

## Study on the utilization of the technology of phosphate recycling using seawater

Whole term

1995. 6 ~ 1997.3

### (Purpose)

This technology is recycling phosphate as a fertilizer by recovering phosphates from the wastewater treatment process. Utilization of sea water in this process is important in economical aspect because it is a source of magnesium that is necessary for the recovery of phosphates, and the recovered phosphates can be utilized in manufacturing fertilizer.

The study on the utilization had been conducted for 2 years from 1995 to 1996. The objective was to establish a technology for manufacturing MAP, and using the recovered phosphates effectively as a high-quality fertilizer, by evaluating and investigating the improvement of the economical efficiency due to the production of MAP using seawater. In this year, the operational conditions for manufacturing MAP were reduced; the application in the real facility was investigated; the effectiveness of MAP-merchandise was confirmed; and the packed MAP was displayed for people to recognize the product.

In addition, methods for increasing the quality of manufactured MAP, marketability and economical efficiency were investigated, using the above results.

### (Results)

#### 1) Investigation on the optimal conditions for manufacturing MAP

The optimal conditions for the double cylinder method are: pH equal to 7.8, the diameter of MAP being less than 1.4 mm, the Mg/P ratio being over 1.5, the maximum aeration of the airlift being 130 m<sup>3</sup>/m<sup>2</sup>/h, and the flow rate being 30 m<sup>3</sup>/day (LV 39.8 m/h). The optimum conditions for the single cylinder method are: pH being 7.9, the Mg/P ratio being over 1.5, the flow rate being less than 14.4 m<sup>3</sup>/day (LV 34 m/h), and the return rate being more than 3 times. A stable phosphate removal can be achieved in the case of using sea water as the Mg source possesses a Mg/P ratio of over 1.5, and it is easy to operate in case of a variation in the phosphate concentration in the raw water, as well as it has a sound economical efficiency.

#### 2) Investigation on the optimal operational conditions of MAP manufacturing equipment

The MAP mixed with ammonium sulfate and calcium sulfate, attains the highest strength at a diameter and a depth of 3 mm and 6mm, respectively. The number of rotations for making powder is optimal at 250~500 rpm. Drying for 4-10 hours at a temperature of 80 ° C shows a low breakdown in water, and a high strength is attained. In the process of manufacturing MAP, the components can be adjusted according to the mixing material, the amount of components and the condition of manufacturing. And it is confirmed that the products can be manufactured for variety of usages such as for slow effect and immediate effect.

#### 3) Test on the effectiveness as a fertilizer

According to the results of the application on alternative lawns, flower beds on bare grounds and tree planters in a greenhouse; MAP can have the same effect as a market-fertilizer in case of adjusting N and P concentration. The effect of MAP as phosphoric fertilizer depends on the diameter. Therefore, the effectiveness can be adjusted by changing the diameter of MAP. As a result, MAP is a well sound product as phosphoric and nitrogenous fertilizer; and it is environmental and soil friendly thanks to being a recycled fertilizer.

#### 4) Examination on a method to increase the quality

The manufacture of MAP can be changed by adjusting the characteristics, the time of effect as immediate and slow, depending on the characteristics of the raw material, the mixing ratio of the raw materials, and the shape of the particles. And the leaching rate of MAP is so low that it does not raise the electric conductivity of soil. Therefore, it is environmental protective material. An increase in quality can be expected based on these characteristics.

5) Investigation on the economical efficiency of the manufacture of MAP and the marketability

Marketability of the manufactured MAP considering the agricultural share is sufficient. And the unit cost for manufacturing MAP is not so competitive, however it is as competitive as a fertilizer used in house-gardening.

6) Summary

The technology for utilization can be established based on the results from the MAP manufacturing technology using seawater, which is economical and effective, to the technology for manufacturing MAP products based on the fertilizing value of MAP. It is expected that this technology is used as a way of water environmental conservation and recycling the exhausted resources.

Collaborators: Kitakyushu City

Japan Institute of Wastewater Engineering Technology

Personnel in charge of the study: Akira Yamane, Katsumi Kamata, Masumi Isono,

Shigeharu Inoue

Keywords

MAP manufacturing, MAP products, Test for fertilizing value, Quality improvement, Marketability, Economical efficiency