CLEARWATERBAY TECHNOLOGY, INC.
The Process Development Company

CLEARWATERBAY TECHNOLOGY

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CWB TECH GOING GLOBAL WITH NEW OFFICES IN ASIA

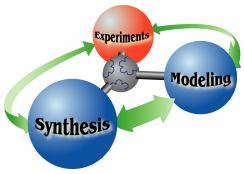
INSIDE THIS ISSUE:

SPECIAL POINTS OF INTEREST:

- Opening of CWB Hong Kong office
- New Training Courses at CWB China Office
- TECH TIP: How to define *Biomass* component in Aspen Plus?
- Happy Holidays!

As mentioned in our newsletter from last fall (October 2011), ClearWaterBay Technology has extended its global reach with offices in Beijing (CWB China), and most recently with the opening of our new office in **Hong Kong SAR, ClearWaterBay Technology, Ltd**. ClearWaterBay Technology Ltd. (CWBHK) located at Yuen Long Industrial Estates in Hong Kong has been set up with the main objective to compliment and strengthen the service by ClearWaterBay Group in the area of bench-scale experimental testing, pilot testing and small-scale manufacturing.

The new facility was recently inaugurated with a lavish opening ceremony and the launch of the new website www.cwbhk.com , held on July 28-30, 2012, at the company site in Yuen Long, as well as at Royal Pacific Hotel and Towers, Kowloon. The opening ceremony and banquet consisted of entertainment programs, such as *Lion Dance* and *Magic Show*. On the third day, a technical seminar was organized to brief about the company's objective and range of services we provide.



The Technical Seminar had the following topics and speakers:

- Introduction of ClearWaterBay Technology – Dr. Lionel O'Young, President
- Better Reactor Synthesis – Dr. Vaibhav Kelkar, Group Manager / Principal Engineer, CWBLA
- Crystal Clear "Integrative Approach for Successful Crystallization Process Development – Dr. Christianto Wibowo, Group Manager / Principal Engineer, CWBLA
- Experimental Set Up in CWBHK – Dr. Alex Chan, Manager, CWBHK
- A New Process Development Case Study Report – Keys to Success - Dr. Vaibhav Kelkar, Group Manager / Principal Engineer, CWBLA
- Our Services & Advantages of R&D in Hong Kong – Stephen Chan, Project Manager, CWBHK
- Setting Up and Operating a Plant in Hong Kong – Abraham Kwong, Project Manager, CWBHK

CWB Tech's goal has always been to provide the total solution to the clients' process R&D needs. Our new Asia offices further that goal along with our main office in Southern California. Follow us at www.cwbtech.com .

TRAINING COURSES IN CWB CHINA OFFICE

Pinch Technology

A 5-day interactive short course on the theory and applications of Pinch Technology. Students learnt how Pinch Technology is a tool for process analysis, not just heat exchanger network synthesis, although both topics are taught in the course. The course included 14 interactive workshops, both hands-on and using Pinch analysis and heat exchanger network design software.

Advanced Process Simulation—Ethylene

A 5-day hands-on, interactive short course with modeling whole process flowsheets. In a step-by-step manner they simulated process models for the furnace area, quench area, cracked gas compressor, cold fractionation, hydrogen/methane separation, cold end heat recovery, and warm fractionation areas of the plant. Utility system models were also incorporated for the cascaded propylene and ethylene refrigeration systems, and the steam and power system. The course was taught using Aspen Plus process simulation software.

CWB CHINA COURSE SCHEDULE (about 20 participants)	
Pinch Technology	**Advanced Process Simulation—Ethylene**
6/18 – 6/ 21 6/25 – 6/29 9/17 – 9/21 9/24 – 9/28	10/22 – 10/26 10/29 – 11/2 12/3 – 12/7 (upcoming) 12/10 – 12/14 (upcoming)

If you would like to schedule an in-house training course, please contact us at shortcourse@cwbtech.com

TECH TIP: HOW TO DEFINE BIOMASS IN ASPEN PLUS

Before going on to developing the process model in a simulation in Aspen Plus, there is an important step of defining components and their physical property data. However, unlike processes that contain conventional components, processes that contain solids such as coal, biomass (for example, generating ethanol from biomass) require a different approach to assign all the physical properties of the solid component "Biomass" into the simulation.

In the NREL treatment of the biomass components, they are entered as solid components (Humbird et al, NREL/TP-5100-47764, May 2011). NREL has developed an in-house database of biofuel components (Wooley and Putsche, 1996) compiled from literature, estimated properties where necessary, to determine a set of consistent physical properties. Another approach to avoid increasing complexity all the biomass components can be combined into a single entity. This is done by specifying Biomass as a Nonconventional Component similar to a coal assay.

Nonconventional solids:

- Are solid components that cannot be characterized by a molecular formula
- Are treated as pure components, though they are complex mixtures.
- Characterized in terms of empirical factors called component attributes each representing composition of individual ingredient
- They do not participate in phase or chemical equilibrium calculations. After undergoing a reaction, the solid assay composition changes and the new wt% is assigned to the NC substream at the outlet of the reaction block

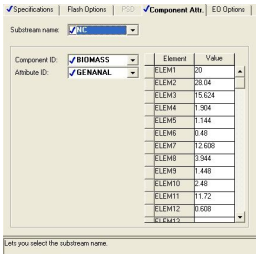
To Specify	Description
Nonconventional Component (Solid)	20 component attributes
Composition	Mass Flows and Wt%
Reaction	Does not participate directly, Specify NC attribute composition at outlet
Physical Property Model	GENANAL
Physical Properties Required	Density (DNSTYGEN), Enthalpy (HCGEN)
Where to Enter Physical Property Parameters	Properties\ Advanced\ NC-Props Form OR User-defined Components Wizard Aspen Plus requires at least the first element of the heat capacity polynomial (HCGEN) and density polynomial (DENGEN), for each constituent of each nonconventional component.

How to specify a non-conventional component in Aspen Plus

Examples of nonconventional solids are coal and wood pulp.

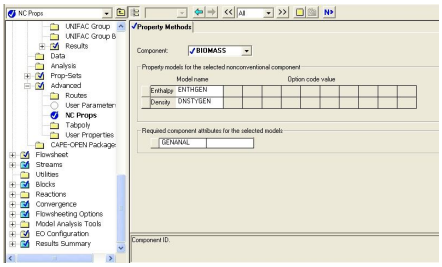
Specifying a Stream

Consider the following example: on the Stream Input Component Attribute sheet, the elements of the GENANAL component attribute are specified for the NCPSD substream (maximum of 20). The values are wt% basis and hence have to add to 100.



Specifying Properties

On the Properties\ Advanced \NC-Props form, the GENANAL component attribute is defined as required for the selected Nonconventional Component Property models. A stream class defines a stream structure in terms of number of substreams, type of component carried in each substream (conventional or nonconventional), and whether the substream carries particle size distribution.



Nonconventional components generally do not participate in phase equilibrium calculations, but are included in enthalpy balances. For a process unit in which no chemical change occurs, only sensible heat effects of nonconventional components are significant. In this case, the enthalpy reference state may be taken as the component at any arbitrary reference temperatures (for example, 298.15 K).

Two properties are required to specify properties of nonconventional components:

- DNSTYGEN is a general model that gives the density of any nonconventional solid component. It uses a simple mass fraction weighted average for the reciprocal temperature-dependent specific densities of its individual constituents. There may be up to twenty constituents with mass percentages. You must define these constituents, using the general component attribute GENANAL. The units are MASS-DENSITY and TEMPERATURE. Use the elements of GENANAL to input the mass percentages of the constituents.
- ENTHGEN is a general model that gives the specific enthalpy of any nonconventional component as a simple mass-fraction weighted-average for the enthalpies of its individual constituents. You may define up to twenty constituents with mass percentages, using the general component attribute GENANAL. The specific enthalpy of each constituent at any temperature is calculated by combining specific enthalpy of formation of the solid with a sensible heat change. (*Aspen Plus User Guide, Chapters 6-9*)

Other Simplifications

For Biomass , heats of formation have to be measured for components because of lack of data. While NREL has used a temperature-dependent polynomial (Wooley, 1996) for wood cellulose from literature from Domalski, 1987, it can also be modeled with no temperature dependence for solid heat capacity.

Cellulose (or Glucan) and Xylan (and also Mannan Galactan, Arabinan) are considered to be a solid throughout the process and will never be in solution. Additionally, they are polymers, but the molecular weight formula will be taken as the repeat unit only. The other properties are determined on a weight basis and then converted to mole basis for the database. Lignin is considered to be a solid throughout the process and will never be in solution.

For detailed information on our upcoming training courses, contact us at shortcourse@cwbtech.com, or or **Gary Koehler** of Garlind Associates at garlind2@verizon.net, or **Hideo Iketani** of I.T. Solutions at iketani@its-ykh.co.jp or, **Abdul Rahman Hariri** of Winmore Engineering Sdn Bhd at rahman.hariri@winmore-engineering.com

HAPPY HOLIDAYS FROM CWBTECH

All of us at ClearWaterBay Technology would like to wish you and your family a very happy and prosperous new year!

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