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Development of biogas production technologies for low temperature using, Vietnam as an example

Popular Abstract

Biogas digester, a green renewable technology, has widely installed by millions of animal farms, but the knowledge, experience and management competence of end users as regards biogas production processes are limited in developing countries such as Vietnam. To solve these problems, the main aims of this thesis are to research and develop optimised environmentally-friendly biogas production from animal manure that also reduces greenhouse gas emissions. The main findings of this PhD study were that:

- The international recognised, precise and reproducible VDI method was suggested as being the most suitable batch method to determine biochemical methane potential. The liquid replacement method was also suggested to determine methane concentrations in biogas in laboratories with limited access to gas chromatography.
- In order to predict the specific methane production rate, an equation was developed for the specific microbial growth rate at psychrotrophic and psychrophilic temperature conditions. This equation could be used in combination with the Chen & Hashimoto kinetic model to predict the specific methane production rate in simple, small-scale biogas digesters in developing countries.
- A simple, one-dimensional thermal balance model using air temperature and digester design as input variables was developed which gave valid estimates of the gas production measured from full scale digesters in Hanoi, Vietnam during a period from summer to winter. It was also shown that the slurry temperature in digesters that are buried, un-insulated and without solar passive heating can also be predicted using a soil temperature model.
- Digester temperature was significantly influenced by air temperature. The use of insulation on top of the digesters significantly reduced digester temperature variations caused by air temperature fluctuation, but does not affect biogas production significantly.