Current Status of Biomass Pyrolysis in Brazil

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UNICAMP

BIOWARE

Biomass to energy is becoming more widespread and generating a significant amount of the primary energy in Brazil due to the optimal conditions in all regions of Brazil, such as availability of indigenous raw materials, low biomass cost, great experience in bioenergy use, technology development, local equipment suppliers, high level of human resources, and legal and legislation base. 47.5% of the overall primary energy consumption is non-fossil, 13.5% is firewood and charcoal, and 16.6% sugar cane products (fuel ethanol and bagasse for bio-electricity). There are many possibilities to introduce biomass pyrolysis and also bio-oil gasification to syngas in the Brazilian market. The commercialisation of the technology has the potential of starting in the range of up to 1 t/h dry biomass.

As well as the successful Brazilian Fuel Ethanol Program which has been running for 30 years, the recently created Biodiesel Program (PNPB) and many other biomass technologies are under development or are running as commercial plants nationwide. The ECI conference, "BIOENERGY II: Fuels and Chemicals from Renewable Resources" in Rio de Janeiro in March 2009 will be a great opportunity to see the rapid development of the biofuel field in Brazil.

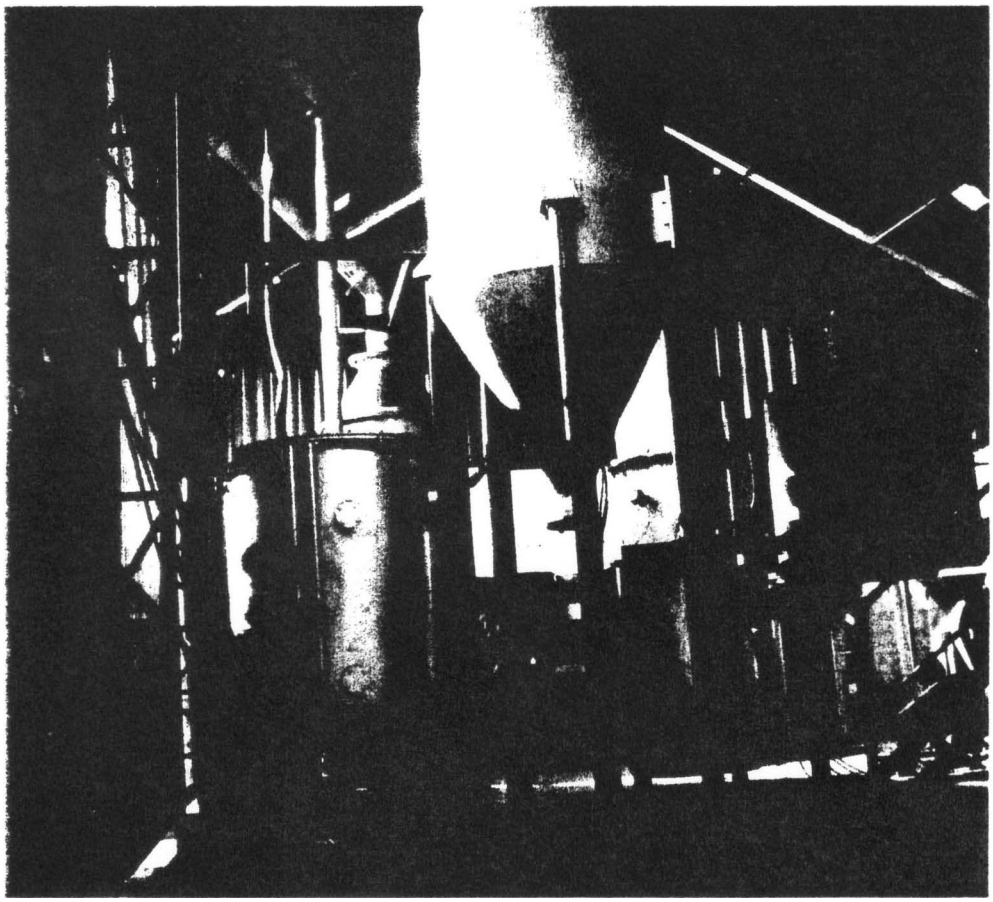

Figure 1. Plant Located at Unicamp.

Research at Unicamp

Unicamp Pyrolysis plant

Biomass fast pyrolysis R&D is progressing well in Brazil. The research group at the University of Campinas (Unicamp) in the city of Campinas and the spin-off company BIOWARE have fully developed a pyrolysis technology based on a fluidised bed reactor. The new demo plant has a capacity of 200 kg/h and is under Brazilian patent submission. See Figure 1 for an updated picture of the plant located at Unicamp. The main characteristics are the innovative two-stage bio-oil recovering system, heat recycling process, and two phase separation equipment. Feedstocks such as tobacco waste, orange bagasse, sugar cane straw, and sawdust have been tested successfully.

Bio-oil as an emulsion agent

A partnership with Prof. José Falcón from the University of Oriente in Cuba has enabled the application of bio-oil as an emulsion agent to heavy oil, asphalt, fuel oil, diesel, and gas-oil. Interest in using bio-oil based emulsifiers to dilute heavy oil is very high, as almost half of Brazilian petroleum production has a high viscosity. Asphalt dilution will also avoid the use of naphtha or diesel as a solvent in road paving. These solvents are expensive and highly pollutant for air and soils and are also potentially underground water contaminants. A large scale test involving bio-oil emulsion with fuel oil and diesel co-firing in thermoelectric plants located in Southern Brazil is under contract. This type of test is necessary to measure the yield and emissions of the new fuel as a mixture of fossil and renewable fractions. Gas-oil/bio-oil mixtures are being tested in a catalytic cracking unit at Petrobras Research Centre (CENPES) in Rio de Janeiro. Results will be published soon to assess the possibilities of this use in conventional refineries. The equipment built to prove the emulsions is shown in Figure 2.

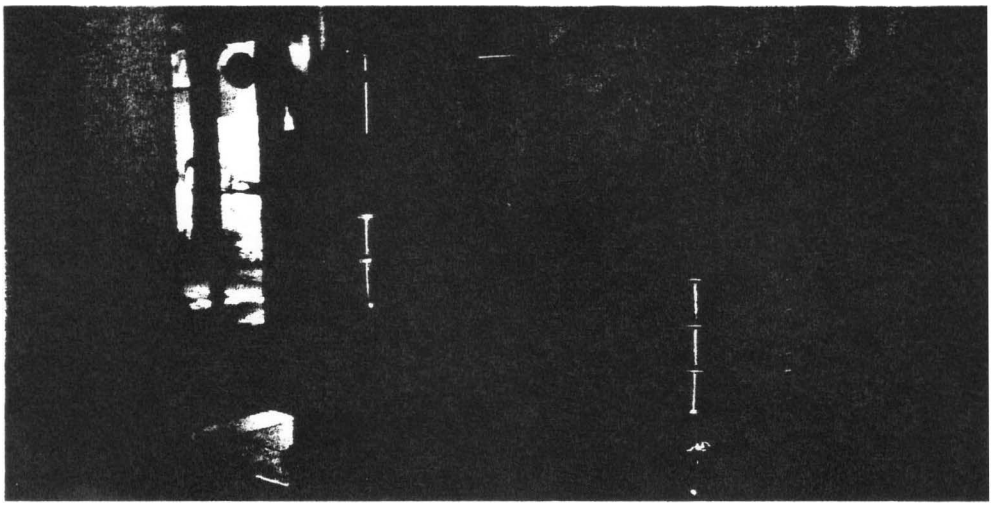

Figure 2. The Equipment Built to Prove the Emulsions.

Bio-Fertilisers

Unicamp have also driven the research to replace traditional fertilisers with bio-fertilisers from biomass fast pyrolysis products. Char can be aggregated in soil as a kind of young Terra Preta de Indio, an archaeological practice of Amazonians. Bio-oil and a mixture of bio-oil and char can also help in fixing nitrogen in soils. Acid extract is an aqueous solution produced in the pyrolysis process and is already an agricultural input in organic production. A chapter of a book concerning this subject will be released in the second quarter of this year.

Carbonisation of biomass

Bioware is also developing an innovative carbonisation system based on its proprietary technology of a screw and shell reactor. The first plant, with a capacity of 300 kg/h, will process a variety of agriwaste and elephant grass into sustainable charcoal briquettes and tar. The facility is autothermic and will burn the pyrolysis gas as a source of process heat. Financial support is being provided by a bank (Caixa Econômica Federal).

Another commercial development is the extrusion briquette machine with a capacity of 100 to 500 kg/h and a continuous torrefaction oven to process briquettes. Both the briquette machine and the oven are enterprises financed by the São Paulo Research Agency (FAPESP) in its special PIPE program (Innovative Research in Small and Micro Companies). This is being developed under Bioware with the guidance of a collaborator Dr Felix Felfli, an expert in biomass briquette torrefaction.

Syngas production

The group will also soon look at gasification tests for bio-oil. Syngas production in a high pressure, oxygen gasifier can be a great opportunity to achieve synthetic liquid or gaseous biofuel. There is high interest in this as a thermo-chemical route. The demand for bio-oil as a liquid feedstock to feed this kind of process can increase the production. The central idea is to produce the bio-oil in a small/medium distributed system followed by a shipment from numerous pyrolysis plants to a large gasification plant connected to a gas cleaning system, a pressurisation unit and a catalytic plant.

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