Commercial Production of Lignin from Kraft Black Liquor

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Introduction

A commercial scale lignin removal plant is currently being constructed at Domtar's Plymouth, NC pulp mill.

The plant will produce approximately 70 tpd of kraft lignin, with production scheduled to begin in February, 2013.

This presentation provides details on why the Plymouth site was chosen, the process, and potential applications for the lignin produced.

Domtar's North American Pulp and Paper Manufacturing System

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PULP

- 12 Chemical Pulp Lines
- 3 Non-integrated Market Pulp Mills, 9 Integrated Mills (w/net external pulp sales).

HIGH VOLUME PAPERMILLS

- 12 Core paper machines producing 3.2 MM tpy high-volume UFS papers.
- 7 of the 15 most productive machines in North America.

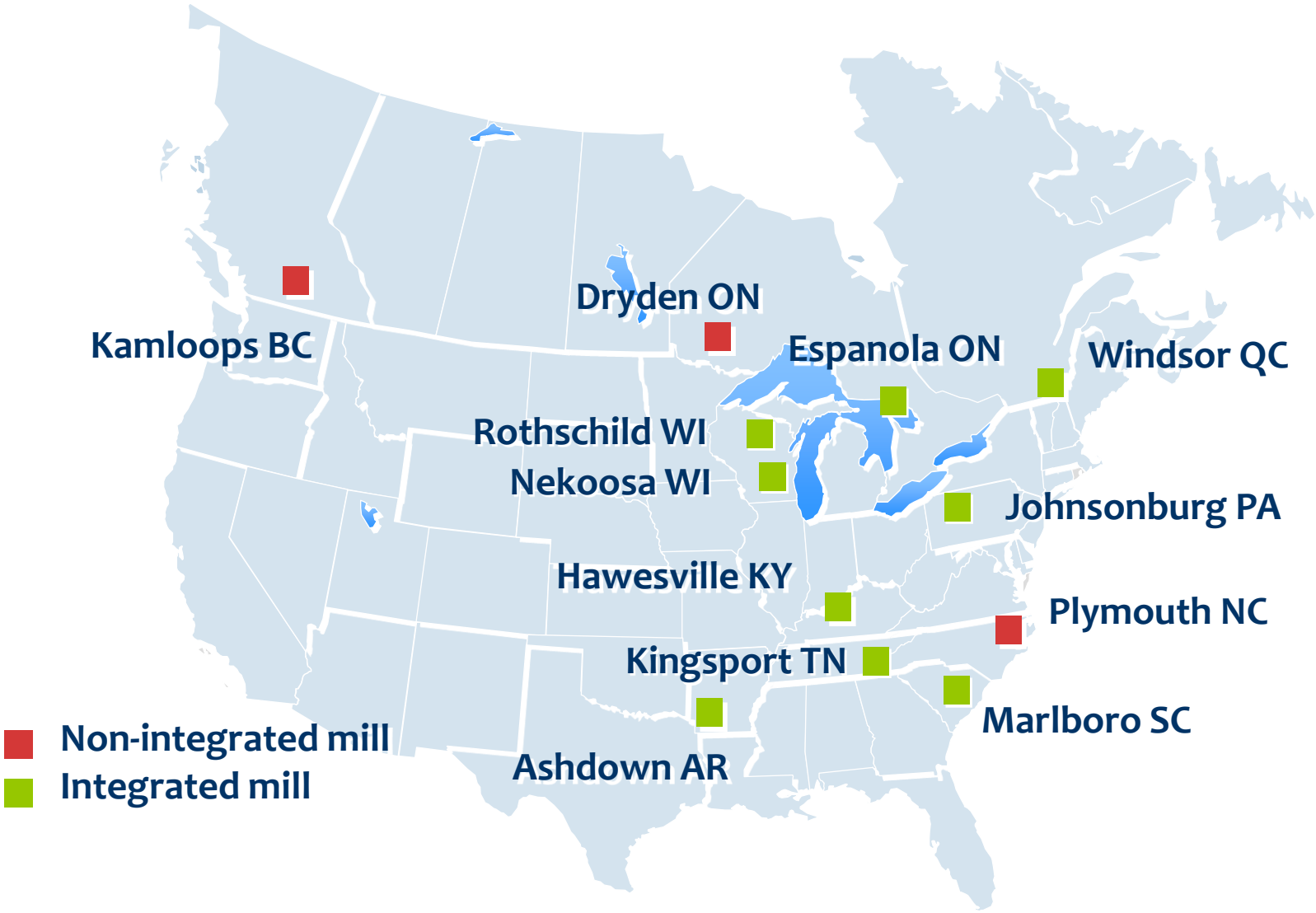
PREMIUM and SPECIALTY GRADES PAPERMILLS

- 11 machines producing premium printing, specialty and technical papers.
- Variety of high value products on smaller, flexible machines.

CONVERTING PLANTS , FORMS PLANTS and DISTRIBUTION CENTERS

- 10 converting operations, 3 Forms Plants.
- 10 North American product distribution centers

Domtar's Chemical-Pulp Manufacturing System (12 sites)



So why are we building a lignin plant in Plymouth ?

Lignin Opportunities

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Lignin is the second most abundant polymer .

Lignin represents 30 % of all the non-fossil carbon on the planet.

Lignin availability exceeds 250 billion tons.

Yet the market for kraft lignin is currently small. Why ?

Market Challenges

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- The needs of users, and potential users, are typically very specific. The lignin market is not a commodity markets.

- Lignin has the image of being a low quality, low priced waste product.

-The available sources are not sufficient to make industrial decision makers feel comfortable about this raw material.

** Its important to distinguish between lignosulfonates and kraft lignin. Example, lignosulfonates are water soluble, kraft lignins are not. (unless modified).

Potential Applications

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Non-Fuel Major Applications: Chemicals and Materials [FPInnovation, PEERS conference, 2012]

Replace phenol in PF resins

Replace polyols in PU foams

Replace PAN in Carbon fiber

Dispersants

Polymer blends and composites

Chemical derivatization-further specialty chemicals

Activated carbon

(FP Innovations, PEERS conference, 2012)

Technical Challenges

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Impact on the recovery cycle.

Non Uniform structure of lignin

Maturity of the technology.

Purification methods.

The Plymouth Mill: History (I)

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Began operations in 1937 as the North Carolina Pulp Company with production of 200 tpd of pulp.

First paper machine in 1947.

Acquired by Weyerhaeuser Company in 1957. Acquisition followed by a major expansion.

New, state-of-the-art pulping and bleaching lines were installed in 1995.

One HWD and one SWD line, a shared Recovery Boiler.

The Plymouth Mill: History (II)

In the 1990's, produced almost 3,000 ton per day.

Multiple product lines (linerboard, medium, fluff pulp and fine paper) on five machines and one dryer.

Medium and Linerboard mills idled in 2002 and 2006 respectively.

Two fine paper machines closed in 2006. Mill became part of the new Domtar company in March 2007.

The largest paper machine converted to a fluff pulp dryer in 2010. Mill currently 1,250 admt per day *softwood* fluff pulp from the two fiberlines.

Rationale

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The Issue:

Swing from a HWD/SWD mix to 100% SWD made Recovery Boiler production bottleneck by approximately 5% . Mill capacity out of balance, underutilized assets.

The Solution:

Remove lignin from black liquor and reduce Recovery Boiler loading.

Simultaneously, use available biomass boiler and co-generation capacity to generate required marginal steam and power.

Re-balance mill, increase overall efficiency and reduce cost structure.

Rationale for Selection of Metso Lignoboost™ Project at Plymouth

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The Synergistic Opportunity:

Justified as a stand-alone project based on improved mill cost structure.

First new, commercial demonstration scale source of lignin in decades (70 tpd).

Short-term: use lignin for internal and external fuel. Also use as a platform for (collaborative) new application and product line development.

Medium- to long-term: replace lignin with readily available low cost biomass. Use lignin in higher value biochemical and biomaterial applications.

Enables lower risk, and relatively lower cost, development of external value added markets.

Internal use of lignin provides an "out" for material while its ***commercial scale*** manufacture is demonstrated and refined.

Summary

The first commercial scale installation of Metso's Lignoboost process is underway at Domtar's Plymouth, NC pulp mill.

Production begins in February 2013 producing 70 tpd

Short- to intermediate-term: lignin source to be used as a high quality bio-fuel for internal and external use. Also, used to create a platform for (collaborative) development of new applications and product lines.

Intermediate to long term: higher value applications as bio-chemical and bio-materials.

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