

## Research on the Development of Technology to Transform Sewage Ash into Raw Materials for Fertilizer Production

Year of Research

2011~2013

Establishment of energy and resource recycling

### (Purpose)

The soaring price of fertilizers and the raw materials for fertilizers for use in grain production world-wide has begun to obstruct efforts to secure raw materials to make the chemical fertilizers which have ensured stable high yields of agricultural products in Japan. On the other hand, phosphorus and other raw materials for fertilizers that originate in people's food consumption and excretions are effectively collected by sewage systems constructed in cities, and sewage ash which can be produced in sewage treatment plants contains phosphorus equivalent to phosphorus ore. This research develops technology to use sewage ash as a raw material for fertilizer production based on a joint research project with the Ministry of Agriculture, Forestry and Fisheries titled "Implementation Technology Development Project to Promote Agriculture, Forestry and Fisheries Policies".

### (Results)

The research addressed five issues and obtained the following results.

#### (1) Research on element control

- In the experiment for explaining the volatility characteristics of heavy metals, a high volatility rate was confirmed for heavy metals and no volatility was observed for phosphorus. These results suggest the possibility of producing safe phosphorus fertilizer by volatilizing the heavy metals contained in sewage sludge ash.
- While exploring the optimal methods for recovering phosphorus, it was found that an electro dialyzer that uses the ion-exchange membrane and titanium and platinum electrodes can separate some of aluminum and phosphorus in the eluate.

#### (2) Process Study

- The results of the analysis of a survey of 83 municipalities in Japan and an analysis of their sewage sludge ash samples have been summarized and released as a survey report regarding the effective utilization of sewage sludge ash.
- i) Temporal setting of chlorination conditions, ii) Review of process flow, iii) Calculation of costs, iv) FS evaluation, v) Study of methods to reduce costs were conducted to review the production process of fertilizer ingredients from sewage sludge ash.
- Sewage sludge ash is applicable as an alternative to the phosphate rock used in the wet phosphate production process. Since a large amount of Al, Fe, Pb, Si and other impurities are contained in the ash, the mixing limit was found to be approximately 1%.

#### (3) Effect and evaluation study

- The effect of the processed sewage sludge ash on crop growth was studied. An experiment to cultivate quing-geng-cai (Chinese cabbage) using the provided sewage sludge ash processing material showed that there is no adverse effect on the plant growth and confirmed the benefits of fertilization.
- The concentration of arsenic, copper, zinc, and cadmium in the processed sewage sludge ash was reduced by 52% to 95% compared to the raw sewage sludge ash. It was confirmed that the elements with a high plant availability were effectively removed.

#### (4) development of system for making fertilizer ingredients

- The establishment of a system with cheaper costs to those obtained from production cost analysis was set as a goal. Price trend analysis for fertilizers, etc. showed that the import price for phosphate rocks is increasing.

(5) Support organization

- The "Feed and Agricultural Materials Inspection Center" suggested the necessity of a scientific explanation for the removal process of heavy metals, focusing especially on the material balance of heavy metals.

※Nagoya University, Iwate University, Public Works Research Institute ,  
TUKISHIMA KIKAI Co. Ltd., KOBELCO ECO-SOLUTIONS Co. Ltd.,  
Tokyo University of Agriculture, National Institute for Agro-Environmental Sciences  
Japan Fertilizer & Ammonia Producers Association,  
Japan Institute of Wastewater Engineering and Technology

Inquiries ; Resource Recycling Research Department, Takashi Ishida, Shuichi Ochi, Hiroyuki Iwami,  
[03-5228-6541]

Key words

Raw materials for fertilizer, phosphoric fertilizer, chlorination volatilization method,  
acid extraction process, safety evaluation