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Abstract

Brazil is the leader of ethanol biofuel development and also for biomass charcoal, yet lacks in clean rural biofuel and bioenergy production from waste are common. 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 Bio-Systems (SIBS) 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 system design based on industrial ecology using innovative process equipments 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 SIBS approach has many benefits and potentials. The system design use hybrid bio-fuels and internal combustion (IC) engine. The project was developed using simulation system tools for the process analysis (synthesis, modeling, and design) of two stage anaerobic bio process and its integration. SuperPro Designer Process simulation software was used to make synthesis and evaluate these options and performs material balance, environment impact analysis. Case study was made with the anaerobic process, aerobic micro algae production, production of biodiesel from micro algae in several stages and recycle of reactor output are found to be very useful to produce biofertilizer, bio-methane charcoal, bio electrical energy with recycle of water, CO2 and microbial biomass, which are integrated to internal Combustion and fuel cell for combined cold, heat and Existing biogas and biodiesel from micro algae technologies has potential for practical application combined with hydro pyrolysis, as well as green hydorobiodiesel to make fuel electrical energy towards sustainable local development. The systems tools and methods used for several preliminary project developments of clean SBS are reported to build up the integrated system developments of industrial ecological complex as base case that need to adopted for the present and future need of clean production of fuel, feed and food with the economical and ecological sustainability.

Keywords: Waste, Energy, Biomass, zero waste Biogas, Pyrolysis, Biodiesel, System tools