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The research related to the pellet industry at University of British Columbia, Department of Chemical and Biological Engineering (UBC/CHBE) continues to be very active with focus on safety and improvement of product quality. The following are some of the highlights;

- Exploratory research to gain understanding of the gas evolution inside an enclosed storage silo. The Large Research Reactor (LRR) donated by Pinnacle Pellets Inc and Pacific Bioenergy Corporation and located and running under room temperature conditions with no sun exposure in the Clean Energy Research Center (CERC) was loaded up in March 2011 with approximately 3 tonne of high quality pellets donated by Premium Pellet Ltd. The reactor is equipped with two data collection systems logging data from 336 temperature sensors and 6 pressure sensors for profiling the thermal conditions during an extended storage period. The sensors are arranged by means of hanging vertical cables donated by OPI Systems Ltd as well as cross-wise by means of rods. Gas samples (CO, CO₂, CH₄ and free H₂) have been taken to establish a profile of the concentrations from the bottom to the top. There are also 70 humidity sensors tracking the moisture migration in the silo. The first phase of the research was running for 30 days under sealed condition after which air now is circulated through the silo with continues logging of data and gas sampling.

The objective is to establish if there is a stratification of gas at various levels which would prompt the potential use of special safety advice for large scale silos and to better understand the relation between oxygen depletion, gas evolution and self-heating. The impact of renewed oxygenation after complete oxygen depletion provides a measure of impact of incremental ventilation. The discovery of free hydrogen (highly explosive when mixed with oxygen) is significant since accumulation in pockets could be a safety concern in large storages. Comprehensive data analysis will provide very important insight in to the mechanism causing severe oxygen depletion during storage of pellets. The experiment also provides an insight in to the impact of internal convection in the reactor vessel. The mass balance calculations conducted does not explain where the oxygen goes and further analysis may disclose the potential existence of adsorption or conversion of oxygen to solid oxides. This in turn provides clues to how to avoid gas evolution in the next generation of pellets under development.

This research is supported by WPAC funding and a report is under preparation in combination with a scientific paper.

- A number of experiments with pelletization of various feedstock materials have been conducted based on assignment and financing from outside parties. These tests follow a rigorous and comprehensive testing and reporting protocol. The work has been done primarily using the small CPM pelletizer which has limitations in terms of being representing the mechanism of large commercial presses. UBC is in the process of applying for funding to acquire a larger machine which would better represent the pressure and temperature which exist in large commercial presses. Results of this application will be known probably sometime in September 2011.

- To develop a deeper understanding self-heating in pellets remains a focal point in the research at UBC. Kinetic models for thermal conductivity as well as heat capacity as a function of moisture have been developed and are essential parameters in the continued work on developing a prediction model for self-heating related to moisture ambient temperature in the presence of oxygen as well as in oxygen deprived atmosphere. This work provides a knowledge base essential for prediction and early detection of self-heating phenomenon. This work has been funded partly by WPAC.
- Mass loss during self-drying of woody material is being investigated with the objective to quantify the benefits of having feedstock dry in the open before being used as a feedstock for pellets production. Bales of biomass equipped with temperature sensors, weight scale and monitors for ambient temperature and relative humidity are observed in an outdoor storage area. The benefits of maturing of feedstock in an outdoor environment at pellet mills are well known but have never been quantified before.
- A number of other research projects not funded by WPAC are under way at UBC such as steam treatment of woody materials to explore the effects of steam-drying as a pre-treatment. The objective is to explore the potential for using pelletized wood as a feedstock for ethanol production.
- The Request for Proposals under the federal program called Investments in Forest Industry Transformation (IFIT) has opened up with closing date on September 28, 2011. <http://cfs.nrcan.gc.ca/subsite/investments-forest-industry-transformation/home>
- The Request for Proposals (No SOIG-11-03 Agricultural Biomass Torrefaction Research Program) <http://www.ceati.com/files/ifp/hplig/HPLIG%20IFP-2011-05.pdf> under Center for Energy Advancement through Technical Innovation (CEATI) just closed on July 21, 2011.
- The work to convert the CEN testing standards, quality classification standards as well as quality assurance standards for solid biomass is currently being done under ISO Technical Committee 238. I am participating in this work which will have a profound effect on commercial contracts as well as definition of sustainability over time. The number of standards in preparation is in the order of 60 with about 20 are in addition to the CEN standards. The development process will take another 2 years to complete.
- The study of torrefaction technologies available around the world were completed in May 2011 by NORAM in close cooperation with WPAC. The study was funded by Premium Pellet Ltd, BC Bioenergy Network, NRCan and WPAC and a report is in preparation with limited distribution to producing members of WPAC.
- The SECTOR Project has received a go ahead in Europe and will start January 1, 2012 with a funding level corresponding to approximately \$20 million of which half is funded by the European Commission and the other half by the 20 members of the consortium consisting of the major European power producers, torrefaction technology providers and research institutions. The objective is to demonstrate the feasibility of producing torrefied pellets in large quantities and to specification using woody as well as herbaceous feedstock. Significant emphasize is placed on densification, safety in handling and storage, milling/feeding/combustion characteristics and development of testing and quality standards. I am the only non-European member of the Advisory Committee for the SECTOR Project and will keep you informed of the progress.

Additional updates will be released on a regular basis with reference to scientific source documents and research results in abbreviated form suitable for the industrial community.