SESSION 4B INNOVATION & RESEARCH

4B1 Hydrolyzing of Mixed Office Waste (MOW) Paper

***Ramiro Escudero**, Jeovani González,,Feng Rao*, Institute of Research in Metallurgy and Materials; *Pedro Navarro,* Faculty of Chemical Engineering, Universidad Michoacana de San Nicolás de Hidalgo, México.

Deinking of Mixed Office Waste (MOW) type paper was carried out by using a flotation column, and adding separately sodium hydroxide, and the enzyme Cellulase Trichoderma Sp., as defibrillators.

The computational simulation of the molecular coupling between the enzyme and cellulose was performed, to establish the enzyme-cellulose molecular complex and then to identify the principal amino-acids of endo-β-1,4-D-glucanasa in this molecular link, which are responsible for the hydrolysis of the cellulose.

The deinked cellulose fibers were characterized according the standards of the paper industry, in the laboratory of the company "Bio-Papel Scribe S.A. de C.V.", installed in Morelia, Michoacán, México, to compare the deinking efficiency of every chemical reagent used as defibrillator during the pulp conditioning.

Experimental results show the feasibility to replace sodium hydroxide with the cellulase Trichoderma Sp., by obtaining deinked cellulose with similar optical properties, named whiteness (brightness), reflectance factor, opacity and tonality.

According to the mathematical simulation and analysis of the molecular coupling of the enzyme to cellulose by the Docking technique, the most important endo-β-1,4-D-glucanase amino-acids in this molecular bond were determined, which promote hydrolysis of the cellulose and the subsequent release of the ink, which are: Glutamate, Asparagine, Tyrosine, Aspartate, Tryptophan, and Phenylalanine.

Keywords: Paper deinking, flotation column, enzyme Trichoderma Sp., paper pulp, MOW paper

4B2 Method for Continuous Fractionation of MFC

Mohammed Shanb Ghazani, UBC

A laboratory-scale continuous device was developed to test the possibility of fractionation of MFC through use of visco plastic fluids in a continuous method. The methodology was based on control of the threshold of motion by a balance between the driving force and the resisting force, owing to yield stress of a visco-plastic fluid. Ideal separation using spherical and fibre-shaped nylon particles were presented along with speculative discussions of the observed trend behaviour. MFC, produced from bleached eucalyptus kraft pulp was used as our particle system, and fractionated in both batch-wise and continuous methods. We were then able to establish a reasonable estimate of the fractionation yield which varied between 10 and 55 percent, depending on the target particle size. These results point to the possibility of reducing energy significantly in the production of MFC. Finally, in what we find the most surprising result was that we found small quantities of nano-fibrillated cellulose in the fractionated fibres.

4B3 Structural Challenges Using Non-Ferrous Materials to Repair Bleach Towers

Robert Gallant, TAC

Definition: **Carbon Fiber** Reinforced Polymer Composites, or **CFRP** Composites for short, is a term used to describe a fiber reinforced composite material that uses **carbon fiber** as the primary structural component.

Limitations: Availability and lead time for engineering and delivery to meet Shutdown Schedules.

Purpose: In choosing the proper spec's for a structural repair and corrosion resistant lining used in the pulping industry such as chlorine dioxide bleach towers, causticizes, pulp vats, digesters and storage vessels, all elements and components must be understood in relation to their intended process. These would include

- External structural support such as reinforced concrete or carbon steel.
- Membrane (primary corrosion barrier)
- Mortar
- Masonry units, Brick or Tile
- Exterior protection (paint)
- Insulation
- Operating and external ambient temperatures
- Ph
- Location and environment

Because corrosion engineering is a highly specialized industry, not many engineers are called upon to design or to install acid brick structures or linings. Fewer still have sufficient experience with these materials to determine the causes of trouble with or failure of such an installation.

When failure occurs, it can almost always be traced either to

1. A lack of understanding of the limitations and the uses of the materials by the designer.
2. Insufficient experience with or understanding of the handling of the materials by the installer.
3. Underbidding of a job by a contractor trying to substitute cheaper materials or cut corners.

Conclusion: A cast study detecting failure mechanisms, engineering solutions and how applying technology for new ideas can be adapted.

4B4 Innovative Approaches too Landfill Capacity

Trevor Mahoney, XCG Consulting, Kitchener

The presentation will focus on the development of site-specific solutions to optimize landfill capacity. XCG will discuss the importance of taking the time to evaluate all aspects of a design to ensure landfill airspace is optimized.

The capacity of a landfill is usually restricted by:
Approved landfill footprint/setbacks;
Final approved grades; and
Regulatory requirements.

We typically focus on maximizing airspace via:
Filling methods;
Compaction – increasing waste density;
Reducing the use of landfill cover soil/implementing alternative daily cover;
Utilizing settlement; and
Final cover configuration – saving space by using geosynthetics.

However, through innovative design, sometimes there are opportunities to create more airspace within an existing approved landfill footprint.

The Harmac Pulp Mill Landfill includes a pulp mill, a landfill, and other operational infrastructure. In 2016, Harmac began design of a landfill expansion. The original design, by another firm, included the conveyance of stormwater run-on via a pipe beneath the landfill expansion area (rendering it inaccessible for future maintenance). The new cell was to be bordered by a five-metre wide perimeter road and an open “v” ditch to collect stormwater from the expansion area. The expansion area design included 3V:1H side slopes (33% grade) and an engineered landfill liner. XCG proposed a new design and instead of directing stormwater run-on beneath the expansion area, XCG designed a large diameter conveyance pipe and incorporated it into a perimeter berm. XCG also proposed removing the perimeter road, replacing it with the aforementioned berm. Instead of the “v” ditch, XCG incorporated perforated piping to collect the surface water from the expansion area and tie it in to the main large diameter stormwater conveyance pipe. By eliminating the width of the perimeter road and the “v” ditch from the design, site capacity was increased by almost 40%.

4B5 Evolution of Conventional Industry into Industry 4.0-IoT-Internet of Things

Eddy Nahed, Asystom / Bureau Recherche & Development-R&D de Toulouse, France

I am reaching out to you, since I have interest presenting a new way to bridge the gap between conventional industry and Industry 4.0/Internet of Things. It is a new perspective of using artificial intelligence to mitigate risks. I believe everyone shall regard safety and efficiency as paramount and shall never neglect any plausible option to reduce any foreseen risk exposures. Innovative ideas are priceless; in order to survive the 21st century, the industry shall be the leader in innovation and shall grab the opportunity to supersede current passive preventive maintenance by implementing new methods based on predictive strategies.

The world industry has evolved in 4 phases: mechanisation, mass production, computerization and now we are in the cyber-physical (industry 4.0). The purpose of the current is to present our innovative way to evolve any industry into the 4th phase; the mill industry is no exception.

Let me start by introducing "Asystom"– Universal Smart Monitoring Solution for Predictive Maintenance. Asystom develops innovative, turn-key solution that monitors and analyzes any machine behaviour and predict anomalies. Our aim is to provide targeted maintenance to avoid incidents, reduce downtime and complement current preventive means.

Designed for anomaly detection based on machine learning, Asystom has created the first universal solution to monitor machines of different ages and designs, without constraints of installation and deployment. Our solution is scalable, non-intrusive and work independently from existing infrastructure.

This turn-key solution is unique since it combines through a miniaturized box, an unequaled number of physical parameter measurements, cutting edge computing power with years of autonomy. Information is stored in the cloud through an encrypted secure network and accessible through a Web-based application.

Based on the above introduction, we believe it is an ingenious idea to monitor motors, conveyors or any revolving or moving devices. Therefore, we believe the insertion of such monitoring device complements preventive maintenance and will help immediate intervention to avoid incidents and reduce downtime. The presentation will include practical applications and other demonstrations.