Natural Resources Canada
Ressources naturelles Canada

CANADIAN FOREST SERVICE

SPOTLIGHT

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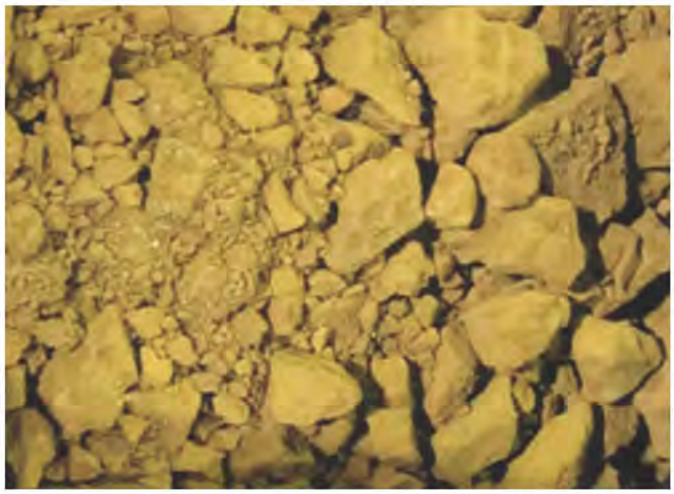
Lignin: An Important Building Block in the Development of Bio-Products

As a building block in the development of higher value forest products, lignin has the potential to help Canada's forest sector take advantage of emerging growth opportunities in the global bio-economy.

What is Lignin?

Lignin is an organic substance which binds the cellulose fibres in wood and renders them stiff and strong. It can be processed into different forms and adapted to fit specific product requirements.



Extracted Lignin

Uses of Lignin

Lignin is removed from wood during the pulping process and is traditionally burned in pulp and paper mills as a source of heat and power. However, recent improvements to the lignin extraction process provide the sector with two key advantages: they allow mills to separate lignin more economically than traditional methods; and they produce a better quality lignin.

This higher grade lignin has the potential to be converted into higher value bio-chemicals and bio-products such as paints, packaging, resins, adhesives, carbon black for tires, and carbon fibre for the automotive industry.

Examples of lignin-derived bio-products

Not only are bio-product markets forecast to grow at a high annual rate due to increased demand for "green" products, they also have the potential to provide the pulp and paper sector with important new revenue streams.

Supporting Lignin Research and Development

Given the significant market potential of using lignin in a variety of products, Natural Resources Canada has been supporting lignin research and product development since 2007. In this period, it has invested $7.4 million under its Transformative Technologies Program (TTP) to enable FPInnovations, Canada's national forest research institute, to conduct research on lignin extraction and conversion processes. The funding has also supported FPInnovations to research and develop potential new markets and products for lignin.

The department also invested an additional $1 million under its Pilot Scale Demonstration Program to help move lignin research closer to commercial-scale production. In collaboration with the Ontario government's Centre for Research and Innovation in the Bio-Economy (CRIBE) in Thunder Bay, this funding supported the construction of a unit capable of extracting and evaluating lignin recovered from black liquor, a by-product of the pulping process. This unit is able to produce 100 kilograms of lignin per day, an amount sufficient to further develop and commercially test various lignin-based products for performance.

In 2010, FPInnovations and the Natural Sciences and Engineering Research Council of Canada (NSERC) established a biomaterials and chemicals strategic research network to develop, in partnership with the forest sector, technology platforms that will help foster the development of value-added products from forest-based lignin. This network is funded under NSERC's Forest Sector Research and Development (R&D) Initiative which is focused on the development of new products and enhanced production processes that benefit the Canadian forest sector. FPInnovations scientists who work on TTP research projects are members of this network.

To help move R&D from the laboratory to industrial facilities, NRCan's Investments in Forest Industry Transformation program is also funding pilot and first-commercial applications of innovative new technologies. Almost 15% of applications submitted to the program under two calls for proposals were for biochemical projects that were looking to maximize value derived from wood through processes such as lignin and hemicellulose extraction, and bio-methanol production. This demonstrates that forest sector companies are actively looking for ways to diversify their businesses with new products and processes.

The Road Ahead

Canada's pulp and paper sector has struggled during the past decade because of declining newsprint demand brought on by the growth of digital media. Today, however, it is reinventing itself and looking to add to its revenue mix by producing new bio-products. Such products will enable the sector to gain access to opportunities in new market areas, create jobs for Canadian forest sector workers, and improve the competitiveness of the industry as a whole.

The successful extraction and conversion of lignin will also develop Canada's position as a producer of high-quality 'green' products for the emerging global bio-economy.

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