The Graduate School of Science's

6th monthly Seminar

entitled "*Biogas technology for waste management in the palm oil industry*".

Date: 06 November 2020

Time: 9:00 AM-11:00 AM
How? Online using **Zoom**
(*The talk will be in English*)

Who should attend?

Interested researcher, faculty and graduate student should attend. To attend, RUPPer or non-RUPPer can access the Google Form via the URL below for FREE registration before 27 Oct. 2020. URL: https://bit.ly/2SQBoLP

Speaker: **Assist. Prof. Dr. Sompong O-Thong**, International College, Thaksin University, Thailand
Moderator: Dr. Chan Oeurn Chey

Short Bio.: Assist. Prof. Dr. Sompong O-Thong is a lecturer at an international college, Thaksin University. He has been working on biogas production in Thailand for 10 years. He has 102 international publications and an H-index of 32. He builds an academic, industrial link in biogas technology for Thailand and Malaysia. He is currently acting Deputy Director of International College and leader of the sustainable development program at an International College, Thaksin University.

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Entitle: Biogas technology for waste management in the palm oil industry

Summary

The palm oil industry generates a large amount of solid waste such as empty fruit bunches (EFB), mesocarp fiber, palm kernel shell, old oil palm trunk, and oil palm frond from plantations area and extraction process. Crude palm oil is only 21% (w/w) of fresh fruit bunches, while the rest is remaining as waste such as a palm kernel shell (7%w/w), palm mesocarp fiber (15% w/w), decanter cake (4% w/w), EFB (23% w/w), palm kernel cake (5% w/w) and palm oil mill effluent (25% w/w). Methane production from the SS-AD process of EFB using recycling solid-anaerobic digested (S-AD) sludge and liquid-anaerobic digested (L-AD) sludge as inoculum was investigated under thermophilic (55^{o}C) and mesophilic conditions (40^{o}C). The methane production rate of L-AD sludge (2.98-3.27 L-CH_4 L^{-1} reactor d^{-1}) was found 1-2 times higher than recycling S-AD sludge (1.36 L-CH_4 L^{-1} reactor d^{-1}) as inoculum. Methane production of L-AD and S-AD sludge inoculum was 53.5-54.1 and 31.2-39.0 m^3 CH_4 $tonne^{-1}$ EFB, respectively. The SS-AD of EFB with L-AD and S-AD sludge under thermophilic conditions had specific methane activity of 34-96 times higher than the mesophilic condition. *Clostridium* sp., *Methanosaeta sp.*, and *Methanoculleus* sp. were responsible for the SS-AD of EFB with L-AD sludge inoculum. Biogas production of palm oil mill effluent (POME) and EFB was performed by coupled L-AD and SS-AD processes. POME was fed to L-AD digester, while mixed of effluent from L-AD and EFB was fed to SS-AD digester. The maximum overall methane production of 60.9 m^3-CH_4 ton^{-1} waste was obtained at an optimal hydraulic retention time of 30 days and an organic loading rate of 1.66 gVS L^{-1}-reactor $d^{-1}$for L-AD and 6.03 gVS L^{-1}-reactor d^{-1} for SS-AD with L-AD effluent recycling rate of 16.7 mL L^{-1}-reactor d^{-1}. The bacterial communities in the L-AD reactor were different from the SS-AD reactor, while the archaeal community was similar in both reactors. *Synergistaceae, Caldicoprobacteraceae* and *Lachnospiraceae* communities were increased in the SS-AD reactor. Coupling L-AD and SS-AD is able to increase energy production by 29% and 71% compared to the L-AD and SS-AD alone, respectively, with no outsource SS-AD inoculum required. The L-AD sludge was suitable inoculum for SS-AD of EFB in terms of methane production rate, cellulose degradation efficiency, biogas production, and microbial activity.

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