

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)

In order to make sewage sludge ash available as a fertilizer source, we clarified the removal and control methods and studied the practical system for the constituents and trace heavy metals that make up the sewage sludge ash. We also studied the test and evaluation methods in order to register the sewage sludge ash according to "Regulation of Fertilizers" as a new type of fertilizer that can be used by the public.

(Results)

- (1) The mechanism that can separate and remove trace heavy metals from the sewage sludge ash was clarified for the chlorination volatilization method. The metals that can easily undergo chlorination volatilization showed high treatment efficiency under the reduced pressure condition. It was confirmed that there was no significant change in the phosphoric acid content and citric acid-soluble phosphorus content in the treated ash, and the heavy metals can be specifically separated and removed. The cultural test of Green pak choi showed similar or better performance compared to calcium superphosphate and other conventional products. Further study is necessary because the heavy metal content increased in the ash treated with chlorination volatilization at a low treatment temperature. It was possible to make an overview process of this method. Verification with a pilot plant is required for practical application.
- (2) For the sulfuric acid extraction and electro dialysis purification process, we successfully developed a separation system that can remove Al and other metals (except Fe) from the sulfuric acid elution filtrate of sewage sludge ash using an electro dialyzer with an acid-resistant ion-exchange membrane. This method can replace the sulfuric acid elution filtrate with a mix of phosphoric acid and sulfuric acid that includes less metal content and increases the practicality of sulfuric acid elution filtrate as phosphate fertilizer source. When the ammonium phosphate dibasic was experimentally produced from the obtained phosphoric acid solution, we could achieve a high purity and quality. In order to make this into a process, it is necessary to conduct experiments to verify the performance and specifications of individual equipment.
- (3) We surveyed municipalities on the properties of sewage sludge ash and published the result as Public Works Research Institute Report No. 4243. In addition, we studied the annual variation in three incineration facilities and would like to emphasize the importance of understanding the variation characteristics, which can be used as a reference when reviewing the process of producing fertilizer source for sewage sludge ash. There was no significant difference in the relationship between the particle size fraction and heavy metal in sewage sludge ash from the bubbling fluidized bed furnace.
- (4) From the relationship between the dust collection method and heavy metal content in fly ash in the sludge incineration process, it was confirmed that the sludge combustion method can reduce the heavy metal content in fly ash through the application of cyclone and electric dust collection if the region has a high heavy metal generation with a medium boiling point (Se, etc). The basic experiment to verify the reduction effect of heavy metal content during the application of high temperature dust collection showed that heavy metal constituents (Cr, Ni, etc.) can be reduced by increasing the temperature of 6 dust collector fly ashes to 950°C. In order to quickly obtain the high quality sewage sludge ash, we suggested a method of separating and incinerating only the excess sludge.
- (5) We found that an absorption process is effective for removal of impurities such as Al and Fe by acid extraction process, etc., and also filed a patent application. After establishing the process and reviewing the economic efficiency, we found that the price is 2.5 times that of the imported phosphate rock. Hence, further study is necessary for practical use.

(Conclusion)

We believe that if we can develop a practical technology to transform the sewage sludge ash into fertilizer source at an early stage and provide a fertilizer source at a stable volume and price, we can contribute to the stable production and management of fertilizer in agriculture business.

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Key words

Sewage sludge ash, fertilizer, phosphorus, heavy metal, impurity