Development of Resource Elements Recovery/Utilization Technology from Wastewater

(Research of FY 2017-2021)

1. Purpose

Sewerage has many potential renewable energy resources such as treated wastewater, sewage sludge, sewage heat, and phosphorus. However, its rate of utilization is still low.

This study aims to investigate the feasibility of the recovery and utilization of rare resource and metal from sewerage and develop the technology for their practical application.

2. Achievement of This Year

There are concerns over the future depression and the short supply of mineral resources including rare metal.

Table 1: Estimated volume of rare metal in sewage sludge and its ratio to domestic needs (Extraction)

Kind of metal	Estimated volume (t/year)	Ratio to domestic needs
Ag	11.3	0.8
Au	0.09	0.1
Hf	0.68	29.6
P	114,000	64.6
Pt	0.05	0.15

*each value is estimated from median value

This year, information collection and approximate estimation are made to study the feasibility of rare metal recovery from sewage sludge.

(1) Volume estimation of rare metals in sewage sludge

The case examples about rare metals included in sewage sludge are studied. Researchers compare the potential generation of rare metals and their

domestic needs, and estimate their values. Using the content rates (median and maximum values) of rare metals included in sewage sludge of sixty-four WWTPs in Switzerland, the content rate of Japanese sewage sludge is assumed. The result of investigation for ninety-two metals estimate that Hf (hafnium) has the highest economic value of 1.77 billion to 103 billion JPY per year (2.6 million JPY per kg.)

(2) Rare metals that might be included in domestic wastewater

Rare metals that might be discharged as wastewater are investigated through the internet, etc. Among these metals, Ag and Pt widely used as body soap, shampoo, laundry detergent, kitchen detergent, and house detergent, are investigated on their annual sales amount and the rate of product (assumed value) including Ag and Pt to approximately estimate their possibilities that they are in wastewater.

The result of estimation demonstrates Ag of under 30t is discharged into wastewater per year. This value which is about 2.5 times of the above (1) estimation of 11.3t per year indicates the possibility that sewage sludge includes a certain quantity of Ag resource in it.

On the other hand, Pt estimated that annual discharge amount is 0.3t is supposed to have low possibility being in sewage sludge.

(3) Applicability of recovery technology

Phosphorus recovery technology has high usability as resource recovery from sewerage. The technological compatibility between phosphorus recovery from sewerage and rare metal recovery from sewage sludge is studied.

Alkaline extraction is a technique that precipitates phosphorus from sewage sludge ash. Here, most of the rare metals are supposed to move to the residue of incineration ash after alkaline extraction. Therefore, it is likely

that sludge with a high content of rare metals can be extracted rare metals from its residue.

3. Future issues

The study result demonstrates the possibility that sewage sludge includes many rare metals in it. Even metal with high recovery possibility from sewage sludge varies its profitability when being practically applied because of unstable market price. Therefore, knowing the potential of rare metals is critical to consider the feasibility of resource recovery. Since this study deals with documents including other countries, research on the recovery potential of rare metals included in domestic sewage sludge is critical in the future.

Keywords: rare metal, resource utilization, resource recovery