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**June 23, 2011**

### **Nanocellulose – A Revolutionary New Product?**

“STOCKHOLM, SWEDEN, Feb 25, 2011 - The world's first pilot plant to produce nanocellulose was inaugurated yesterday by research company Innventia in Stockholm. The facility makes it possible to produce nanocellulose on a large scale for the first time and is an important step towards the industrialisation of a new energy efficient manufacturing process.”

“POINTE-CLAIRE, P.Q., May 30, 2011 - FPIInnovations has announced inauguration of its new NanoCrystalline Cellulose (NCC) research facilities, which consist of a state-of-the-art pilot plant, new high-performance equipment for the Québec City laboratory and two new research laboratories located at Pointe-Claire.”

“MONTREAL, June 3, 2011 (CNW) - Domtar and FPIInnovations are pleased to announce CelluForce, the corporate identity chosen for their new joint venture, launched in July 2010. CelluForce will manufacture nanocrystalline cellulose, a recyclable and renewable nanomaterial, that will be commercialized throughout the world. The new company's identity was developed to reflect both the origin of the nanomaterial, extracted from tree cellulose, and one of the multiple properties of the product to be sold by the new company.....Nanocrystalline cellulose will be produced in a large-scale commercial demonstration plant using cutting-edge technology. The plant is currently under construction on the site of Domtar's pulp and paper mill in Windsor, Québec. The construction of the demonstration plant is progressing quickly, and it should be operational in the first quarter of 2012.”

These press releases signal one part of the global pulp and paper industry's efforts to address the increasingly apparent threat posed to its traditional products by electronic media. To the uninitiated, they beg the question, “Just what is nanocrystalline cellulose?”

A partial answer can be found by consulting the Internet, itself an example of one of those electronic media threatening the industry. A Wikipedia entry on nanocellulose (a synonym for nanocrystalline cellulose) explains:

“Nanocellulose or microfibrillated cellulose (MFC), is a material composed of nanosized cellulose fibrils with a high aspect ratio (length to width ratio). Typical dimensions are 5–20 nanometers width and length up to 2000 nanometers. It is pseudo-plastic. Moreover, nanocellulose exhibits the property of certain gels or fluids that are thick (viscous) under normal conditions, but flow (become thin, less viscous) over time when shaken, agitated, or otherwise stressed. This property is known as thixotropy. When the shearing forces are removed the gel regains much of its original state. The fibrils are isolated from any cellulose containing source including wood-based fibers (pulp fibers) through high-pressure, high temperature and high velocity impact homogenization .... Nanocellulose can also be obtained from native fibers by an acid hydrolysis, giving rise to highly crystalline and rigid nanoparticles (generally referred to as nanowhiskers) which are shorter (100s to 1000 nanometers) than the nanofibrils obtained through the homogenization route.”

To understand this, it helps to know that a nanometer is a very, very small unit of length – about a hundred thousand times smaller than the diameter of a human hair. It also helps to know that the cellulose in wood fibers consists of long, chainlike molecules made up of carbon, hydrogen and oxygen atoms. These long chains are arranged parallel to one another in assemblages called fibrils. The main body of the wood fiber consists of countless such fibrils arranged parallel with one another and roughly parallel to the axis of the fiber.

Technical details aside, nanocellulose appears to have myriad potential applications, both within and outside of the pulp and paper industry. In an online article

(<http://news.inventhelp.com/Articles/Science/Inventions/nanocellulose-12415.aspx>), Ann Delphus writes the following:

“Nanocellulose is described as being as strong and light as Kevlar, and when used as a barrier film for packaging applications, performs as well as petroleum-based plastics formulations in keeping oxygen from spoiling food. It creates a very clear, transparent barrier film.

If that weren't enough, nanocellulose can also be used to replace carbohydrates and other additives in some processed foodstuffs when it is used as a viscosity agent. According to Mikael Ankerfors, Innventia research manager, nanocellulose is not processed in the body as carbohydrates are, making it possible to create lower-calorie food products.

Perhaps most remarkably, nanocellulose can also be used to produce membranes and reserve parts for the human body.

The interest in nanocellulose has been focused on its use as a strengthening agent for many products, including paper, composites, and plastics. Perhaps its greatest appeal is that it is environmentally compatible and renewable, unlike products based on fossil fuels.

Innventia's investment in long-term research of nanocellulose and the construction of its pilot facility comes with a price tag of approximately 11 million euros. However, the company believes such large-scale production will enable many companies to participate in the incredible potential of nanocellulose technology and its applications.

The single-word line of dialogue, ‘plastics,’ spoken to Dustin Hoffman's character in ‘The Graduate,’ is fabled to have foretold the huge success of plastics manufacturing firms within a year of the film's release in 1967. If a remake were produced today, would “nanocellulose” roll off the tongue with the same ease? Would it produce the same effect? We think it would. ‘Nanocellulose.’ Keep an eye on it.”

## **Recent Forestweb/Industry Intelligence Headlines**

Forestweb and its sister company, Industry Intelligence, publish weekly news reports tracking recent developments in and around the paper and forest products industries. Subscription information is at <http://www.forestweb.com/Corporate/index.cfm>

Below is a small sampling of recent headlines, together with brief synopses.

### **June 19**

*Neo Industrial's viscose fibers business Avilon sees profit in May with the introduction of its in-house technology for converting paper grade pulp into material for viscose production*

Having previously suffered from availability problems and high price of dissolving pulp, Avilon has in this way significantly lowered its production costs.

*Cosmo Specialty Fibers in Cosmopolis, Washington, prepares to ship first small batch of pulp from Port of Tacoma to China; larger shipments expected to start from Port of Grays Harbor in July*

The Cosmo mill, which celebrated its grand opening in May, uses hemlock for fiber and is currently manufacturing a viscose pulp.

### **June 12**

*IP proposes to acquire Temple-Inland for US\$30.60/share in cash, 'disappointed' at board's unanimous rejection of offer it says represents a 44% premium to Temple-Inland shareholders*

The offer reflects the potential cyclical improvement in Temple-Inland's building products segment and International Paper's willingness to share a portion of the significant synergies available from the transaction with Temple-Inland shareholders.

*Weyerhaeuser to expand, modernize equipment at its Columbus, Mississippi, pulp mill to reduce operating costs, improve product quality, reduce water consumption by 15%*

Local officials say Weyerhaeuser will spend more than \$66 million over two years on the improvements.

### **June 5**

*Sappi to invest more in pulp, including chemical cellulose, as contribution to profits from papermaking will drop to 40% from 60% in five years, says CEO, who expects coated mechanical paper, coated fine paper prices to rise this summer*

Within five years, Sappi will derive 40% of its profits from its paper business compared with 60% now

*Domtar, Buckeye stand out in estimation of Chip Dillon, named in Wall Street Journal's 'Best on the Street' survey of industry analysts*

Analyst says investors overreacted in their concerns about the paper sector and that paper consumption “is not declining as significantly as most investors were knee-jerked into believing.”

**May 29**

*World pulp producer shipments drop back in April from record high in March, are 3.3% ahead of year ago despite 88% operating rate; stocks up one day to 33 days*

Shipments to China were 25.1% ahead of a year ago, though 31.1% lower than those of March 2011. Deliveries to Western Europe were a bit ahead of April 2010, but down 12.8% from March 2011. Shipments to North America continued to lag, down 5.8% from both April 2010 and March 2011.

*Private equity firm Gores Group to reopen acquired Cosmo Specialty Fibers mill in Cosmopolis, Washington, will produce dissolving pulp using hemlock for applications ranging from clothing to food processing, pharmaceuticals*

The Gores Group acquired the Grays Harbor County, Wash., high purity cellulose mill from Weyerhaeuser Company, which closed the mill in October 2005.

**May 22**

*Preparations under way this week for construction of 1.3 million tonnes/year Montes del Plata pulp mill in Uruguay*

The mill, at US\$1.9 billion is the largest investment in Uruguay's history. It is jointly owned by Finland's Stora Enso and Chile's Celulosa Arauco y Constitución SA. Andritz Group of Austria is responsible for design and construction.

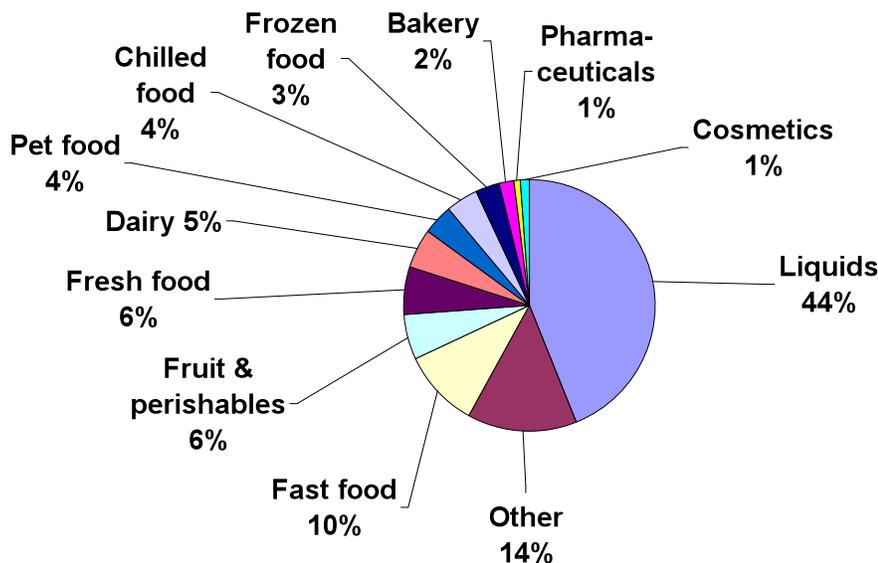
*IP plans for Franklin, Virginia, mill 'tremendous news', says Gov. McDonnell; project that will create 213 jobs seen as sign of state's economic rebound*

Governor Bob McDonnell today announced that [International Paper](#) (NYSE: IP) will invest \$83 million to repurpose a portion of its closed mill in Isle of Wight County as a fluff pulp mill capable of annually producing up to 270,000 metric tons of high quality fluff pulp for the global market. The project will create 213 new jobs.

**Statistics Corner: Barrier Coatings Market**

Functional and barrier coatings are materials that are coated onto paper and board to enable it to serve as a suitable package for its contents. They prevent liquids and vapors from penetrating the packaging material. According to PIRA International, the global market for functional and barrier coatings for paper and board was valued at \$3.8 billion in 2007, growing at 3.1% and is expected to reach \$4.6 billion by 2014. Figure 1 shows the relative importance of various barrier coating applications.

The article above on nanocellulose suggests the possibility that the new material may become a player in this market.



**Figure 1. Global market for barrier coatings, 2007 (Source: PIRA International)**