Integrated Ecogreen System for Sustainable Waste Management

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Given the growing world population, the increasing energy consumption and global warming threats, the search for long-term alternative energy sources is of extreme importance. This project aims to solve the challenging problem of energy and secure sustainable agriculture by generating clean sources of energy, producing fertilizers cheaply, and ridding the environment of plastic. Biomass is a promising alternative source of renewable energy. Using biomass in an integrated and enhanced pyrolysis system has been studied. The pyrolysis reactor is fed with biomass feedstock consisting of agricultural wastes including, rice straw, sawdust, and cow manure sludge to produce biochar, bio-oil, and pyrolysis gas. The co-pyrolysis of proposed feedstock has not been studied before. Samples of mixed ratios have been studied at different temperatures. Results show that a low co-pyrolysis temperature and adding more rice straw with the sawdust and cow manure promote biochar production. All samples had 15 wt.% sawdust. While cow manure alone provided more biochar yield, it was determined it is sufficient to make the tradeoff of less yield given the amount of rice straw to be rid of when co-pyrolyzed in the following by weight ratio 25:15:60 % (rice straw, sawdust, cow-manure sludge). In addition, the system includes novel improvements such as developed pre-treatment stage, adding zeolite to catalyze the reaction, and recycling reactor heat. Furthermore, biochar is mixed with plastic to make durable construction eco-brick and rid the environment of plastic. The system's reject water is utilized to make cheap effective fertilizers. These improvements show significant increases in the overall performance and productivity and revolutionize biomass pyrolysis.

Awards Won:

University of Arizona: Renewal Tuition Scholarship