Bioenergy and Biofuel Production from Wastes/Residues of Emerging Biofuel Industries

Samir Kumar Khanal[1*], Mary Rasmussen[2], Prachand Shrestha[2], Hans (J) Van Leeuwen[2], C. Visvanathan[3], Hong Liu[4]

[1]Department of Molecular Biosciences and Bioengineering University of Hawaii at Manoa, Honolulu, HI 96822, USA
[2]Department of Civil, Construction and Environmental Engineering /Biorenewable Resources and Technology (BRT) Program Iowa State University, Ames, IA 50011-3232, USA
[3]Environmental Engineering Program Asian Institute of Technology, Bangkok, Thailand
[4] Department of Biological and Ecological Engineering Oregon State University, Corvallis, OR, USA
[*]Corresponding Author 1955 East-West Rd., Ag. Sci. 218 Tel: 808-956-3812; Fax: 808-956-3542 khanal@hawaii.edu

doi:10.2175/106143008X328752

Introduction

Energy is indispensible in modern society. We need energy for home appliances, lighting, transportation, heating/cooling, communication and industrial processes to supply commodities for our daily needs. As many developing countries have just begun to enjoy the comfort of modern gadgets, the demand for energy will continue to grow. The global demand for all forms of energy is expected to increase by more than 50% and energy consumption, especially in developing nations, will increase over 90% by 2025. Dwindling international reserves in the face of rapidly increasing consumption rates, combined with increasing energy insecurity due to regional conflict and the environmental devastation that results from global warming and acid deposition, demand that we act quickly and decisively to develop a sustainable, affordable, and environmentally friendly energy source. Biofuels[1] derived from plant-based feedstocks and organic residues are a renewable, environmentally clean energy source, and have potential to significantly reduce consumption of fossil fuels.

Bioethanol and biodiesel are the most promising clean and alternative renewable liquid fuels produced on commercial scale. Bioethanol is currently produced mainly from corn (United States) and sugarcane (Brazil). Tropical countries have other options, for instance Thailand is developing cassava-based ethanol plants. There is also growing interest in developing a commercially-viable cellulose-to-ethanol technology in the United States. Biodiesel – another biofuel – is produced from soybeans (United States), rapeseed (European Union), and palm oil (Malaysia). Non-food based feedstock such as jatropha is being currently examined in India for biodiesel production.

[1]There is no distinct definition of bioenergy and biofuel. For ease of convenience, in this review paper, bioenergy mainly refers to gaseous fuels used for stationary applications such as for heat or electricity generation; whereas biofuel refers to liquid fuel mainly used for transportation.