

Characteristics and biogas production potential of livestock wastewater with various anaerobic reactors

Abstract

Global energy demand for petroleum and natural gas has been growing up rapidly with population and economic growth. However, reserves of fossil fuels have been limited and the global warming crisis is increasing, so that the technology improvement for energy issues has become a trend nowadays, especially biomass energy. Biomass is a renewable energy source, which has the advantages of decentralization, small power generation, and reducing greenhouse gas emissions.

Biogas is a type of biofuels, which can be produced via anaerobic digestion of wet organic feedstock in anoxic environments. Biogas is primarily composed of methane (CH₄) and carbon dioxide (CO₂), as well as traces of hydrogen sulfide (H₂S), moisture and some other gases. Animal manure, wastewater sludge, and food waste are the applicable sources of biogas, and swine manure is one of the major sources for generating biogas. The biogas collection from piggery farms is used as a fuel for power generation or direct combustion in Taiwan recently. However, Taiwan is located in the subtropical and tropical climate zones of Southeast Asia. Pigs are sensitive to extreme temperatures, so it is crucial to reducing heat stress. The traditional way of cleaning pig sheds with a lot of clean water not only wastes water resources but also dilutes the concentration of chemical oxygen demand that greatly affects the biogas production.

This study investigated the biogas production potential of swine manure (SM) under various anaerobic reactors in Taiwan. Factors influencing biogas production, such as temperature, farm sizes, and COD concentration, were evaluated. Results show that differences in farm sizes had no significant effect on biogas production per unit of the pig. The biogas produced was approximately 0.04 m³/day/head. This work also investigated the daily average biogas production with various anaerobic reactors. Results from this study can be used as reference data for the development of biogas power generation and the rate of biogas production on pig farms in Taiwan.