



Canadian Innovation in Bio-chemicals

The newly formed Bio-Pathways Partnership Network, facilitated by FPAC and led by industry, provides a forum for member companies to meet, partner on initiatives of common benefit, and exchange knowledge and contacts.

To learn more visit:
fpac.ca/bio-pathways-partnership

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Bio-pathways Partnership Network

Forest Products Association of Canada
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Forest Products Association of Canada

The bio-revolution is underway. Opportunities to develop new and innovative bio-products and bio-processes are expanding every day. With an abundance of available sustainably managed and renewable wood biomass, knowledge, experience, and existing infrastructure, Canada's forest products industry is well positioned to capitalize on opportunities in the new bio-age.

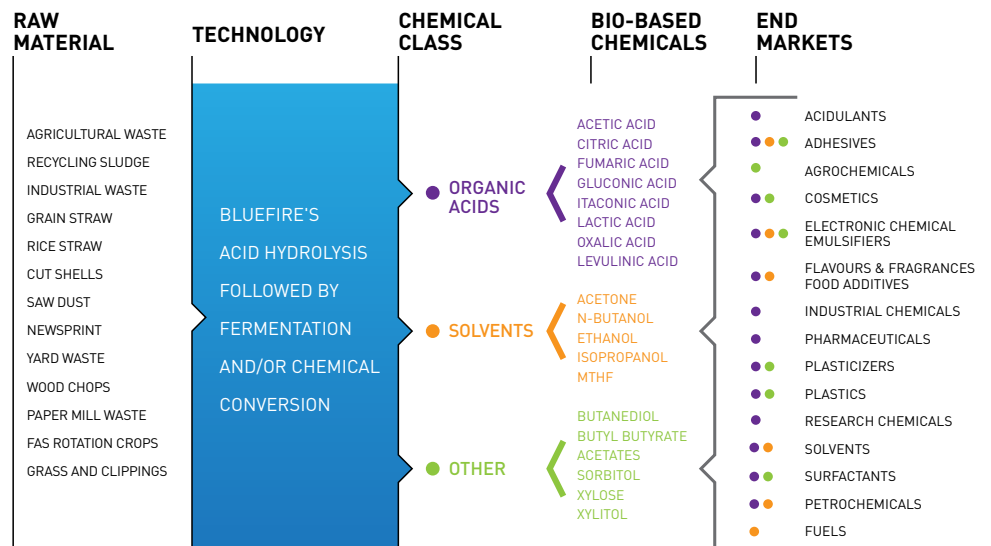
INDUSTRY TRANSFORMATION LEADS TO A WEALTH OF OPPORTUNITY

Recognizing the need for economic growth, Canada's forest products industry is changing the way it does business by developing transformative technologies and integrating them into traditional mill operations.

According to the Future Bio-Pathways Report released in February 2011, there are dynamic growth opportunities to develop new products (e.g., cellulose-based) that can be converted into bio-chemicals and used in novel ways, such as making bulletproof vests, food additives, and greener tires. Opportunities also exist to convert older, smaller-scale pulp mills to produce a range of bio-chemicals to serve niche markets.

GREAT MARKET POTENTIAL

The potential market size for bio-chemicals over the next five years is staggering, and exceeds that of the traditional forest products industry. According to the Organisation for Economic Co-operation and Development (OECD), the bio-economy will contribute



Source: BlueFire Ethanol Inc.

1 to 14 new drugs per year¹, and will be responsible for 10 percent of chemical production by 2030. Worldwide demand for industrial enzymes is expected to reach U.S. \$4.4 billion by 2015, with a compound annual growth rate of six percent.

SUPPORT FOR INDUSTRY INNOVATION

Government funding programs (e.g., the federal TT-PSD—Transformative Technologies Pilot Scale Demonstration program) are helping to drive innovation and yield significant advances in bio-chemical production.

Canada has world-class research and educational institutions that contribute to bio-chemical research and innovation (e.g., the National Resource Council's Institute for Chemical Process and Environmental Technology, the Bioindustrial Innovation Centre, the Institute for Chemicals and Fuels from Alternative Resources at the University of Western Ontario, and the Bio-refining Research Initiative at Lakehead University). Bio-chemical related networks, such as the Natural Sciences and Engineering Research Council's Biomaterials and Chemicals Strategic Research Network (Lignoworks) and ArboraNano (a business-led Network of Centres of Excellence that focuses on new applications for nanocrystalline cellulose) are helping to leverage public and private knowledge, expertise, and resources.

DEMONSTRATED SUCCESSES: FROM CONCEPT TO COMMERCIALIZATION

Canada has a number of state-of-the-art pilot-scale demonstration projects underway that have the potential to replace a wide range of platform chemicals and synthetic chemical products made from petroleum with a green, renewable feedstock:

- » The world's first commercial-scale nanocrystalline cellulose (NCC) pilot plant is located in Windsor, Quebec. With funding from Natural Resources Canada and the Government of Quebec, FP Innovations partnered with Domtar to build the NCC plant, which will produce one tonne of NCC per day by milling and hydrolyzing wood cellulose, then separating and concentrating the NCC particles. A new NCC pilot plant is also underway in Edmonton, which is a joint initiative between the Alberta and federal governments in partnership with Alberta-Pacific Forest Industries Inc. (Al-Pac) under the Western Economic Partnership Agreement (WEPA).

The huge commercial potential of nanocrystalline cellulose (NCC) stems from the wide range of promising applications in the automotive, aerospace, chemical, textile, forestry, and other industries. NCC's unique properties (e.g., strength, solidity, electromagnetic response) give it limitless potential for use in commercial products, including high-durability paints and optically reflective films; improved paper, packaging and building products; advanced composite materials; and innovative bio-plastics for bone replacement and tooth repair.

- » FPIinnovations, in partnership with the Centre for Research and Innovation in the Bio-economy (CRIBE), Natural Resources Canada, and AbitibiBowater, is developing a world-class black liquor and lignin evaluation centre. The core of the lignin demonstration plant is state-of-the-art technology that ties directly into the black liquor stream of AbitibiBowater's Thunder Bay kraft pulp mill. The plant recently produced its first batches of operational

The potential market for lignin-based products is enormous. Lignin can be used as a green alternative to many petroleum-derived substances, such as fuels, resins, rubber additives, thermoplastic blends, nutraceuticals, and pharmaceuticals.

1 BIOTECCanada Beyond Moose and Mountains (<http://www.biotech.ca/en/policy-matters/beyond-moose-and-mountains/bioeconomyfacts.aspx>)



lignin and, when fully operational, will produce up to 100 kg of lignin per day to serve R&D labs across Canada that are developing novel uses for wood products.

- » Mercer International received funding from TT-PSD to demonstrate the feasibility of generator acid purification (GAP-S) technology at its Zelstoff Celgar mill in Castlegar, B.C. The GAP-S system is designed to treat the chlorine dioxide generator effluent from the pulp production process and reduce the amount of chemicals purchased and discharged after use.
- » Alberta-Pacific Forest Industries Inc. (AP-FI) has received final approval to install a methanol purification system at its mill northwest of Grassland, Alberta. The innovative system will allow AP-FI to separate, purify, and utilize or sell grade AA methanol extracted from the steam stripper off gas stream.

Through integration and collaboration, Canada's forest products industry is on the cusp of transforming renewable wood fibre into bio-chemicals for solvents, renewable plastics, insulations, cosmetics, pharmaceuticals, and so much more.

PLATFORM FOR MUTUALLY BENEFICIAL PARTNERSHIPS

The global market for renewable wood-derived bio-chemical products and processes is indisputable. New and innovative partnerships with traditional and non-traditional players, both at home and abroad, will help manufacturers and researchers bring innovative bio-chemical products to market.

With access to world-class R&D, global partnerships, and anticipated returns on investment in bio-chemical products and processes, the time is right to support and partner with Canada's forest products sector.

Bio-chemicals derived from biomass are generally obtained through industrial fermentation processes that make efficient use of a broad range of microorganisms to produce high-value fine chemicals, bulk chemicals, enzymes for use in pharmaceuticals through bio-catalysis, and a broad range of industrial chemicals (e.g., insect repellants, solvents, plastics, vitamins, and food additives).

CANADA'S ENVIRONMENTAL ADVANTAGE

Canada is seen as the world's most environmentally advanced supplier of forest products because it is committed to sustainable forest management and abides by forestry regulations and laws that are among the most stringent in the world. Members of the Forest Products Association of Canada (FPAC) adhere to strict environmental principles: harvest legally, regenerate harvested lands promptly, reduce waste, promote paper recovery and recycling, reduce greenhouse gases, and remain open to public scrutiny. All FPAC members are third-party certified under one, or more, internationally recognized standard for good forest management – Canadian Standards Association (CSA), the Forest Stewardship Council (FSC), Programme for the Endorsement of Forest Certification Standards (PEFC), and/or the Sustainable Forestry Initiative (SFI).

