CHAPTER V

CONCLUSION AND RECOMMENDATION

Conclusion

In recent years, biogas production has become the most interesting option for the solid waste management. There are several studies done in the past on biogas production from animal dung and municipal waste in Thailand. However, there is not much work done on other feedstocks such as food waste. Therefore, this study concentrated on biogas production from food waste. To improve biogas production from food waste, previous studies have been done on the use of addictives such as zeolites, use of recycled slurry, and pretreatment methods such as chemical, physical and biological. However, these methods are very expensive and labor consuming. Optimization of some parameters that have effect on biogas production has been recommended by other studies as the least expensive and easy method for enhancing biogas production. In addition, this method is environmental friendly because there is no usage of chemicals and heat. There are several parameters that can be optimized such as C/N ratio, pH, total solids, particle size and temperature. Total solid and particle size were two parameters chosen for this research because other parameters were previously studies.

Hence the aims of this study were to assess the influence of total solids and particle size of food waste on biogas production and to conduct economic evaluation of biogas production from food waste using different particle sizes. To achieve these objectives, firstly the samples of food waste were collected to analyze the chemical and physical compositions in order to assess its suitability for biogas production. Secondly, the anaerobic digestion tests on the influence of particle size and total solids on biogas production were conducted. On the influence of particle size, food waste was grouped into three samples whereby the smallest size particle was ground in an electric blender, medium size particle was ground by manual hand mixer and the biggest size contained unground food waste. The ratio of the variation in biogas production from the different particle sizes were used in the economic evaluation

whereby NPV, BCR and PBP were calculated. The influence of total solids on biogas production was measured by performing a series of laboratory digesters in different total solids of 5 %, 10 % 15 % and 20 %. The physical composition analysis results indicated that food wastes contained high biodegradable materials such as noodle, rice, and meat; hence making them suitable substrates for biogas production because they can be easily digested by the microorganisms. Further, the analysis of chemical composition revealed that the waste had more chemical oxygen demand (COD), biological oxygen demand (BOD) and moisture content (MC) of 278,388 mg/kg, 103,889 mg/kg and 77.1 % respectively. This indicates that the waste can be used for biogas production. The anaerobic test results on the influence of particle size on biogas production indicated that food waste that was made into smaller particle produced more volume of biogas (400 mL/day) than those that were not ground (210 mL/day). In this case, the ratio in the variation of biogas production from the smaller particle to bigger particle size was about 2:1. The results of the influence of total solids on biogas production indicated that TS_{15} (360 mL) produced the highest volume of biogas than TS_5 (150 mL), TS_{10} (290 mL) and TS_{20} (225 mL). For both tests, there was no huge variation in methane concentration. Comparison of the three production conditions shows that project A that included production of biogas using grinded food waste by an electric blender had the highest NPV, BCR and shortest PBP of 9,351,503 Baht, 2.09 and 8.00 yrs respectively. Project B had the second highest NPV, BCR and shorter PBP of 6,796,643 Baht, 1.61 and 10.18 yrs respectively. Production of biogas from the non ground food waste was not economically viable because the PBP was 15.61 yrs which exceeded the lifetime of the project (15 yrs). This study recommends producing biogas using ground food waste by using either a manual hand mixer or an electrical blender however economically, using an electric blender is more desirable.

In conclusion, the study observed that the particle size and total solids of food waste had higher influence on biogas production. Further, the particle size of food waste had effect on the economic evaluation.

Recommendation

In future, the following must be done:

1. The results of this study should be done in the ambient and outdoor situation to verify the experimental results.

2. More studies studies should be done on the other parameters that have similar effect on biogas production

3. Biogas production from the food waste is the most complex process because food waste contains wastes of different physical composition which have different digradation rate, therefore, this study recommends that more research should be done in this field so that only food wastes with the same physical and chemical composition should be digested together.

4. Biogas production from food waste is greatly affected the alkalinity, this is because food waste (especially those from Asia) has more acid compared to other feedstocks, in this case proper pH monitoring and controlling should be done to avoid total process failure.

5. Upcoming studies should concentrate much on the suitable inoculums for food waste to increase the biodegradability and at the same time to reduce the retention time.

6. Food waste contains more grease and fats in this case, the study recommends that the degreasing facilities should be included in the actual biogas production system.

7. The study further recommends co-digestion of food waste with the animal dung to increase the start up process.

8. Biogas production from food waste using a batch system is a very complex and difficult process, therefore this study recommends either using a continuous or semi- continuous system.

9. If batch system is the only viable option, then the digesters need to be air siphoned to remove air by using an inet gases such as nitrogen or argon, however this will increase the cost of the system.

10. Finally, other pretreatment methods such as microwave, thermal or chemical pretreatment should be explored.