

Feasibility Study on Energy Utilization in Marugame City Public Sewerage System

(Research of FY 2019)

1. PURPOSE

Global warming control and developing recycling society require aggressive utilization of reusable energy resources, such as sewage sludge, raw garbage, and unused biomass resources. The Ministry of Land, Infrastructure, Transportation, and Tourism has stated as one of its targets that wastewater treatment plants (WWTPs) shall be an aggregation, self-sufficient, and supply base of water, resource, and energy.

Based on the above background, this feasibility study aims to obtain data on sewage sludge generated at Marugame city municipal WWTP and unused local biomass from its neighborhood for considering their possibility as biomass energy resource by methane fermentation.

2. Outcomes of This Year

The study dealt with sewage sludge generated at Marugame city WWTP and local biomass from the neighborhood. Sewage sludge included primary, excess, and mixed raw sludge; local biomass included udon noodle shop residuals, including noodles and tempura, school lunch residuals from cooking and leftovers, and bone-in chicken residuals from restaurants. Basic property tests and batch methane fermentation tests were conducted for them. Test results are as follows.

1. A fundamental property of local biomass

- ① While mixed raw sludge has 3.4% total solids (TS), many local biomasses have 7.7 to 56.0%, which means high TS or semisolid.
- ② Many local biomasses had 82.4–98.6% organic component rates equivalent to mixed raw sludge except for bone-in chicken of 67.1%.
- ③ While many local biomasses had equivalent nitrogen and phosphorus concentration to mixed raw sludge, the bone-in chicken had 5-10 times their concentration.
- ④ Each principal ingredient of sewage sludge, residuals from udon noodle shop and school lunch, and bone-in chicken was protein, carbohydrate, and fat.

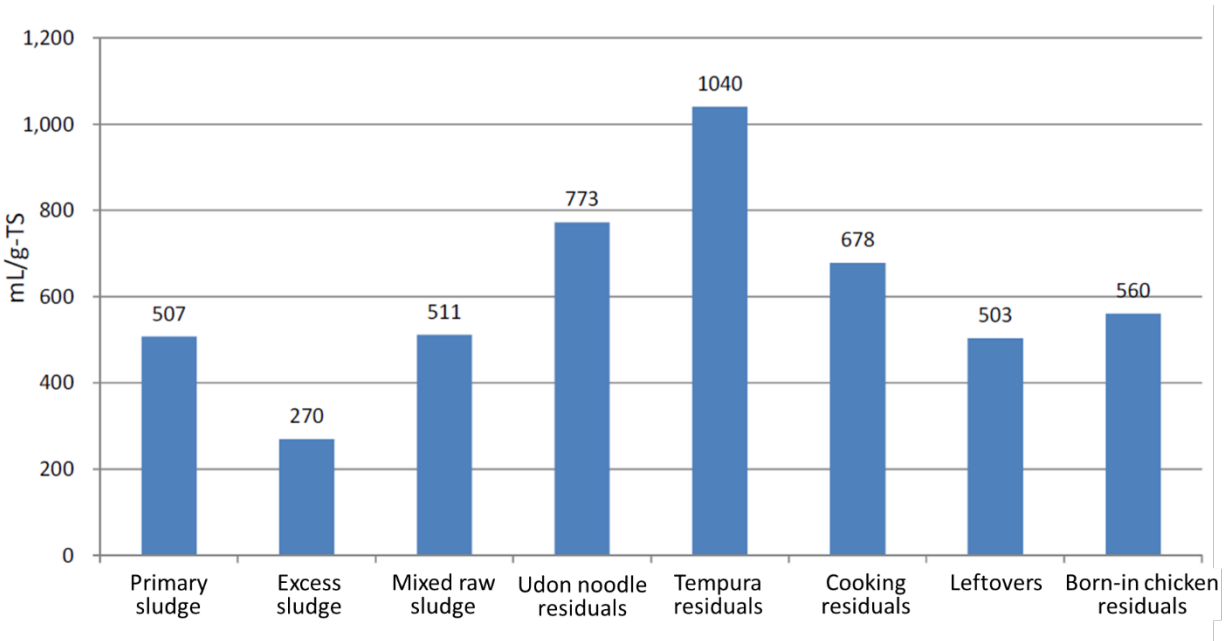


Figure 1. Methane fermentation property of each biomass

2. Methane fermentation property

- ① Each local biomass generated 503–1,040mL/g gas per supplied TS, which is equivalent to or more than that of mixed raw sludge (Figure 1)
- ② Each mixed raw sludge, udon noodle residuals, and cooking residuals showed methane fermentation within five days. On the other hand, tempura, leftovers, and bone-in chicken took 10–20 days for methane fermentation.

3. Digestive liquid property

- ① After the methane fermentation test using udon noodles and cooking residuals, the digestive liquid did not show many differences from mixed raw sludge for most items, such as M alkalinity.
- ② The bone-in chicken had 1.3-1.7 times higher M alkalinity, soluble T-N, and NH₄-N than mixed raw sludge, which was considered to need attention for return load at the wastewater treatment.

3. Future Plan

Marugame city is constructing a new WWTP adopting a bio-gas generation system for the operation starting in 2023. This study result will encourage Marugame city to consider local biomass utilization.

Keywords: **Methane fermentation, Local biomass, Food residuals**