

TECHNOLOGY HORIZONS

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LOOKING BACK ON THE ZETON SYMPOSIUM: MASTERING CONTINUOUS MANUFACTURING AND MODULAR PLANT SOLUTIONS FOR TOMORROW'S HIGH-QUALITY MEDICINES

On Thursday, March 6, 2025, Zetron proudly hosted its exclusive symposium, "Mastering Continuous Manufacturing and Modular Plant Solutions for Tomorrow's High-Quality Medicines" at the University of Twente in Enschede, the Netherlands.

What an incredible day it was! We welcomed 79 participants from leading pharmaceutical companies such as AstraZeneca, Eli Lilly, Roche, Merck, Sanofi, J&J, and many others. Top CMOs in continuous manufacturing—including Ajinomoto, CordenPharma, Flamma, and Snapdragon—were also present, making the day a true convergence of thought leadership and cutting-edge innovation.

Inspiration, Innovation & Interaction

Throughout the day, our expert speakers - Bert Metten, Gareth Alford, David Linder,

Richard Spencer and Gabriel Loh - gave presentations on the future of continuous manufacturing and modular factory solutions. Under the engaging leadership of our chair, Anne Bard, we explored the key trends, challenges and opportunities shaping the pharmaceutical manufacturing landscape.

Unique Behind-the-Scenes Look

A highlight of the day was the exclusive tour of Zetron B.V., where participants experienced innovation in action—including a glimpse of a ContiUnity® process system project currently under construction. This behind-the-scenes visit offered valuable insight into how modular technology is engineered and scaled across a wide range of applications, from lab-scale systems to

full-scale modular cGMP/GAMP compatible production plants.

Let's Continue the Conversation

Couldn't make it, or want to dive deeper? We'd love to continue the conversation about how modular and continuous manufacturing solutions can support your organization. Whether you're interested in a visit to our facilities or a follow-up meeting at your location, feel free to reach out via marketing@zetron.nl.

A heartfelt thank you to everyone who joined us and helped make this day unforgettable! ■

ZETON DELIVERS SUSTAINABLE BIO-OIL PRODUCTION PLANT TO ARBIOS BIOTECH IN PRINCE GEORGE, BC



Aerial view of the main process modules of Chuntoh Ghuna, photo courtesy Arbios Biotech

Set in the traditional lands of the Lheidli T'enneh First Nation at the confluence of the Fraser and Nechako Rivers in British Columbia's northern capital of Prince George, lies the Chuntoh Ghuna facility, a large-scale sustainable bio-oil production facility. Developed by Arbios Biotech, the Chuntoh Ghuna facility (pronounced Chan-toh Hannah, meaning "the forest lives") confirms Arbios' leadership in the commercialization of sustainable bio-oil production. Arbios is a joint venture of two organizations with a shared vision: hydrothermal liquefaction (HTL) technology leader, Licella (www.licella.com) and global sustainable forestry products company Canfor (www.canfor.com).

Arbios approached Zeton in late October 2020 for a strategy on Modular Constructability for a large scale commercial sustainable bio-oil production facility. This facility that would come to be known as the Chuntoh Ghuna Facility would utilize Licella's Cat-HTRTM HTL technology to transform forest residues and other woody residuals into a renewable bio-oil that can be refined into renewable transportation fuels with a low carbon footprint.

Arbios and Zeton worked throughout the COVID-19 pandemic to engineer and design the main unit's process modules. Zeton worked to incorporate various design elements and learnings from Arbios' existing large scale pilot plant in Somersby, Australia as well as sub-packages from various suppliers, fabricators and Arbios' equipment supplier partners into a 27-module full production plant. The execution strategy incorporated the staged delivery of several modules with some major equipment being delivered straight to site.

Final design, fabrication and testing at Zeton was completed in Q4 2023 with delivery and site re-assembly completed in 2024. As of Q4 2024, the facility has entered into the commissioning phase, with operations commencing in 2025.

Designed to produce 50,000 barrels of bio-oil a year, the Chuntoh Ghuna facility is, according to Arbios, the largest HTL facility in the

world. Significant non-process engineering support and services in the execution of this project was provided to Zeton and Arbios from Precision Specialized Inc (Logistics and Transport), Pillar Resource Services Inc (fabrication and sub-contracting) and many more.

Arbios' Chuntoh Ghuna facility was developed in close partnership with the Lheidli T'enneh First Nation (www.lheildi.ca) and with support from the Government of British Columbia through the Province's Initiative Agreement Program under the Low Carbon Fuel Standard (LCFS). Additional support in various stages of the project was provided by Sustainable Development Technology Canada; the BC Innovative Clean Energy Fund; and Natural Resources Canada's *Clean Growth Program*. ■

"Our strength comes from forming the right partnerships to build upon our technology and expertise. Building the world's first HTL facility of this size and scale had the potential to bring its unique set of challenges but combining our world class team with experienced and specialized vendors really helped moved this project forward."

- Stefan Muller, COO, Arbios Biotech

"The Chuntoh Ghuna Hydrothermal Liquefaction (HTL) project required innovative solutions to numerous complex aspects of the plant design; demanding design conditions of coincident high pressure and high temperatures provided difficult equipment and pipe stress challenges. The Arbios and Licella technical teams provided valuable insight into the design and worked collaboratively with the Zeton engineering and drafting teams to jointly arrive at solutions for all of the presented problems. With project management and coordination across many locations and time zones this was a significant achievement for all team and parties involved."

- John Ones, Zeton's Senior Project Manager

THE SDR PILOT PLANT: A STEP FORWARD IN SUSTAINABLE CHEMICAL TECHNOLOGY



With sustainability and innovation driving industrial progress, we are pleased to support the realization of the SDR (Super-Dry Reforming) pilot plant for the Laboratory for Chemical Technology (LCT) at Ghent University. This groundbreaking project represents an important step towards a circular economy and a more sustainable future.

What is SDR and Why is it Important?

SDR technology focuses on maximizing carbon monoxide (CO) production from (bio)methane (CH₄) and CO₂. Carbon monoxide is an essential raw material for the production of renewable chemicals, contributing to the development of more sustainable industrial processes. This project is supported by the Moonshot Flanders program, which aims to develop groundbreaking technologies to tackle today's and tomorrow's climate challenges.

Technological Advancements and Impact

This advanced pilot plant facilitates the conversion of CO₂ into valuable raw materials, which not only reduces emissions but also bridges the gap towards a carbon-neutral chemical sector.

The Chemical Looping pilot system designed for this project can perform a wide range of gas-solid reactions at elevated pressures and high temperatures. The system consists of several components built into separate modules, all connected via a general process backbone.

One of the key technological innovations in this project are the reactors, which Zeton designed and manufactured itself to withstand extreme conditions of >900 °C and 25 bar(g), with CE marking. The high temperatures required unique materials and sealing solutions to ensure reliable performance. Another key feature is the very fast gas switching system. Zeton's 'first-time-right' approach ensured that challenges and risks were addressed upfront, leading to faster and more effective results.

Collaboration and Success

The realization of this project was only possible through strong collaboration between academic and industrial partners. Key stakeholders include the Laboratory for Chemical Technology (LCT) at Ghent University, Catalisti, Flanders Industry Innovation Moonshot, and Zeton's project team. Thanks to our integrated approach, we have accelerated market readiness without compromising the reliability of both project execution and plant operation.

We look forward to following the further developments and impact of SDR technology and continuing to contribute to groundbreaking sustainable solutions. ■

CDI OPENS NEW LOCKPORT FACILITY

Chemical Design, Inc. (CDI) is proud to announce the successful relocation to our new facility at 115 Oakhurst Street in Lockport, NY. This move marks a major milestone in our continued growth and our commitment to delivering world-class purification and separation systems.

The 16,000 sq. ft. facility consolidates CDI's office and production operations under one roof—streamlining collaboration, boosting efficiency, and expanding our in-house capabilities. With dedicated areas for engineering, quality control, and panel assembly, the new building positions CDI to better serve the evolving needs of our customers in hydrogen purification, natural gas treatment, industrial fluid processing, and more.

The relocation began in early March 2025 and was impressively completed in just three consecutive Saturdays. This efficient transition would not have been possible without the dedication of the entire CDI team. A special thank you goes to Reannin Seefeldt, who played a pivotal role in leading the move and ensuring a smooth transition from start to finish.

As we settle into our new home, CDI looks forward to continued innovation, stronger collaboration, and new opportunities to support clients across the globe. We welcome visitors and partners to stop by and see our expanded capabilities firsthand.

To learn more, visit: chemicaldesign.com ■



IN BRIEF

HIGHLIGHTING RECENT AND COMPLETED PROJECTS AND ENGINEERING STUDIES

- Hastelloy CSTR & pump modules for continuous pharma (flow chemistry)
- Low temperature ContiUnity® reactor module
- A crude oil desalter pilot plant
- A slurry hydroprocessing miniplant
- A recycle polymer conversion pilot plant
- A hydrometallurgy demonstration plant
- A lithium extraction pilot plant
- A 500 BPD hydrogenation demonstration plant



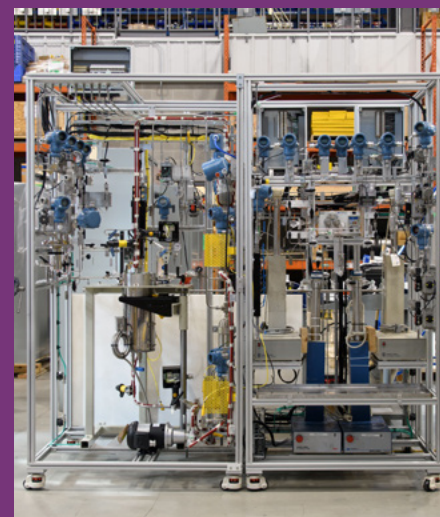
A novel battery materials demonstration plant



A CO₂ to Ethylene pilot plant



A ContiUnity® Mixer Settler



A high pressure polymerization lab unit



CONTACT US

TO DISCUSS YOUR PROJECT REQUIREMENTS,
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