

## Sustainable Bio Economy of Food and Fuel Based on the Industrial Ecology of Innovative Process Design of Biomass Solid Wastes Technology Management

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## Abstract

Energy demand and the price for energy is increasing day by day everywhere as global economic problems. Renewable energy from waste is one of the alternative source which can be use parallel to conventional energy resources. Agro industrial wastes pose a major concern today due to the increase of production with time and thus needs ecological solution. For this problem an integrated system, industrial and ecological using the clean Small Integrated Process Systems (SIPS) based on the Zero Waste, Industrial ecology, cleaner industrial design and green chemistry concept was studied using the three basic principles. The first principle is to use all components of the biological organic materials of the wastes. The second principle is to obtain more co-products from the wastes. The third principle is to close the loop via reuse, recycle and renewal of the material and nutrient flows. This paper deals with tools and methods used to make the small process system design using innovative process equipment design and the process optimization for waste minimization. The main objective is not only small scale energy production, but as well as with the co-production of hot and cold thermal energies from agro wastes along with small electric power. The SIPS approach has many benefits and potentials. The system design use Biodigestion process, hydrogen and methane bio-fuels and internal combustion (IC) engine. The project was developed using simulation system tools for the process analysis (synthesis, modelling and design) of two stage anaerobic bio process and its integration. Super Pro Designer Process simulation software was used to make synthesis and evaluate these options and performs material balance, environment impact analysis. Towards the economical valorisation product development from municipal solid wastes (MSW), agro wastes and municipal waste water sludge solid wastes as the raw material biomass ,the H2 rich gas (H2, CH4 etc.) was found to be the main product using the two stage process design of anaerobic bio digestion from liquids, where as the ammonium and water recovered as liquid fertilizer and carbon dioxide are co products. The economic viability reports, environmental emissions reports, systems tools and methods used for several preliminary project developments of clean SIPS are obtained. The integrated biosystem system design are under developments of industrial ecological production using solar energy as base case ,yet this system designed need to adopted for the present and future need of optimized clean production of bio energy production with the economic and ecological sustainability from biomass wastes to the local energy and bioeconomy demand.

Keywords: Biomass, Bio energy, Municipal Solid Waste, Auto thermal, IC Engine