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Science, Technology, Research and Innovation for Development (STRIDE)

Fast Pyrolysis of Napier Grass in a Fluidized Bed Reactor

GRANTEE: Xavier University (XU)

PRINCIPAL INVESTIGATOR: Dr. Maria Theresa Isla-Cabaraban

INDUSTRY PARTNER: Greenergy Development Corporation Affiliated Renewable Energy Center

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Grass as source of alternative fuel

Promotion of sustainable energy options to support the increasing requirements for economic and social development with minimal adverse effects on the environment continues to be a challenge in the Philippines. Biomass pyrolysis as a source of renewable energy capable of supplying increasing amounts of bio-power with reduced carbon and other greenhouse gas emissions is a promising solution for the growing population, dwindling fossil fuel reserves, increasing energy demand, unstable energy supply, and global warming. Common sources of biomass include energy crops, excess residues from sugar cane, rice, coconut, and corn. However, these are already scarce and may no longer be sufficient to meet energy demands of the country.

Dr. Cabaraban (2nd from left) explains the production of bio-oils, bio characterization and syngas from Napier grass

To help address scarcity of biomass supply and encourage sufficient local energy generation, the Xavier University in Cagayan de Oro, with support from USAID STRIDE, worked on the analysis and assessment of Napier grass (usually used as fodder for livestock and considered waste) as a substantial source of bio-oils, biogas, and bio-char for the production of fuels and byproducts via a fast pyrolysis pathway. Pyrolysis is a process of thermal decomposition to produce liquids (bio-oils; tars, high molecular hydrocarbons, and water), bio-char, and gases (*syngas*; mainly CO_2, CO, H_2, CH_4, etc.). These pyrolytic products can be used as fuel for power generation, feedstock for chemical or material industries, feed supplement for livestock, and fertilizer for agricultural soil.

Milestones

In the course of project implementation, major breakthroughs were accomplished as follows:

- Establishment of effective management of agro-industrial wastes in environmentally and economically acceptable ways through pyrolytic conversion of sludge to biofuels, and utilization of biofuels for electricity generation purposes;
- Development of energy self-sufficient pyrolysis equipment and auxiliary components with a continuous feeding system and cyclones to separate bio-char particles;

Workers demonstrate the milling process of decorticated Napier stalk

- Establishment of protocols for optimum heating conditions for the generation of biofuels;
- Conduct of fast pyrolysis experiments in bench scale and fluidized bed technology with air as the fluidization agent and sand as the inert solid;
- Characterization of products for fast oxidative pyrolysis of Napier grass in a fluidized-bed reactor;
- Investigation of the effect of heating conditions such as heating temperature and heating rate on the final products;
- Development of a bench-scale fluidized-bed pyrolysis system to investigate the effect of air on the yields of bio-oils and bio-char from the fast pyrolysis of Napier grass stalks; and
- Collaboration with Greenergy Development Corporation for technical guidance to make the technology more relevant and available to the community and industry. This in the long run is expected to drive economic and social progress in the Philippines.

Moving forward

These results can be cascaded and advocated to local government units for technology adoption using biomass to generate electricity either for community consumption or to be sold to the grid. A small-scale biomass pyrolysis system can provide communities with cheap energy, promote productivity and help create employment; thereby, improving living conditions.