Enviro Fibre – environmentally friendly bagasse paper pulp

By Les Nielsen – Chairman, Enviro Fibre

AFTER preliminary investigations Farming for the Future, Babinda formed a company called Enviro Fibre to progress a novel bagasse to paper pulping process.

Enviro Fibre was fortunate to partner in this project with Queensland University of Technology (QUT) through Professor Bill Doherty, Centre for Tropical Crops and Bio-commodities, and Dr. Thomas Rainey, Science and Engineering Faculty, to conduct extensive laboratory testing. This project is supported by funding through Sugar Research Australia (SRA).

You may ask ‘why is it necessary to investigate a new pulping method?’ After all, paper pulp from bagasse is being made at sugar mills around the world. Currently Australian paper mills import Thailand bagasse pulp for use in hygiene products and pay up to $1000 per tonne. It was necessary to look at a novel pulping method because of:

- Environmental issues – most pulp factories use a mixture of caustic soda and sodium sulphide as their pulping agent (ie. the Kraft process). With our sugar industry positioned adjacent to the reef and other World Heritage areas the use of this method would be unacceptable to the Australian public.
- The distributed nature of the sugar industry in Australia would make the Kraft process uneconomical. Scale is important for this process to justify the recovery of the pulping reagent and many millions of tonnes of fibre are normally required.

Wood chip and bagasse as raw materials have equivalent value in their pulp form but bagasse has a cost advantage in comparison as it is available at a sugar mill at the end of a conveyor belt.

From a cane grower’s viewpoint, Enviro Fibre is an opportunity for the industry to generate additional revenue. The following illustrates the value per tonne of cane to the industry from the research we have completed:

- Our research to date suggests that for each one tonne of cane, $30–$50 of value is generated from pulp as follows:
  - One tonne of cane contains 15 per cent fibre = 150 kg of fibre
  - Fibre is made up of 1/3 pith 2/3 pulping fibre → 100 kg of suitable pulping fibre
  - Amount of pulp produced at 50 per cent yield = 50 kg of pulp
  - Pulp price is between $600–$1000 tonne AUS → $0.60–$1.00 per kg of pulp
  - Value per one tonne of cane = $30–$50 per tonne of cane

The additional revenue from by-product fertiliser is another $20 per tonne of cane. Note that pith can simply be used to supply part of the energy requirement of the pulp factory.

A QUT progress report says that the aim of the bagasse paper pulp project is to modify the current potash-based processes in order to achieve high quality bleached pulp and convert the black liquor by-product to a fertiliser. As the process will use chemicals on a ‘once-through’ basis, the need for a chemical recovery plant is avoided. This will reduce the capital cost of a pulp mill by 30 per cent, with the possibility of further reductions through utilising existing sugar mill boiler capacity.

QUT is working on the development of the environmentally friendly process. The work has involved both Laboratory and Pilot Plant Pulping trials at Central Pulp and Paper Research Institute.

(a) De-pithed bagasse. (b) Unbleached bagasse pulp.
India, black liquor preparation at the Mackay Renewable Biocommodities Pilot Plant (MRBPP), and the impacts of black liquor on germination and early plant development conducted by Farmacist. The activities were conducted by independent specialists to validate QUT’s work. A number of preliminary laboratory tests were performed at CPPRI and then 300 kg of wet and aged de-pithed bagasse was collected from a nearby sugar factory and pulped with 17 per cent KOH (Potassium hydroxide) in a 11 m³ rotary digester.

The higher KOH used in the pilot plant experiments (17 per cent) compared to the QUT laboratory experiments (15 per cent) was to ensure that the bagasse was properly cooked. The higher concentration resulted in increased delignification compared to the laboratory trials.

**Economic modelling**

The techno-economic modelling (based on 100,000 tonnes of dry de-pithed bagasse) was used to determine the financial viability for the case where higher pulping catalyst (17 per cent KOH) is utilised in the process. The currency exchange rate has markedly improved to 1AUD = 0.75USD since the last evaluation. The updated modelling shows the Internal Rate of Return is 30.7 per cent and the Net Present Value is $87.5 million over 15 years, while the Discount Rate is 10 per cent. Please note that the inflationary environment is subdued.

**Fertiliser potential**

In order to investigate the potential of the black liquor as a fertiliser, Farmacist evaluated four crops, sugarcane, soybean, maize and oats using three different soil, sand (from a sugarcane farm), vertosol clay (from Clermont in the Burdekin Delta) and heavy clay (from Clare in the Burdekin). The results from the trial indicated that black liquor performs similarly to the conventional fertiliser. There was little significant difference between the two fertiliser programs and where a difference was observed, it appears to be more a result of the soil type rather than the black liquor fertiliser. The microbiological investigation indicated that black liquor stimulates bacteria population and suppresses fungal growth, indicating that it improves soil health.

Further trials are planned in the next phase of the project in order to assess the effect that black liquor would have in a cropping system, rather than a fallow situation. But based on the promising results obtained to date, QUT researchers will encourage Enviro Fibre to approach fertiliser producers to explore commercial opportunities to use K-based black liquor as a fertiliser.

It is worth noting that if the pulp plant is co-located with a sugar mill, the black liquor could be combined with mill mud, bagasse fly ash and biochar (derived from a pyrolysis technology that produces syngas via sugarcane pith and other wastes to supply heat and energy to neighbouring localities) to produce pelletised slow release fertiliser.

**Summary**

This bagasse paper pulp project has the potential to provide a diversified additional income stream for growers.

This is an excellent example of collaboration between industry grass roots (growers), a research organisation (QUT) and funding bodies Sugar Research Australia and Regional Industries Research and Development Corporation.

Enviro Fibre has sufficient confidence through this research to move to the next phase which will be to build a Pilot Plant to prove its commercialisation potential.

Capital raising is the next step in this project and on the release of a Prospectus, we will be seeking interested parties.

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