



Queensland University of Technology  
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# Developments in pulp and paper manufacture from sugarcane bagasse Symposium and Workshop

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## *Developments in Fibre Processing Technology*

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## Developments

- **Low energy EAZY process**
- Twin-Roll press washing
- Electrosep nonfouling electrolytic membrane
- TRI black liquor steam reformer gasifier



## Low Energy EAZy Process

- Developed by HurterConsult & North Carolina State University
- Patented EAZy process – U.S.A., Mexico, China, pending in other countries
- Developed for pith containing nonwoods – corn stalks, bagasse, sorghum
- Mild extraction (E) → acidification (A) → ozone (Z) → ECF or TCF bleaching



## Low Energy EAZy Process

- Low temperature (less than 120 °C) "extraction" versus traditional high temperature (165 °C) cooking
- Ozone applied in a manner that does not degrade fragile nonwood plant fibres
- Acid & ozone steps act as chemical depithing agents as well as traditional bleaching steps
  - Traditional mechanical depithing is not required



A low temperature "extraction" step is used instead of traditional high temperature cooking resulting in lower energy consumption

Ozone is applied in a manner that does not degrade fragile nonwood plant fibers

The acid and ozone steps act as chemical depithing agents as well as traditional bleaching steps

## Low Energy EAZy Process

- Very short sequence ECF or TCF bleaching – moderate to high brightness i.e. single P stage – 87 – 89 %ISO
- Maintain high pulp freeness and excellent pulp properties
- Low energy process
  - no mechanical depithing
  - low processing temperatures
  - short sequence bleaching
- Tested extensively on corn stalks but more work required for bagasse



Very short ECF or TCF bleaching sequences provide moderate to high brightness – for example a single pressurized peroxide stage can achieve 87 – 89 %ISO brightness.

The process maintains high pulp freeness – in excess of 400 CSF and excellent pulp properties.

Overall, the process is a low energy process as there is no mechanical depithing, process temperatures are low – below 120 C – and a short bleaching sequence can be used.

The process has been tested extensively on corn stalks and to a small extent on bagasse. More work on bagasse is required.

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## Twin-Roll Press Pulp Washing

- Many nonwood pulps including bagasse require much larger washer surface areas than woodpulp for various types of vacuum and pressure washers
- Need to find another way to wash nonwood pulps



Many nonwood pulps require much larger washer surface areas than woodpulp for various types of vacuum and pressure washers. This has been one of the limiting factors on the scale-up of nonwood fibre pulp mills.

The question is: “Is there another way to wash nonwood pulps without damaging the fibre.”

## Twin-Roll Press Pulp Washing

- Press washing - adopted for most newer woodpulp mills
- Not been used in nonwood pulp mills
- Metso installing press washing in new 500 ton/day ECF bagasse pulp bleach plant at Tamil Nadu Newsprint & Papers Ltd.
- Will press washing impact on bagasse pulp quality



Metso TwinRoll Press Washer



Press washing has been used in the woodpulp industry for many years and twin roll press washers are installed in virtually all of the newer woodpulp mills.

However, they have not been used in nonwood pulp mills.

Metso is currently installing a new 500 ton/day ECF bleach plant for bagasse at Tamil Nadu Newsprint & Papers Ltd. in India and it includes press washers.

It will be interesting to see if the press washers work as effectively on bagasse as they do on woodpulp and whether there is any impact on pulp quality be it positive or negative.

If press washing works well on bagasse, it may allow for the scale-up of nonwood pulp mills beyond what is currently available today.



## Developments

- Low energy EAZY process
- Twin-Roll press washing
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- TRI black liquor steam reformer gasifier



## Electrosep Membrane

- Nonwoods contain silica which enters the black liquor causing problems in conventional chemical recovery systems
- Viscosity of concentrated black liquor makes it difficult to achieve high solids content
- Find other ways to recover nonwood black liquor



Silica in nonwood fibres enters the black liquor and causes many problems in conventional chemical recovery systems. Also, nonwood black liquors have viscosity problems that make it difficult to achieve high solids content.

The need has been identified for many years to find other ways to recover chemicals from nonwood black liquor.

## Electrosep Membrane

- Electrosep Inc., Oregon, USA ([www.electrosepinc.com](http://www.electrosepinc.com))
- Nonfouling electrolytic membrane technology
- Caustic recovered directly as NaOH
  - Eliminates evaporators, recovery boiler, recausticizing, lime kiln – significant capital cost reduction
- Lignin separated by the membrane
  - Can be sold to third parties or used as fuel
- Hemicellulose goes through the membrane and can be fermented



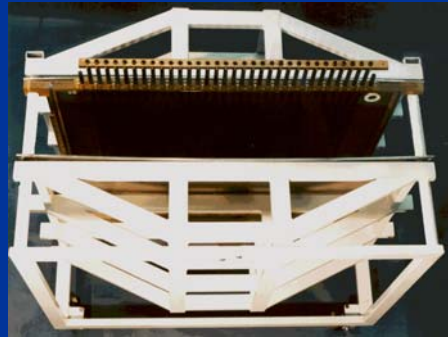
One possible solution is offered by Electrosep's nonfouling electrolytic membrane technology. I believe that it has huge possibilities for handling black liquor from nonwood pulp mills, especially smaller to medium sized mills that cannot afford conventional chemical recovery.

The caustic is recovered directly as caustic at the electrode. The pH drops as caustic is removed causing the lignin to precipitate, and it is removed by the membrane. The hemicellulose passes through the membrane and can be fermented into alcohols.

This technology eliminates the evaporators, recovery boiler, recausticizing system and lime kiln in a conventional chemical recovery system which would be a significant reduction in capital investment.

## Electrosep Membrane

- May be ideal for small to medium size mills
- 1<sup>st</sup> commercial installation on wheat straw in India - 2007



The technology may be well suited to smaller to medium size nonwood pulp mills.

The first commercial installation is scheduled for start-up in 2007 at a wheat straw pulp mill in India.

## Developments

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- **TRI black liquor steam reformer gasifier**



## TRI Steam Reformer

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## TRI Steam Reformer

- ThermoChem Recovery International Inc., Baltimore, U.S.A ([www.tri-inc.net](http://www.tri-inc.net))
- Low temperature gasification (steam reforming)
- Commercial success - NORAMPAC, Trenton, Ontario, Canada – over 18,000 hours
- Net energy positive at 60% black liquor solids
- Silica discharged with other non-process elements



Another possible solution is ThermoChem Recovery's low temperature gasifier or steam reformer.

They have a successful commercial operation at NORAMPAC in Trenton, Ontario, Canada which has operated for over 18,000 hours.

Of interest to nonwoods that have difficulties achieving high black liquor solids due to viscosity issues is that the technology is net energy positive at about 60% solids. Also, the gasifier can handle silica which is discharged along with other non-process elements.

Another possibility that has yet to be tried commercially is that it may allow for easier recovery of sulphite liquors.

## TRI Steam Reformer

- May allow switch to higher yield sulphite cooking
  - Lower pulp costs due to higher yield and brighter unbleached pulp requiring less bleaching chemicals



TRI Pulse Combustor



Another possibility that has yet to be tried commercially is that it may allow for easier recovery of sulphite liquors.



