

# Pulp Digest

August 2014

## Sustainability

Chrissy Saville is the newly appointed Sustainability Coordinator at the Centre. She has worked at the PPC for over five years now and has taken on a number of roles from Summer Student to Lab Tech while she was enrolled in the Forest Resources Management (FRM) program at UBC. The FRM degree has a strong focus on environmental integrity – students learn to responsibly harvest our renewable resources while striving for a strong and resilient future for BC's forests. As such, sustainability is not only an important aspect in her everyday life, but it is an integral part of her studies.

### **What are some initiatives you have already introduced at the PPC? What kind of feedback are you receiving?**

So far, I've incorporated a styrofoam recycling program and a composting program. Also, George Soong and I sent roughly one tonne of waste wood chips to Nexterra last month which will help power our campus. I'm also creating some much needed space in our labs for students to air dry their waste pulp - this way their pulp can be recycled instead of being thrown in the garbage because it's gone moldy from being water-logged. I think people are generally happy about reducing waste and I've even had several people enthusiastically volunteer to help out with these initiatives.

### **What are some other things you are working on introducing in the short term?**

I would love to reduce the amount of water that we use in the labs without hindering the working pace of students and staff.



### **Do you have any long term goals as Sustainability Coordinator?**

Most importantly, we need to reduce our waste pulp. The refining trials in our Pilot Plant produce a mass amount of high quality pulp that, unfortunately, cannot be used in any way by us. Once it's refined, we only use a small fraction of it for analysis and the rest is waste. We have no way of drying this large quantity of pulp sufficiently enough for the recycling trucks to take it; it's been turned down by several paper companies and art schools because the hauling costs were higher than what the pulp was worth (due to the extra water weight), or because they had no need for it; it has been refused for compost because there is not enough nutrients in it; and we can't donate it for garden mulch because, even though it has been thoroughly washed, it has previously come in contact with delignifying agents.

If we had a lab-sized twin wire press to make our waste pulp into dry pulp sheets, it would help a lot. The dry pulp sheets could be recycled or even donated to companies to make paper or packaging material, or even animal bedding. Unfortunately, presses are very expensive so I'd have to say that this is definitely a long term goal.

## New Faculty



Dr. Scott Rennekar will be joining the Department of Wood Science as an Associate Professor in Advanced Renewable Materials. Prior to joining UBC, Scott has been a faculty member in the Department of Sustainable Biomaterials at Virginia Tech since 2005. He obtained his degrees in wood science from Virginia Tech (BS, 1997 and PhD, 2004) and the University of California, Berkeley (MS, 1999). Scott's research program focuses on creating advanced renewable materials through cutting-edge science that will catalyze a green economy. These sustainable products sourced from nature are stronger, lighter, and more energy efficient than their petroleum analogs. He uses materials such as high performance fibres, transparent films and coatings, and nanocomposites in applications for automobile, aerospace, building, and the emerging additive manufacturing industries. Scott will also teach a course on wood adhesives and coatings in the Wood Science undergraduate program applying his combined expertise in wood science and polymer chemistry.

Please join us in welcoming some new faces to the Pulp and Paper Centre:



Hoda

### Hoda Ahmadi

Research Assistant under the supervision of Professor James Olson, Hoda is also a MASC student in Mechanical Engineering at UBC. Her thesis title is "A Production of Cellulose-Mycelia Bio-Composite Foam". Hoda received her BSc in Chemical Engineering from Amirkabir University of Technology (Polytechnic of Tehran), Tehran, Iran in 2012, and then worked as a Technical Engineer at M-I Services Ltd, a drilling fluids and waste management company in Tehran, Iran.



Lee

### Lee Rippon

Recent BAsC graduate from UBC's Chemical Engineering (Process Specialization) program, Lee joins the PPC as an Undergraduate Academic Assistant before he begins his MASc in Process Control in Sept. 2014. He is under the supervision of Professor Bhushan Gopaluni and will focus on adaptive control of paper machines, a CRD project with Honeywell. Lee worked as a Process Technician and later an Environmental Technician at Quesnel River Pulp, and most recently as a Production Engineering summer student at Canexus Corporation in North Vancouver.



Jonathan

### Jonathan Chamignon

A 3rd year MASc student specializing in Process Engineering and Fluid Mechanics from INP-ENSIACET, Toulouse, France, Jonathan is currently working on the characterization of pulp suspensions using pressure filtration, specifically determining the compressibility and the permeability of pulp suspensions. He is supervised by Daniel Paterson and Professor Mark Martinez.



Amirhossein

### Amirhossein Salimian

Currently a Master's student in Mechanical Engineering under the supervision of Professor James Olson, Amir's research will focus on self-folding paper. Amir graduated with a Master's degree in Industrial Engineering from the Science and Research University, Tehran, Iran, in 2010 and was ranked as the top student of his graduating class. He also brings industrial experience as he has worked as a Quality Manager, production Manager, and member of ISO/TS team before joining UBC. Amir enjoys swimming and playing volleyball, is a fan of Farsi literature and enjoys writing poetry and lyrics in his spare time.



Yanfeng

### Yanfeng He

PhD candidate in the department of Chemical and Biological Engineering at UBC under the supervision of Professor Xiaotao Bi. For the next six months, Yanfeng joins Dr. Yonghua Li's research group and will conduct research on the biomass gasification in dual fluidized bed. Yanfeng joins the PPC from China where she is an Assistant Professor at Beijing University of Chemical Technology.



Musavvir

### Musavvir Shourav

Undergraduate Research Assistant in the department of Chemistry under the supervision of Professors Mark Martinez and Richard Kerekes, Musavvir is working on developing a methodology of labelling MFC (micro fibrillated cellulose, i.e refined pulp fibres) with heavy metals. Labelling will enable him to trace and image MFC selectively in pulp mixtures and papers. Musavvir previously spent time at the PPC as a Research Assistant in 2013.



Débora

### Débora Costa do Nascimento

Débora is visiting the PPC from Brazil where she studies chemical engineering. Currently an undergraduate student under the supervision of Professor Peter Englezos in Chemical and Biological Engineering, she is working on super-hydrophobic paper with Negar Mirvakili, current PhD candidate.



Chen

### Chen Wang

Chen is a visiting lecturer from Nanjing Forestry University in China and will stay at the PPC for one year. He is under the supervision of Professor Mark Martinez and will conduct research on pulp suspension flow and rheology of pulp. He graduated with a PhD in Chemical Process Equipment from Nanjing Tech University in Nanjing, China, in 2009.

# Pulp Friction

The Energy Reduction in Mechanical Pulping research program is featured as the exemplar of *Research Excellence* in **UBC's 2013-14 Annual Report**.

For more information on the program, please visit their new website: <http://EnergyReduction.ppc.ubc.ca>

Right: Professor James Olson & Nici Darychuk, Research Assistant  
Photo: Martin Dee



The path to advances in research in the forestry sector are being discovered and developed by Professor James Olson, associate dean for Research and Industrial Partnerships and former director of the UBC Pulp and Paper Centre (PPC). The way forward is clear: significantly reduce energy consumption while meeting provincial economic and sustainability goals through innovative engineering design. To explain the scope of the project, Olson uses the analogy of replacing Victorian-era machinery with today's high-performance technology.

His team's ultimate goal: trim the sector's energy consumption by 20 percent or 1,000 gigawatt/hours a year (the equivalent of 100,000 homes) and cut the sector's

greenhouse gas emissions in half by 2020.

"The message I always try to get out is that the work we do is directly related to the priorities of the province," says Olson. "We are UBC - this sector is key to BC's prosperity. What we're doing is providing

technical solutions to directly impact the competitiveness of the industry and provide highly qualified personnel for the industry."

Softwood pulp is among BC's largest and most economically crucial industries, but mechanical pulping is energy intensive and cuts deep into the sector's margins, reducing its global competitiveness and affecting the many rural communities whose own economies - and jobs - depend upon this industry.

Olson notes that the BC forest industry is strategically important to this province and is reasonably integrated to extract full value from the trees or in industry speak, 'units of value'. He goes on to explain that dimensional lumber or building material has the most value but can't support the industry alone; coupled with pulping revenue however, it can and if the pulping sector is to extract full value, it must make the most efficient use of the fibre.

"WE'RE TRYING TO DEVELOP TECHNOLOGY, DEVELOP PEOPLE AND DEVELOP SOLUTIONS SPECIFICALLY FOR BC AND THE BC FOREST INDUSTRY."

Chemical pulping requires comparatively little electric power but it "dissolves away half the tree" and although the residue is used to generate thermal/electric power, it is not as resource efficient in terms of 'lost' fibre.

Courtesy of its "monster machines" or chip refiners, mechanical pulping literally shreds the chips into 100-percent useable fibre. However, the energy intake is ravenous; each of the 70 or so chip refiners in BC consumes 25 megawatts



Above: Nici Darychuk and Francisco Fernandez handle pulp suspension in preparation for a pilot scale energy reduction experiment.  
Photo: Martin Dee





Above: James Olson, Francisco Fernandez and Nici Darychuk examine an experimental refiner plate on the PPC's low consistency refiner  
Photo: Martin Dee

of power or collectively (and depending on demand) more than 10 percent of all power produced by BC Hydro.

Among other refinements, Olson and his team have proposed the wide-scale replacement of the old power-hungry chip refiners with multi-stage, new-tech, 'high consistency' machines that get the job done with far less energy: "It's like taking an old steam engine and replacing it with a couple of smaller, high-performance engines."

Powered by a \$2.7-million National Sciences and Engineering Research Council of Canada (NSERC) grant, backed by a consortium of 16 mechanical-pulp companies and assisted by the universities of Toronto and Victoria, the result is a focused, five-year university/industry research collaboration.

In addition to funding the latest equipment, the NSERC grant will help attract and support the best graduate students who, along with professors and senior researchers, will target almost a dozen inter-related projects to develop new processes with novel sensors and advanced computer control.

The aim: add to PPC's roster of innovative technologies.

Currently, the list includes PPC's high-performance pulp-screen rotors that cut power consumption in half (now used worldwide with an even more efficient version in the works), new fibre separation and refining processes for mechanical and chemical pulp, and Olson's own work in the development and commercialization of a fibre-quality analyzer that to date, has sold 150 units and reached \$25 million in sales.

Upping the competitiveness and reducing power demand in the BC pulping industry by even a fraction has big downstream payoffs, notes Olson. Not just environmentally but economically. The clean 'surplus' hydroelectric power can be sold over the borders to everyone's collective benefit - and further underline UBC's worth and purpose.

"It is 'UBC for BC,'" says Olson. "We're trying to develop technology, develop people and develop solutions specifically for BC and the BC forest industry."

To view the full UBC Annual Report, please visit:  
[www.annualreport.ubc.ca](http://www.annualreport.ubc.ca)

# Awards & Achievements

## Thomas Bennett Award



Lee Rippon, PPC Undergraduate Academic Assistant, receives the 2014 Thomas Bennett Student Enrichment Memorial Award in Chemical and Biological Engineering (CHBE). Awarded for his participation in student enrichment activities, social and environmental concern, academic achievement, and leadership qualities, the award is well deserved.

The award is a legacy of accomplished CHBE alumnus Thomas Edward James Bennett, who graduated in 2007. During his time at UBC, Tom made a positive and lasting impression on students, staff, and faculty in the Faculty of Applied Science, many of whom were devastated by his untimely death in a tragic mountain climbing incident on April 1<sup>st</sup>, 2010, at the age of 26.

## Research Excellence



The Energy Reduction in Mechanical Pulping program is the coveted exemplar of *Research Excellence* in **UBC's Annual Report 2013-14**. Professor James Olson and the entire team of researchers continue to make a positive impact on the forestry sector, and specifically BC's economic development and sustainable operations.

To read the feature, please see *Pulp Friction* on page 3

# Publications

## Journal

**Jahangiri, Pouyan**, R. Korehei, S. Zeinoddini, A. Madani, Y. Sharma, A. Phillion, D.M. Martinez and J.A. Olson, "On filtration and heat insulation properties of foam formed cellulose based materials" Nordic Pulp and Paper Journal, accepted for publication

**Abstract:** Novel biodegradable, low-density porous materials based on wood fibres are produced in foam laid media and called foam-paper. Applications of foam-paper are studied in sub-micron aerosol filtration and heat insulation. The effect of foam air-content and fibre type on the variation of final product properties is determined. In the first study, the effect of fibre morphology and crowding number are investigated on the major filtration parameters such as pressure-drop, air-permeability and filtration-efficiency. The results show that increasing fibre specific surface and crowding number and decreasing pulp freeness leads to increasing both filtration efficiency and pressure-drop of foam-papers. Different combinations of additives and two methods of drying are applied in order to optimize filtration characteristics. The best filtration properties are obtained using air-dried samples with 10% and 30% weight ratio of Northern Bleached Softwood Kraft (NBSK) valley beaten fibres and freeze-dried Nanofibrillated Lyocell Fibres at high air-contents. In the second study, variations of thermal conductivity of standard foam-papers with respect to foam air-content are investigated. The results of foam-papers at higher air-contents are comparable with the results of commercial heat insulators.

**Yenjaichon, Wisarn**, J.R. Grace, C.J. Lim, R.J. Kerekes and C.P.J. Bennington, "Mixing quality in low consistency fibre suspensions downstream of an in-line mechanical mixer measured by electrical resistance tomography", Nordic Pulp and Paper Research Journal, accepted for publication.

S. K. Mahadeva, K. Walus, **B. Stoeber**, "Piezoelectric paper fabricated via nanostructured barium titanate functionalization of wood cellulose fibers," ACS Applied Materials & Interfaces (ACS), vol. 6, no. 10, pp. 7547-7553, 2014.

## In the Media

### Pulp and Paper Canada

A reference to the inaugural UBC Student Presentation Session organized by PPC researchers during the 2014 Pacwest Conference held in Jasper, AB, May 28-31.

### PAPTAC

PAPTAC and Paper Advance provided official news coverage of the 2014 Pacwest Conference, and referred to the students & researchers who presented as “the next generation”. PAPTAC’s Carmie Lato says “in this time of maximum change, students such as these will help forge the future of our industry”.

## News Release

On July 24<sup>th</sup>, BC Hydro announced an exciting new Power Smart program that will aim to reduce electricity costs for pulp and paper producers. The news comes at an opportune time, especially for the Energy Reduction in Mechanical Pulping research program housed at the Pulp and Paper Centre (*see pg 3 for more on the program*).

### Energy efficiency investments to reduce costs for pulp and paper producers

SURREY – Bill Bennett, Minister of Energy and Mines and Minister Responsible for Core Review and Jessica McDonald, President and CEO of BC Hydro, announced a new Power Smart program that will reduce electricity costs for pulp and paper producers.

The program will help producers remain globally competitive, supporting thousands of jobs across the province and will reduce overall electricity demand, keeping rates low for all customers over the long-term.

The new program builds on existing initiatives for industrial customers where BC Hydro provides a financial incentive of up to 75 per cent of the project cost to support investments in more energy efficient equipment.

Under the new program, thermo-mechanical pulp and paper producers, which have electricity costs that account for as much as 30% of their operating budgets and represent 10% of BC Hydro’s annual power sales, will be eligible for increased incentives ranging from \$5 million to \$25 million for projects that can reduce their power consumption.

The program is expected to reduce electricity consumption by 300 gigawatt hours per year which will save pulp and paper producers \$17.5 million in annual power costs. In addition, by reducing overall electricity demand by this amount, BC Hydro will avoid the need to acquire new sources of power generation, saving ratepayers up to \$265 million and keeping rates low for all customers.

The demand for electricity in British Columbia is expected to grow by 40% over the next 20 years. Investing in energy efficiency is a key component of BC Hydro’s Integrated Resource Plan target to meet 78% of this new demand through conservation, which is more cost-effective than acquiring new sources of power generation.

There are seven thermo-mechanical pulp and paper operations in B.C. operated by four companies: Canfor (Taylor), Catalyst Paper (Crofton, Port Alberni and Powell River), Paper Excellence (Chetwynd and Port Mellon) and West Fraser (Quesnel).

The new program adds to the \$1.6 billion that BC Hydro will spend on Power Smart initiatives as part of the 10 Year Plan.

Earlier this month, government, BC Hydro and FortisBC announced an expansion of energy-efficiency programs to help customers, particularly those on low-incomes, reduce their electricity and gas bills.

BC Hydro continues to work with all of its residential, commercial and industrial customers on Power Smart programs and is also conducting a rate design review to provide large industrial customers with more flexible rate options to manage their costs and stay competitive.

## Upcoming Events

### Imagine UBC Day September 2

First day orientation program for undergraduate students in most programs offered at UBC (including Applied Science). All undergraduate classes are replaced by Imagine UBC Day celebrations.

### UBC Innovate 2014

#### September 29, 5:00-8:00pm, UBC Robson Square

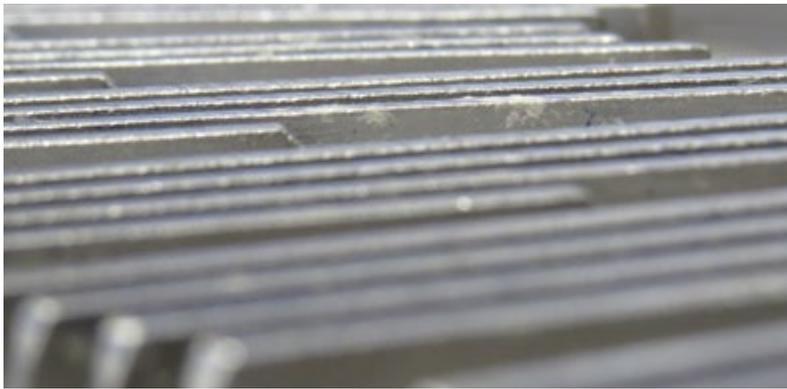
A special showcase of UBC Applied Science research within the broader community. The evening will consist of presentations by some of our most engaging people, including Professor James Olson, followed by a networking reception. Alumni and industry contacts will be in attendance.

Visit [www.innovate.apsc.ubc.ca](http://www.innovate.apsc.ubc.ca) for more information.

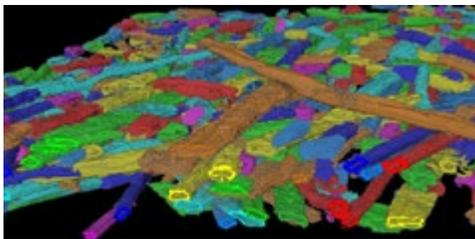


# Guess the Photo

Can you guess what the image below is? We will reveal the answer in next month's issue of *PPC's Pulp Digest*.



## Last Month:



Left: The image shows more than 1000 papermaking fibres, identified uniquely, within a 1mm X 1mm section of paper handsheet. The handsheet was manufactured using 100% NBSK pulp at the Pulp and Paper Centre, and imaged using a high-resolution X-ray tomographic ( $\mu$ CT) microscope at UBC's Okanagan campus (<http://spsl.ok.ubc.ca/xmt.html>). X-ray  $\mu$ CT is a non-destructive imaging technique capable of visualizing in 3D the internal structure of a wide range of materials and biological specimens. Advanced 3D image analysis routines have been developed to isolate each individual papermaking fibre in the microstructural images of paper acquired using  $\mu$ CT as a first step to quantifying the effect of Low Consistency refining on the paper architecture. The work is done as part of a project under the supervision of Dr. Andre Phillion and Dr. Mark Martinez, and sponsored by NSERC and Canfor Pulp.

Photo c/o Yash Sharma

# Social Media



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Thanks for all your TWITTER support. Below we share a few of our recent tweets:

UBC Pulp & Paper Centre @ubcPPC 25 JULY  
Energy Reduction in Mechanical Pulping program featured in #UBC annual report. Check it out

BC Hydro Power Smart @PowerSmartBC 24 JULY  
News release | New Power Smart program will reduce electricity costs for pulp & paper producers, up to 300 GWh/year: [ow.ly/zyaf3](http://ow.ly/zyaf3)

UBC Pulp & Paper Centre @ubcPPC 9 JULY  
Group of high school students dropped by for a tour of our cool facilities today! Contact us if you want one too (photo)

UBC Pulp & Paper Centre @ubcPPC 7 JULY  
Today is the closing date for a FT Research Engineer position to work on the successful Energy Reduction in Mechanical Pulping program.

reThink Wood @reThinkWood 7 JULY  
Will cities of the future be built of wood? Why designers are re-embracing the building material. [owl.li/yShVk](http://owl.li/yShVk) via @BostonGlobe

# Contact

To submit items to *PPC's Pulp Digest* or to join our mailing list, please contact Anna Jamroz, PPC Communications Coordinator at: [anna.jamroz@ubc.ca](mailto:anna.jamroz@ubc.ca)

