

Study on the Reuse of Incineration Ash as Construction Materials

Whole term

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(Purpose)

Sewage sludge disposal along with its environmental impacts, has been identified as a major problem in Kanagawa prefecture, requiring immediate attention for developing its effective utilization policy and process.

For the effective utilization of sewage sludge, the prefecture has come up with a policy to implement area-wide utilization of the sludge along with the stabilization and reduction of the sludge through incineration at sewage treatment plants.

Considering the local situations in the prefecture, where a great demand for construction materials is expected mainly in public works, effective reutilization of the sludge could be attained in form of using it as construction materials.

Reuse of the sludge as crushed stones or aggregates would be effective especially in the Metropolitan area, considering the gradual decrease in supply of natural crushed stones and aggregates. In addition, Kanagawa prefecture having a long shoreline, the reuse of sludge as shore sand to meet the increasing demand for sand to cope with the problem of receding shoreline due to the encroachment by the sea is also gaining attention.

In order to enable those reuses to be implemented, melting processes need to be developed for the incineration ash. Among the kinds of melted slag, granulated slag is already used as construction material at several sites. However, this being a glass material, it can not be compared favorably with natural materials in regard to its strength, adhesion to concrete and resistance to wearing down. Therefore, the technology needs to be developed for stable production of high quality melted slag, which would be comparable to natural materials and could be expected to be used for various purposes as desired.

This study discussed manufacturing technologies by the process of melting-slow cooling-crystallization.

(Results)

The study was conducted on three regional sewage treatment plants in Kanagawa prefecture. The results are as follows.

1. Incineration ash generation

It was estimated that the incineration ash generation would add up to about 60t/day (no humidification) in these three plants in the year 2000.

2. Quality of the incineration ash

The quality of the incineration ash from these three plants was analyzed once in two weeks.

- (1) The phosphorus content was found to be high at the level of 20%. Removed phosphorus by the coagulation process during the sewage treatment contributed high phosphorus content.
- (2) According to the classification based on the content of three components, namely SiO_2 , Al_2O_3 , CaO , the composition of the incineration ash from one plant was found to be similar to that of fly ash, on the other hand, the compositions of the incineration ash from the other two plants showed intermediate compositions between fly ash and natural cement.
- (3) Considering the relation between the alkalinity and melting point (temperature) observed in the sample incineration ash, the study found that the melting point dropped along with the lower alkalinity until it reached the alkalinity level of 0.4.
- (4) Considering the relation between the phosphorus content and melting point, a tendency was observed that the melting point dropped along with the higher phosphorus content.

3. Experimental production of melted slag

Melted slag was experimentally produced by mixing equal amounts of melted slag from the three plants, using a small scale electric melting furnace under a certain pattern of slow cooling. In addition, the quality of the melted slag was analyzed.

As a result, crystallization failed to proceed because the alkalinity was not controlled. However, the water absorption rate met the standard for the asphalt pavement, according to the results of the quality test for the aggregate use. Moreover, considering the wearing rate, it achieved the target level to be used as lower sub-base road material.

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Keywords

incineration ash, reuse as construction materials, shore sand, melted slag, slow cooling, crystallization

