

TECHNOLOGY HORIZONS

A publication by Zetron, the pilot plant specialists

FALL 2020

IN THIS ISSUE

Zetron delivers lithium extraction demo plant to Standard Lithium

GSK's Biopharm Continuous Processing Project offers window into the future of production

Cepsa takes delivery of flexible solvent deasphalting pilot plant

Evonik and Siemens Energy commission Rheticus carbon dioxide-to-chemicals pilot plant

In Brief

AND MORE!



Horizons is also available on our website at zetron.com



ZETON WORKS WITH STANDARD LITHIUM TO COMPLETE A DIRECT LITHIUM EXTRACTION DEMONSTRATION PLANT

Standard Lithium Ltd. (TSX:V SLL) approached Zetron in early 2018 with the goal to fabricate a demonstration plant to showcase an innovative process to extract lithium directly from underground brine. The underground brine, located in Smackover AR, has a rich bromine content. This bromine is currently extracted by three Lanxess operated brine processing plants. In addition to the bromine, the brine in southern Arkansas also contains roughly 200-400 mg/L of lithium, which until now, has been ignored. Standard Lithium partnered with Lanxess to use the otherwise waste tail brine as a means to harvest the dilute lithium.

Traditionally the extraction is completed via large ponds and passive solar evaporation. However the concentration of lithium in the tail brine and the climate in Arkansas are insufficient to make this process viable.

Standard Lithium has developed a proprietary process that uses a solid ceramic adsorbent material that is capable of selectively pulling lithium ions from the tail brine after it has passed through the bromine-extraction step. The proprietary adsorbent materials are used to both load the lithium in the front end of the plant and extract the lithium into a concentrated solution at the tail end of the plant.

The process design was finalized in the fall of 2018 and the contract was awarded shortly afterwards. Through diligent efforts by both Zetron and Standard Lithium, the project was completed and tested in phases during the spring and summer of 2019. The demonstration plant completed installation at site in the fall of 2019, successfully confirming the viability of the novel extraction process and is still in operation at site in Arkansas.

This project showcased the importance of teaming up early in the project, even while the process was still being tested and finalized. This result could not have been achieved without the strong cooperation and flexibility of both Standard Lithium and Zetron in order to deliver their project on time. Congratulations to both project teams on this impressive achievement!

Dr. Andy Robinson, Ph.D., President and COO, Standard Lithium Ltd.: "Zetron has been a flexible, understanding and professional partner to Standard Lithium Ltd, from the very first discussions of project concept, right through to delivery, installation and commissioning of the plant. I would highly recommend Zetron to any proponent wishing to design and build a modern industrial pilot plant." ■

“ZETON’S ENGINEERS CONSISTENTLY PROPOSED UNIQUE AND THOUGHTFUL SOLUTIONS. THE RESULT WAS A CUTTING EDGE FACILITY THAT SUCCESSFULLY INCORPORATED A NUMBER OF NOVEL APPROACHES TO COMPLEX PROBLEMS.”

DR. MEHDI GHODBANE, PH.D., SCIENTIFIC LEADER, GSK

GSK AND ZETON TEAMS ‘REALIZE THE FUTURE’ WITH THE BIOPHARM CONTINUOUS PROCESSING PROJECT

GSK’s Biopharm Continuous Processing Project is an example of an intensified processing approach, demonstrating what next generation production facilities might look like. The system was designed as an R&D system, enabling demonstration of proof of concept, process robustness, and a control strategy for continuous processes. Therefore, the skid was designed to be flexible to provide a testing ground for technologies to inform the direction of future production facilities.

The facility is capable of generating Drug Substance utilizing continuous and integrated operation of the production bioreactor and the vast majority of the purification steps. Unit operations are divided into separate modules with their own local control system. These steps can operate automatically, including the sanitization, start-up, steady state (with PAT facilitated process control), and shutdown steps. The automation was built around customizable parameters (e.g. flow rates, filter sizes, volumes, etc.), thus facilitating the flexibility to execute processes for different molecules across a range of throughputs. The modules also communicate with each other, which

enables the plant to run continuously and respond to process interruptions without operator interaction.

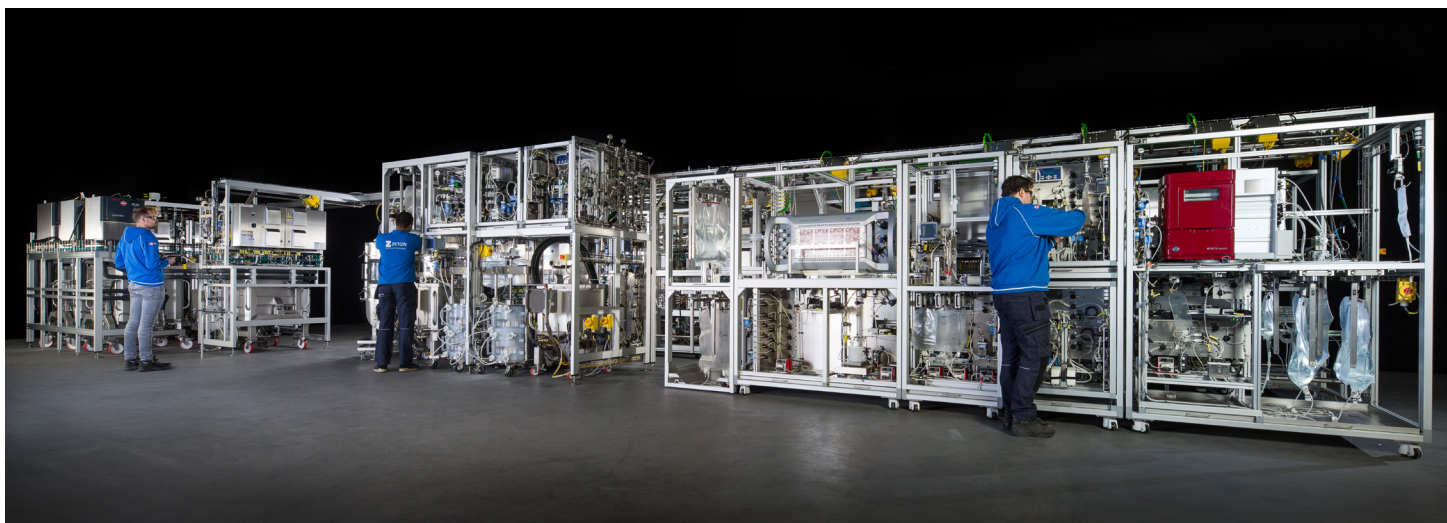
During the project, the joint team of GSK and Zeton Engineers faced a number of technical challenges. As a result of the team’s extensive knowledge of biopharm, and Zeton’s ability as a technology integrator to bring different technologies together in an integrated process facility, we have succeeded in creating a continuous process incorporating off-the-shelf lab equipment and new processing technologies.

Continuous processing has the potential to increase the flexibility and efficiency in Biopharm manufacturing by significantly intensifying the process, requiring smaller equipment and facilities, and reducing risks associated with scale-up. Furthermore, the system was designed with a fully single use flow path which reduces capital equipment cost, significantly reduces the need for equipment cleaning, and enables process flexibility.

The process automation implemented in this project is unique. As one of the Zeton

project members stated: “Zeton is proud that we have been able to successfully implement our customer’s aspirations towards automation and software, and with considerable flexibility. Through considerable effort from the controls teams, GSK’s operating requirements can now be fulfilled at the touch of a button.” The positive attitude and excellent cooperation between the project teams have made this possible, delivering the production facility of the future!

Dr. Mehdi Ghodbane, Ph.D., Scientific Leader, GSK: **“Zeton’s engineers were extremely knowledgeable and eager to tackle challenges they hadn’t encountered in previous projects. They consistently proposed unique and thoughtful solutions, and were always flexible in meeting our user requirements, regardless of the difficulty or complexity. They were a pleasure to work with, and the result was a cutting edge facility that successfully incorporated a number of novel approaches to complex problems.”** ■



CEPSA AND ZETON COLLABORATE TO ACHIEVE MARINE FUEL SULPHUR REDUCTION

Compañía Española de Petróleos SA (Cepsa) and Zeton have recently renewed their 30 plus year relationship by working together on a unique project.

CEPSA has been a leader in the reduction of sulphur content in fuels, in line with international agreements to reduce the maximum content of sulphur in marine fuels from 3.5% to 0.5% from January 1, 2020. This reduction implies a huge change in the operation of all refineries around the world. Despite the technical and research excellence that CEPSA has been demonstrating in these years, it has led the company to investigate new stable low-sulphur marine fuels obtained from processing the heavy waste of the refining processes. To meet the project objectives, non-conventional technologies to economically obtain these fuels and other added-value products, amongst which this deasphalting process, are being investigated and developed from the so-called "bottom of the barrel".

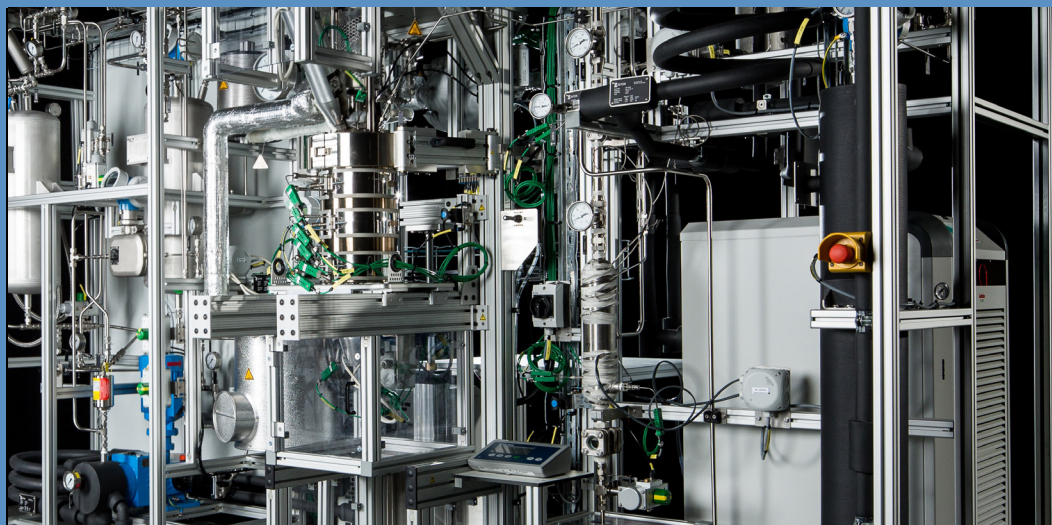
The use of non-conventional technologies in the design, engineering and construction of the project resulted in a semi batch pilot plant which ensures solvent deasphalting with propane, butane and pentane in any mixed composition as the solvent. The reactor can perform liquid and supercritical deasphalting experiments at elevated temperature and pressure (up to 350°C and 70 bar). The configuration of the process makes it possible to recover, sample, and optionally reuse the solvent. The main product

is extracted from the reactor mixture, stripped from the solvent(s) and recovered for analysis, while the residue remains in the reactor and can be removed, hot if needed, for sampling. A flexible automated sequence allows the batch system to run more easily, safely and reliably. Finally, the filling and discharging of hot VGR/ residue is facilitated by custom Zeton solutions.

The excellent cooperation between the CEPSA and Zeton project teams has resulted in an on-time performance and smooth completion of the project, which is currently running on site to the full satisfaction of the customer.

"We are really satisfied with the project management and performance of the unit. It's very easy to use either in manual or automatic mode. High repeatability of results and good reproducibility of the experiments.

"Our sincere thanks to the ZETON project team for their implication in the project, collecting and implementing all our special needs, and for the quick support to any problem arisen during the start-up and subsequent tests." Pilar Cabanillas Estébanez, Researcher - Asphalt/Distillation/ Base oils - REFINING DEPT. ■



SUCCESSFUL START-UP FOR EVONIK'S RHETICUS PILOT PLANT

Evonik and Siemens Energy have recently commissioned the Rheticus pilot plant that converts carbon dioxide into chemicals. Sponsored by the German Federal Ministry of Education and Research (BMBF), the project uses renewable energy to produce valuable chemicals from CO₂ and water through electrolysis with the help of bacteria. This type of artificial photosynthesis can serve as an energy store and thus help to close the carbon cycle and reduce carbon dioxide pollution in the atmosphere. Siemens and Evonik are each contributing with their core competencies - electrolysis and biotechnology - to this artificial photosynthesis process.

For Zeton, involvement in Evonik's part of the project (biotechnology) provided an opportunity to share our knowledge in Carbon Capture and Utilisation (CCU), together with our scale-specific solutions know-how and expertise at the pilot plant scale. The proximity of both parties, both literally and figuratively - Zeton B.V. is located in the border area with Germany - made it possible to work together in an efficient and effective way, with short lines of communication. ■



The pilot plant has started up in Marl, Germany, the largest Evonik site.

IN BRIEF

HIGHLIGHTING RECENT AND COMPLETED PROJECTS AND ENGINEERING STUDIES

- A biomass fast pyrolysis plant for Green Fuel Nordic in Finland
- Three novel natural gas processing pilot plants for the specialty chemicals industry
- An inline oil blending unit
- A reactor system for an agriscience industry application
- A high temperature fluidized bed reactor pilot plant for a chemical industry application
- A novel automated decontamination system for the specialty chemicals industry
- An engineering study for a chemical abatement skid
- An engineering study for a continuous distillation pilot plant



A continuous pilot plant for a confidential application



An ebullated bed reactor pilot plant for heavy oil upgrading



A fully-automated monomer purification system



A continuous pilot plant for the pharmaceutical industry

NEW WHITE PAPER NOW AVAILABLE

SMALL IS BEAUTIFUL: CONCEPTS OF SCALE-UP IN PROCESS TECHNOLOGY

Co-authored by Paul Martin and Robert-Jan Zwiers, this new white paper explores the roles that lab scale systems, pilot plants and a sub-category of pilot plants called "the pilot plant test stand" - *an open architecture process development platform* - play in a successful research and development program. Please contact us if you'd like a copy, or visit the [Downloads & Links](#) section of our website www.zeton.com.



CONTACT US

TO DISCUSS YOUR PROJECT REQUIREMENTS,
OR ITEMS IN THIS ISSUE OF HORIZONS, PLEASE CONTACT:

ZETON INC.

740 Oval Court
Burlington, Ontario
Canada L7L 6A9

Phone: +1 905 632 3123
E-mail: info@zeton.com

David Edwards
Adam Whalley

455 Michigan Drive
Oakville, Ontario
Canada L6L 0G4

Catalina Bayona Velez
Pratik Bhishikar

ZETON B.V.

Marssteden 206
7547 TD Enschede
The Netherlands

Phone: +31 (0)53 428 4100
E-mail: info@zeton.nl

Herman Bottenberg
Robert-Jan Zwiers

Marssteden 210
7547 TD Enschede
The Netherlands

Thomas Ladrak

Visit us online at www.zeton.com