Summary of Outcome of R&D Projects
Ministry of New and Renewable Energy , New Delhi

1. 0 Project Title : **Demonstration of Modular Pyrolysis Unit (20 kg/h) to produce Bio-Oil from Agro-Industrial Biomass Wastes and Methodology for Analysis, Use and Upgradation of Bio-oil**

2.0 Project sanction no. & date : F.No 107/163/2009 – NT(BF) Dated 28/09/2010

3.0 Project time frame : Oct.2010 – Sept.2012 (2 Yeats) (extended till May 2013)

4.0 Executing Institution : The Energy and Resources Institute (TERI), Darbari Seth Block, India Habitat Centre, Lodhi Road, New Delhi-110 003

5.0 Project Outlay : Sanctioned - 169.5 Lacs ; Released till date – 154.06 Lacs

6.0 Key Objective :

To establish technical feasibility and utility of establishing pyrolysis units for continuous pilot scale production of bio oil from agro and agro-industrial wastes at decentralised locations and utilisation of bio oil as a substitute of furnace oil.

7.0 Project Outcome :

Development of modular pyrolysis unit for effective utilization of Agro-industrial Biomass residues for liquid bio fuel.

8.0 Significant achievements summarizing technology development and commercialization

- Performance testing of prototype gas fired Pilot Pyrolysis Test Unit (PTU-I 20kg/h max.) for 400 hours using Karanja and Jatropha oil seed residues with feeding rate of 10kg/h.
- Technical modification of PTU-I to pyrolyse five selected agro residues.
- Fabrication of more suitable feeding system i.e. Hopper and screw feeding system with stirrer for continuous feeding of fibrous agro-residues and coupled with PTU -1.
- Based on performance testing of PTU-I, designing of automated PLC based Pilot Pyrolysis Test Unit (PTU-II) with improved reactor scraper design, material of construction, and inclusion of provisions for both internal gas fired and external electric heating and modification in the condenser system.
- Testing of bio oils and the byproducts e.g. char and non-condensable gases and its physic-chemical characterisation.

Pilot Pyrolysis Test Units (20Kg/h) at Gual Pahari, TERI
PTU-I (semi automatic) & PTU-2 (automated PLC based) (patent filed)

9.0 S & T benefits

Patents filed :

- Patent on "A Pyrolysis – based Bioreactor and method of working for same" (Appl.No.IN782/DEL/2011).

Paper

- Mukherjee, A., Das P, Minu K, "Thermogravimetric analysis and kinetic modeling studies of selected agro-residues and biodiesel industry wastes for pyrolytic conversion to bio-oil" accepted for publication in Biomass Conversion & Biorefinery, Springer (Received: 2 September 2013 /Revised: 26 November 2013 /Accepted: 26 November 2013)
  DOI 10.1007/s13399-013-0107-1

Conference Presentation

- Das, P., Mukherjee, A., Minu, K., "Techno-Economics of Pilot Pyrolysis Plant Utilising Jatropha and Karanja Residues, the Wastes from Indian Biodiesel Industries" paper presented in 6th International Biomass Conference & Expo, April 8-10, 2013, Minneapolis, USA.

10.0 Future direction for Research :

Short term goals (next two years):

- Demonstration of the performance of automated PTU-II for agro residues for production of bio oil.

- Testing of bio oils in single or in blends with furnace oil in industrial boilers and furnaces to generate data on performance and emission benefits with respect to petroleum fuel oil.

Long term goals (Next five years):

- Systematic study on availability of agro residues, collection, transportation and processing of the feed stock as drying and size attenuation as input raw material for feeding system.

- Development of pre-commercial demonstration of Pyrolysis unit for large –scale production of bio-oils from biomass.

- Bio oil to transport fuel through catalytic intervention.

Contact : Dr. Piyali Das
Email : piyalid@teri.res.in