

Modelling and Simulation of a Commercial Thermophilic Biogas Plant

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Abstract : This paper developed a mathematical model of a commercial biogas plant for urban area clean energy requirement. It identified biodegradable waste materials like domestic/city refuse as economically viable alternative source of energy. The mathematical formulation of the proposed gas plant follows the fundamental principles of thermodynamics, and further analyses were accomplished to develop an algorithm for evaluating the plant performance preferably in terms of daily production capacity. In addition, the capacity of the plant is equally estimated for a given cycle of operation and presented in time histories. A nominal 1500 m³ power gas plant was studied characteristically and its performance efficiency evaluated. It was observed that the rate of bio gas production is essentially a function of the reactor temperature, pH, substrate concentration, rate of degradation of the biomass, and the accumulation of matter in the system due to bacteria growth. The results of this study conform to a very large extent with reported empirical data of some existing plant and further model validations were conducted in line with classical records found in literature.

Keywords : energy and mass conservation, specific growth rate, thermophilic bacteria, temperature, rate of bio gas production

Conference Title : ICMMME 2014 : International Conference on Mechanical, Mechatronics and Materials Engineering

Conference Location : Sydney, Australia

Conference Dates : December 15-16, 2014