1 Objective & Project Summary

The purpose of this study was to investigate the effect of microwave irradiation on wastewater sludge drying.

The drying characteristics of sewage sludge were examined using household microwave at different power levels and exposure times. Moreover, the effect of the addition of glass beads to the sludge were also examined.

The results show that drying rate is directly proportional to the microwave power, it increases with an increase in power level. The addition of glass beads had a positive effect on drying enabling us to achieve higher solids content for the same power and reaction time.

2 Method

FIRST PHASE

1. Sludge was placed in crucible, its weigh recorded and placed in the oven. This was the blank sample and its solid content was measured.
2. 20 grams of sludge was placed in a beaker, pressed and placed in the microwave.
3. Some amount of dried sludge was placed in a crucible, weighed and put in the oven.
4. Steps 2 to 3 were repeated for different exposure time and powers.
5. After 24 hours, the weights of each crucible were recorded and solid contents were measured.

SECOND PHASE

Using 3 mm and 10 mm glass beads for 5 minutes at 350 watt and 2 minutes at 640 watt.
1. Steps 1 to 2 are the same as previously mentioned with the addition of 5 grams of glass beads.
2. The beaker was then placed in the microwave, dried, weighed and solid contents were calculated.
3. The experiment was repeated using the same sized glass beads but added to the sludge in different ways. Furthermore, the experiment was also repeated using 10 grams of the 3mm glass beads and 10 mm beads.

3 Results

FIRST PHASE

Optimum result were achieved at 2 minutes with 540 watt (1080 watt) because a high solids content was achieved but with less energy used compared to 340 watt and 460 watt.

The second phase was continued with the following powers and exposure times.

460 watt, 2 min - 73.9% solid content of dried sludge
350 watt, 3 min - 65.7% solid content of dried sludge.

SECOND PHASE

Best results were achieved with 3 mm glass beads at 350 watt for 5 minutes.

350 watt, 5 min, 5 grams - 93.1% solid content of dried sludge.
350 watt, 3 min, 10 grams - 82% solid content of dried sludge.

4 Conclusion

The removal of water from wet sludge is an important step in reducing sludge volume and transportation costs.

The use of microwave irradiation for drying instead of the conventional drying methods has increased because of the large reduction in energy requirements and reaction time (Foladori, et al. 2010).

The results show that 65.74% solid content can be achieved at a power of 350 watt for 4 minutes. However, this can be increased to 93.1% if 5 grams of 3 mm glass beads are used. Using microwave for sludge drying with glass beads allows 43% saving in cost.

However, for choosing the best drying method, important factors such as the location of the processing facility, the product requirements, alternative sources of energy, availability of capital and the balance between energy costs, labor costs, capital costs, and the value added to the product need to be considered.