

Enhancement in Digester Efficiency and Numerical Analysis for Optimal Design Parameters of Biogas Plant Using Design of Experiment Approach

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Abstract : Biomass resources have been one of the main energy sources for mankind since the dawn of civilization. There is a vast scope to convert these energy sources into biogas which is a clean, low carbon technology for efficient management and conversion of fermentable organic wastes into a cheap and versatile fuel and bio/organic manure. Thus, in order to enhance the performance of anaerobic digester, an optimizing analysis of resultant parameters (organic dry matter (oDM) content, methane percentage, and biogas yield) has been done for a plug flow anaerobic digester having mesophilic conditions (20-40°C) with the wet fermentation process. Based on the analysis, correlations for oDM, methane percentage, and biogas yield are derived using multiple regression analysis. A statistical model is developed to correlate the operating variables using the design of experiment approach by selecting central composite design (CCD) of a response surface methodology. Results shown in the paper indicates that as the operating temperature increases the efficiency of digester gets improved provided that the pH and hydraulic retention time (HRT) remains constant. Working in an optimized range of carbon-nitrogen ratio for the plug flow digester, the output parameters show a positive change with the variation of dry matter content (DM).

Keywords : biogas, digester efficiency, design of experiment, plug flow digester

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