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Development of a Control System for Anaerobic Co-digestion Process of Biogas from Food waste and Corn stover Hydrochar

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Abstract

To reach a sustainable development energy demand, environmental pollution, greenhouse effect, solid waste management and dwindling of fossil fuel must be addressed. In this study, we developed a control system for anaerobic digestion (AD) process to maintain a sustainable production of biogas.

The bioreactor of the AD process consists of corn stover hydrochar (substrate) which is obtained from hydrothermal carbonization (HTC) [1], was inoculated with food waste and cow dung to generate biogas as shown in figure 1. A transfer function model of the process was constructed consisting of two differential equations and one algebraic equation. The parameters included in the model are dependent on the operating conditions of the process.

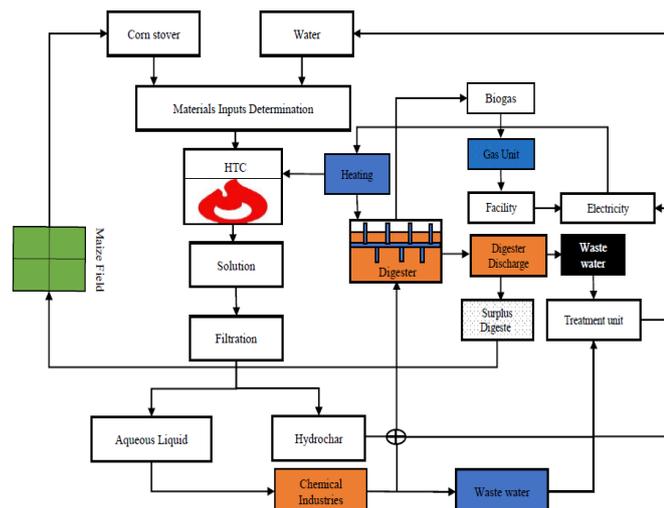


Figure1: HTC and AD processing flow diagram.

Automatic estimation of parameters from the input and output data of the process enables easy use of the model under any operating conditions. A control system was developed as the parameter-estimation system, which made it possible to obtain the least squares estimate of parameters. When cumulative biogas generation per day was predicted using the model, goodness-of-fit analysis indicated an accuracy of over 90% in all cases, validating the model and estimated parameters. Future tasks will involve implementation of model predictive control into anaerobic digestion processes with the model and parameter estimation system developed in this study.

Keyword: Anaerobic Digestion, Hydrothermal Carbonization, Transfer Function Model, Control Signal,

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Reference

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