Study on the utilization of the artificial soil made of incinerated ash of sewage sludge, for house-gardening		
Whole term	1993. 6 ~ 1997.3	

(Purpose)

One of the effective uses of incinerated ash of sewage sludge was to be produced as a particulate soil after granulation and solidification with incinerated soil. However, the increase of the cost for PAV used in granulation and solidification makes the cost of manufacturing increase, and because the soil produced by incinerated ash returns to ash after 1 year, obstructions for growth occur due to clogged roots.

This technology was developed to solve these problems. Granulation of incinerated ash makes the manufactured product possess high strength and water-holding capacity in comparison with the existing products. And the objective was to reduce the manufacturing cost using digested sludge-gas in the process of solidification, as a heat source for plasticity instead of using chemicals.

(Results)

1. Operational condition of each unit process

(1) Operational condition of granulation (Vibro mixer)

In the process of granulation, the optimal conditions are: solid occupies 12.5% in the incinerated ash, the equipment for granulation is 44 mm in diameter, the number of cylinders is 20, and the set oscillation is 50Hz. In addition, according to an investigation to seek the possibility of using the dried sludge, it was found to be unsuitable, because the crushing strength is as low as 1kgf.

(2) Operational condition of the process of plasticity (Rotary Kiln)

The optimal conditions are: the temperature being 910-950 $^{\circ}$C, the time for the plasticity being over 1 hour, and the number of rotations in the kiln being less than 2 rpm.

(3)Operational conditions of the drying process

The input of non-dried things into the kiln was investigated in order to simplify the manufacturing process and reduce the cost. The result was that the generated quantities of less than 1mm powder made by heating increased approximately by 15% based on the injecting quantity to the kiln. Therefore, the drying process is not necessary.

2. Confirmation of the stability of the series operation.

According to the results of a series operation, it was found that a stable operation in this case would be possible in aspect of the facility. However, the yield of the manufacture was 75% and a method to increase the yield was investigated.

3. Investigation on increasing the yield of manufacture.

When the incinerated ash and the powder made by heating are mixed together into a ratio of 8:2, the yield becomes 90%. Therefore, the targeted yield which is 85% can be satisfied. Also the conditions such as: the average crushing strength being 10 kgf, the suction rate of water being 40%, the average bulk density being 0.67 g/cm^3, the plasticity component being about 20%, and the ratio for mixing with the powder made by heating, are stable. It is confirmed that the grinding method of granulation and the recycling of the powder made by heating are effective in increasing the yield.

4. Guarantee of the quality of manufacture.

The comparison of the representative characteristics between the " Hama Soil" and commercial soil indicated that the Hama Soil would have an advantage as a supplement of phosphorus.

5. Investigation on the economical efficiency

Based on the result from the real sized pilot plant, the maintenance cost was calculated using a model designed with facilities of 5 ton/day and 10 ton/day. In comparison with the unit cost of the existing Hama Soil, there was no cost reduction in 5 ton/day scale; however the cost reduction by

scaling up was high in 10 ton/day as 7 yen/kg.

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Keywords	HAMA soil, Kiln-typed incinerator, the powder made by heating, Granulation, Yield