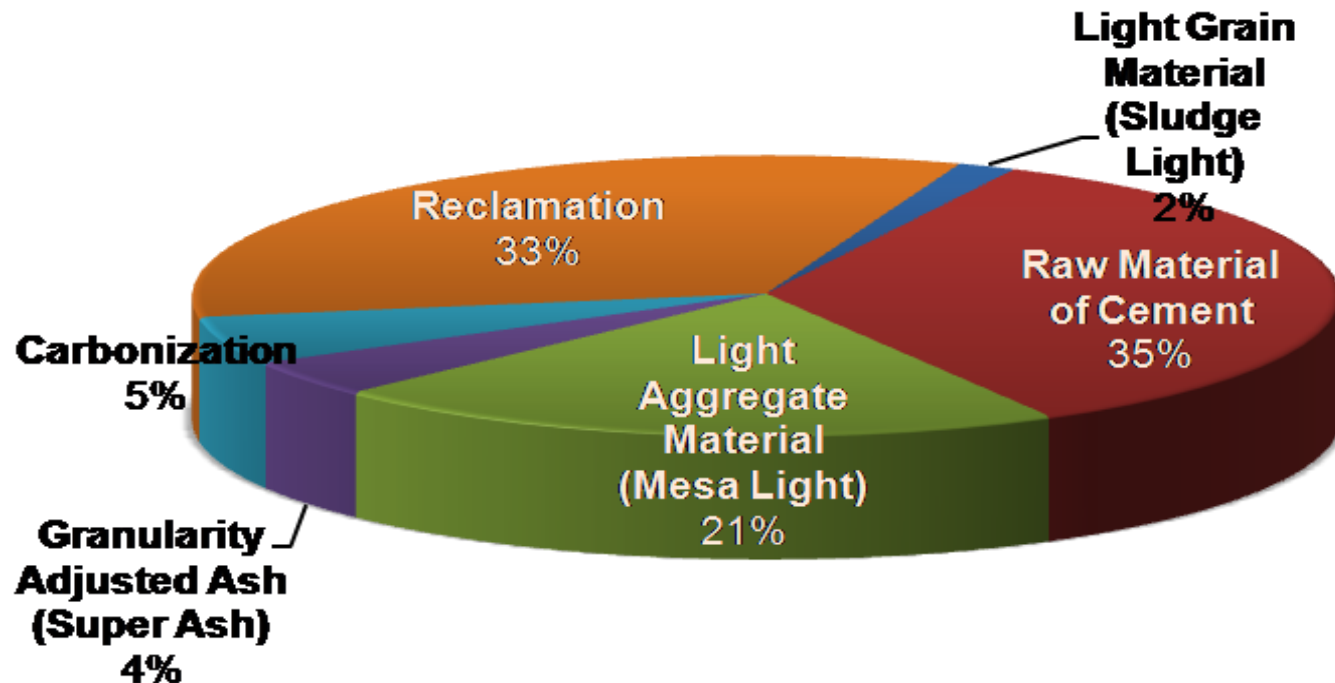
Development of Harmful Substance Removal and Phosphorus Recovery Technology from Sewage Sludge Ash



**Technical Development Section,
Planning & Coordination Division**

Current State of Sludge Disposal and Reuse

- Amount of Dewatered Sludge in All Wards of Tokyo is **About 975,000wt/ Year (2,670wt/ Day)**
- After Dewatering, Whole Sludge Goes to Incineration (**100% Incineration**)
- Expansion of Ash Recycling is Required

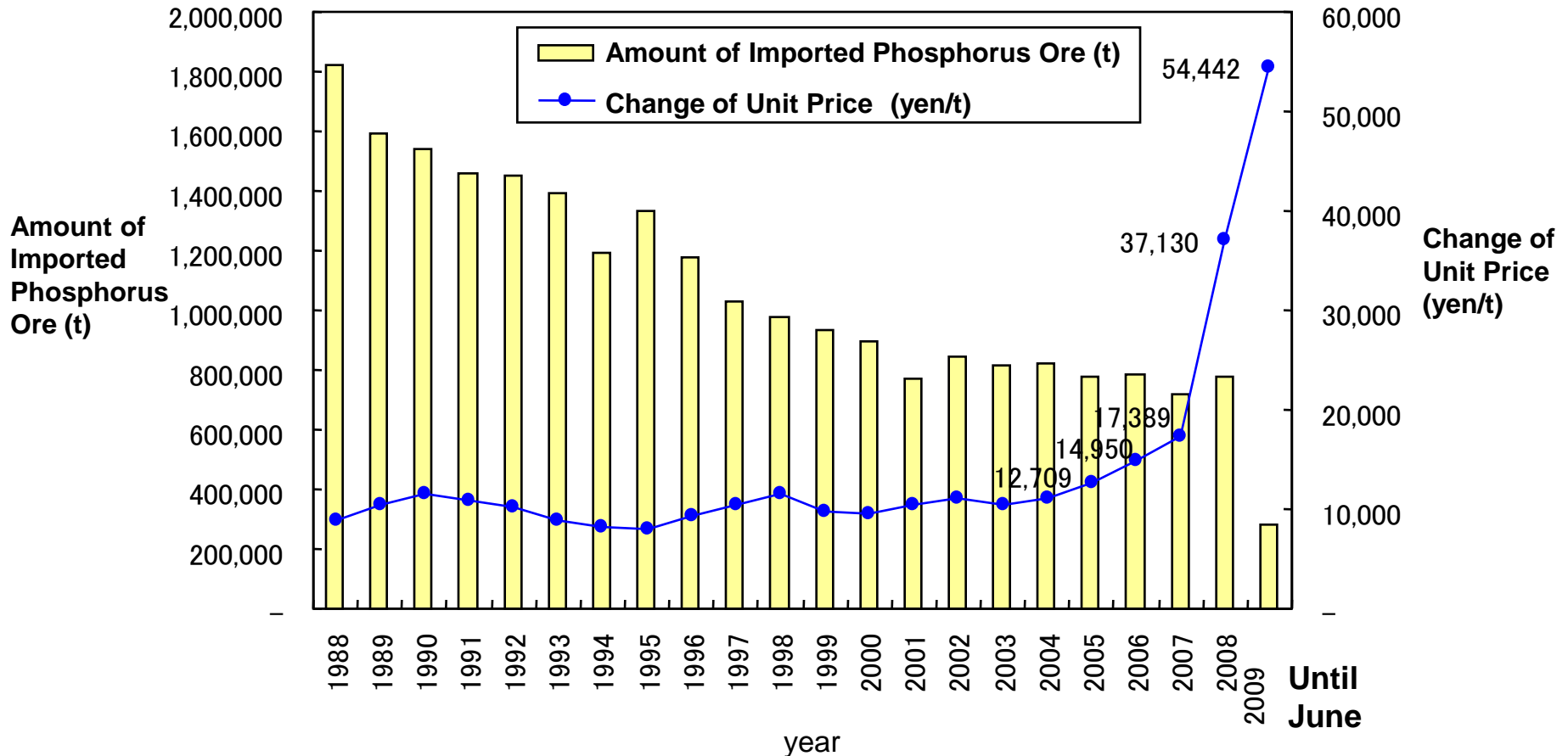


(Result in 2008 Fiscal Year)

Background of Phosphorus Recovery

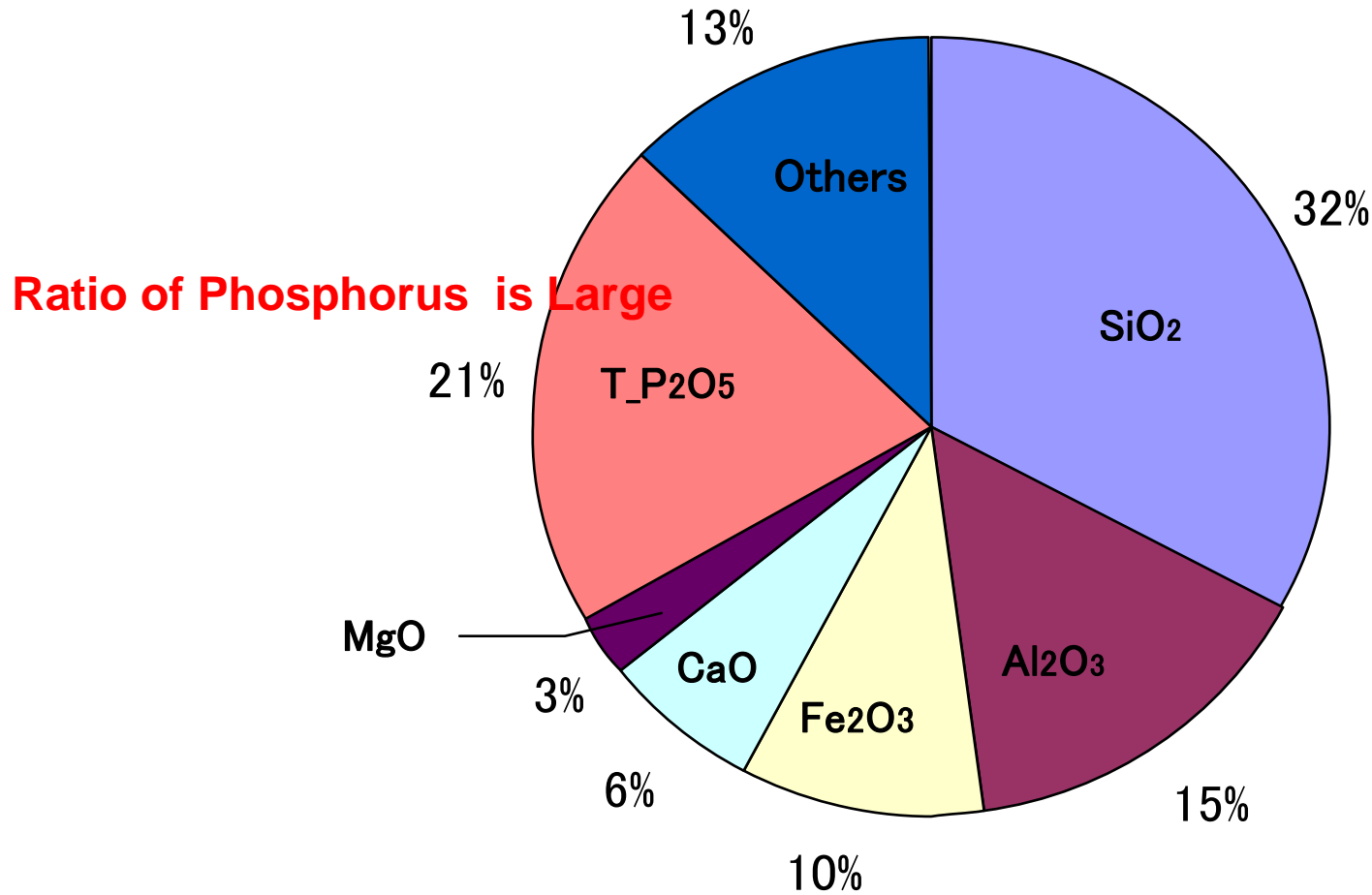
Rise of Phosphorus Ore Price

Expectation for Cheap Phosphorus Resource



Amount of Imported Phosphorus Ore (T) and Change of Unit Price

Composition of Sewage Sludge Ash (Example)



Purpose

- 1. Development of Technology to Make Heavy Metal Contained in Ash Harmless in Order to Expand Ash Recycling and Usage**
- 2. Development of Technology that Efficiently Extracts and Recovers Phosphorus from Ash**

Target of Development

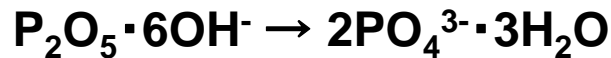
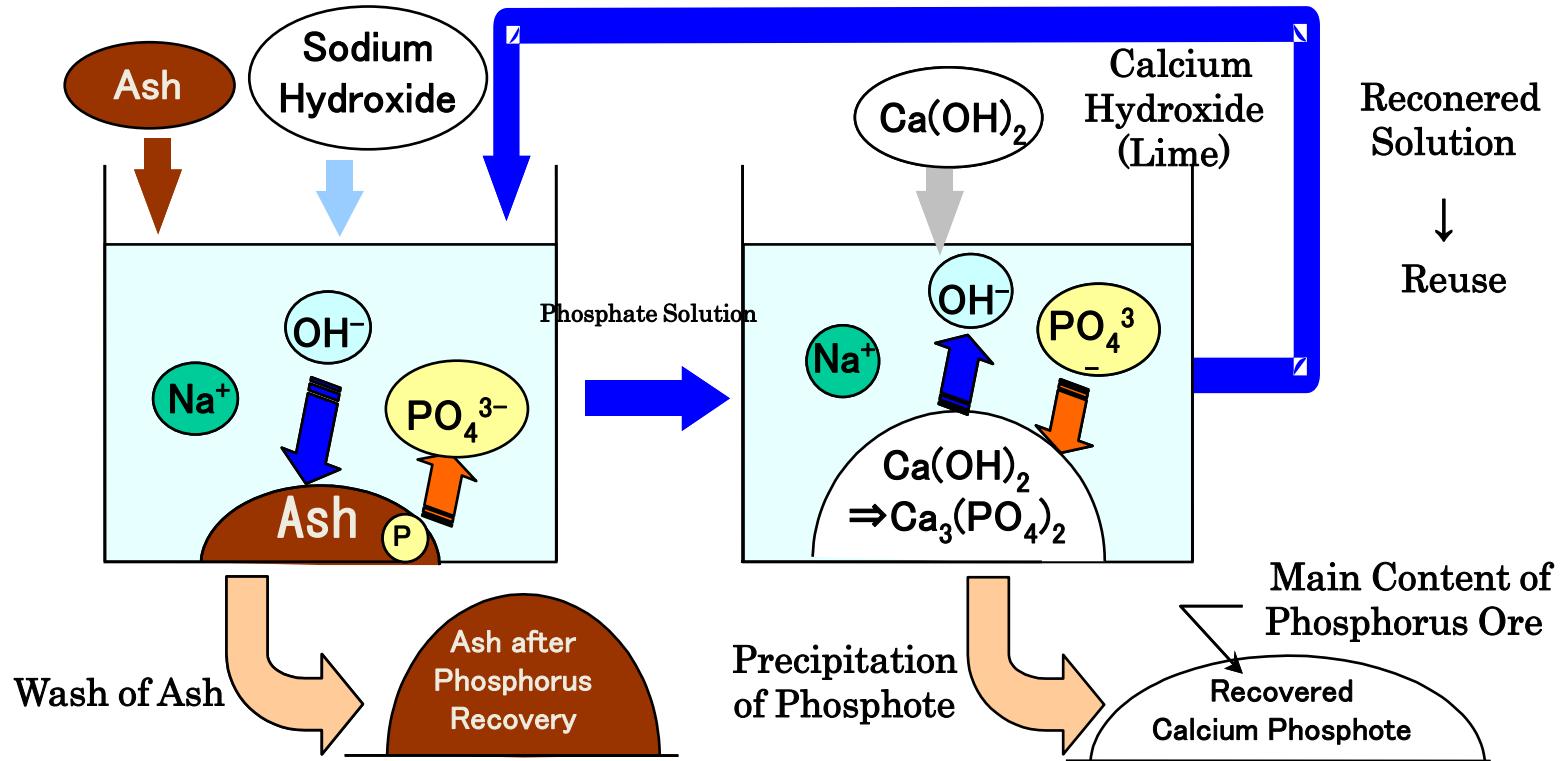
1. Quality of Treated Ash

Ash after Phosphorus Recovery Meets Environmental Quality Standards for Soil (Environment Agency Notification No.46) and Standard for Amount of Content in Soil (Notification No.19).

2. Quality of Phosphorus

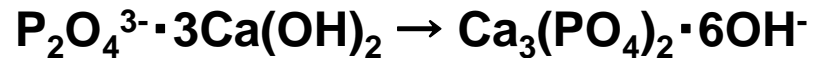
Recovered Calcium Phosphate Meets the Standard on Fertilizer Control Law.

Outline of Technology



Reaction Time 5-30 minutes

Temperature 50-70°C

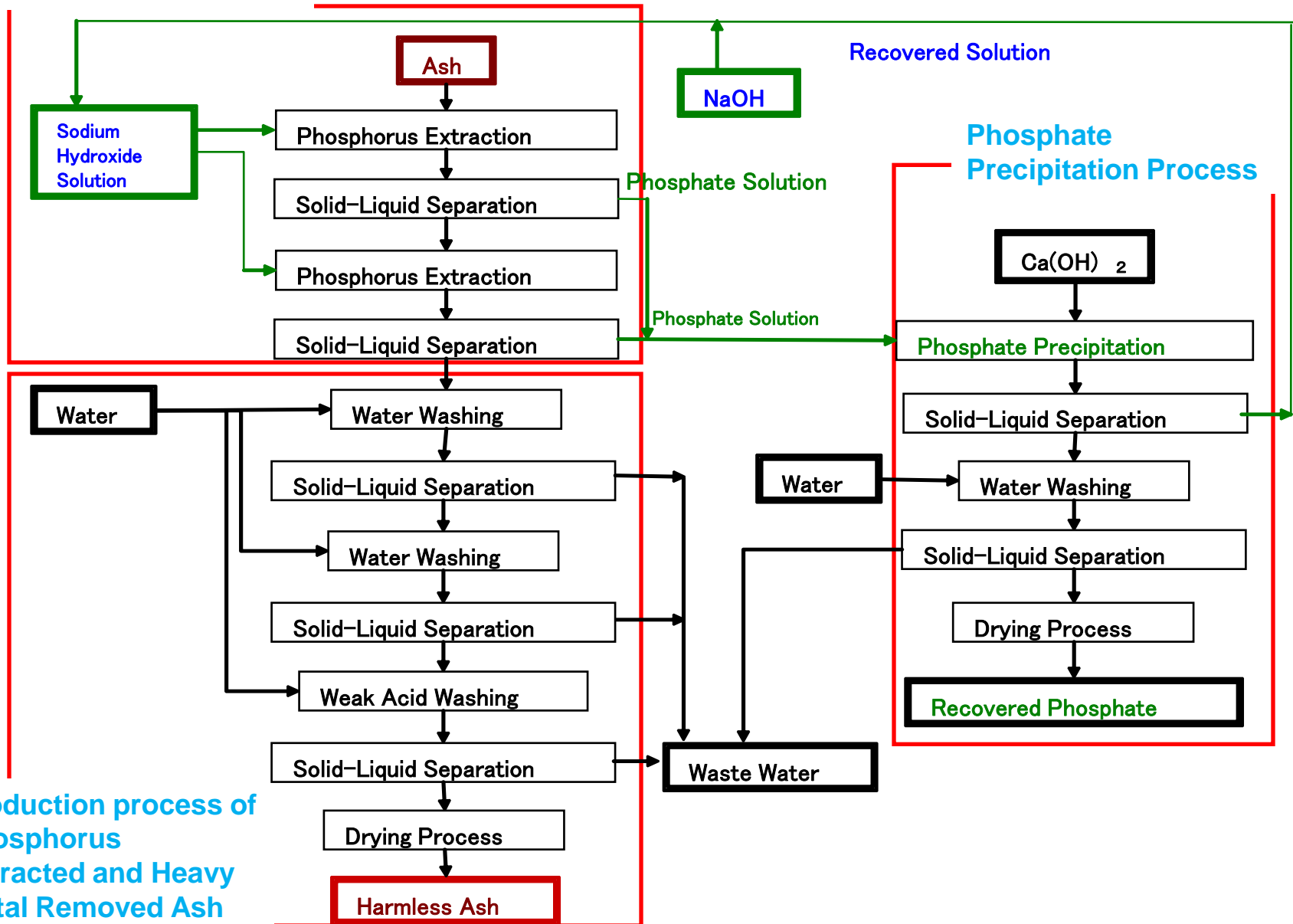


Reaction Time 6-18 hours

Temperature 20-50°C

Process Flow

Phosphorus and Heavy Metal Extraction Process



Pilot Plant



Pilot Plant is Placed at Research and Development Center.

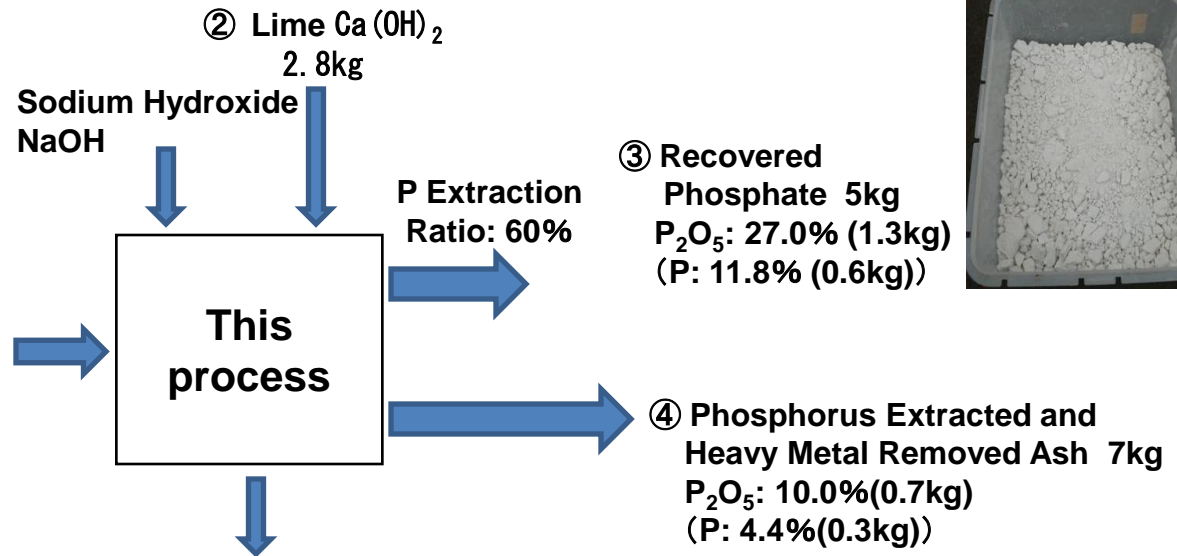
Example of Phosphorus Mass Balance



① Ash
10kg
 P_2O_5 : 23.0% (2.3kg)
(P: 10% (1.0kg))

【 Extraction Conditions 】

- Solution
1N-NaOH
- Weight Ratio of Alkaline Solution and Ash
10
- Number of Extraction
2 times
- Target Value of P Extraction
more than 60%



Result of Analysis (Notification No.46 and No.19) on Phosphorus Extracted and Heavy Metal Removed Ash (Example)

Composition of Ash			Notification No.46			Standard
Water	%-DB	56.0	As	mg/L	less than 0.005	0.01
Ig-loss	%-DB	5.5	Se	mg/L	less than 0.002	0.01
SiO ₂	%-DB	34.2	Cd	mg/L	less than 0.001	0.01
Al ₂ O ₃	%-DB	9.61	CN	mg/L	none	none
Fe ₂ O ₃	%-DB	14.1	Pb	mg/L	less than 0.005	0.01
CaO	%-DB	7.61	Cr(VI)	mg/L	less than 0.01	0.05
MgO	%-DB	3.85	Hg	mg/L	less than 0.0005	0.0005
T-P ₂ O ₅	%-DB	9.74	F	mg/L	less than 0.1	0.8
W-P ₂ O ₅	%-DB	0.62	B	mg/L	0.13	1
C-P ₂ O ₅	%-DB	9.29	Notification No.19			Standard
As	mg/kg	13.4	Cd	mg/kg	5	150
Cd	mg/kg	6	Cr(VI)	mg/kg	less than 2	250
Hg	mg/kg	0.36	CN	mg/kg	less than 1	50
Ni	mg/kg	560	Hg	mg/kg	0.18	15
Cr	mg/kg	566	Se	mg/kg	less than 2	150
Cr(VI)	mg/kg	less than 0.4	Pb	mg/kg	148	150
Pb	mg/kg	174	As	mg/kg	1	150
Ti	mg/kg	5220	F	mg/kg	140	4000
			B	mg/kg	13	4000

Composition of Recovered Phosphate (Example)

Item	Unit	Composition	Standard on Fertilizer Control Law
Water	%	53.2	–
Ig-loss	%	5.9	–
SiO ₂	%	4.57	–
Al ₂ O ₃	%	1.95	–
Fe ₂ O ₃	%	0.06	–
CaO	%	45.3	–
MgO	%	0.31	–
T-P ₂ O ₅	%	32.3	–
W-P ₂ O ₅	%	less than 0.01	–
C-P ₂ O ₅	%	31.9	more than 15%
As	%	0.00023	less than 0.13%
Cd	%	0.0001	less than 0.005%
Hg	mg/kg	less then 0.005	–
Ni	mg/kg	less then 5	–
Cr	mg/kg	less then 20	–
Cr ₆₊	mg/kg	less than 0.4	–
Pb	mg/kg	20	–
Ti	mg/kg	20	–

Results and Schedule for the Future

Results

- 1. Technology to Produce Harmless Ash has been Developed.**
- 2. Technology of Phosphorus Extraction, Phosphate Precipitation and Recovery have been Developed.**

Schedule for the Future

- 1. Decrease of Lead (Pb) Content in Harmless Ash**
- 2. Development of Reuse Technology for Recovered Alkaline Solution**
- 3. Expansion of Recycling for Phosphorus Extracted and Heavy Metal Removed Ash**

Thank You for Your Attention

