Chemrec Uses Honeywell UniSim® to Improve Processes at Biofuels Plant

“We were not able to do this kind of simulation in-house before implementing UniSim simulation technology since we lacked efficient tools. Honeywell’s UniSim Design solution and its dedicated team have now made us more efficient and knowledgeable and helped position us as a technology supplier – we are helping turn pulp & paper mills into biorefineries.”

Erik Furusjö, Process Design Engineer, Chemrec

Benefits
Offering one of the most unique gasification technologies that can help turn pulp & paper mills into biorefineries, Chemrec provides technology for black liquor gasification, which when integrated into pulp mills, provides the opportunity to produce large quantities of renewable motor fuels or electricity from biomass.

The patented Chemrec process is based on high temperature entrained flow gasification of black liquor, producing high quality syngas, a gas mixture that contains mainly hydrogen and carbon monoxide – which is the feedstock for a number of biofuels. Chemrec wanted to capitalize on its patented process and needed a technology in-house to help test and simulate its processes in order to move beyond pilot scale operation, and engineer a full-scale commercial plant. Up until now, solutions used were inefficient and didn’t cover all aspects of the entire process.

Chemrec turned to Honeywell and its UniSim® Design, an intuitive and interactive process modelling solution that enables engineers to create steady-state and dynamic models for plant design, performance monitoring, troubleshooting and operational improvement. With UniSim, Chemrec was able to design and simulate processes as needed.

In addition, UniSim is also used to help evaluate the alternative use of syngas and try out different process configurations and products. Because of the integration of OLI Electrolytes, Chemrec can also use UniSim to simulate properties of concentrated electrolyte solutions, which are very important for pulp mill integration.

With the help of Honeywell’s UniSim solution, Chemrec has primed its company for the future in biofuels and looks to supply their technologies to other plants. Additional benefits include:

- Simulates the quenching and cooling of syngas to discover the effects of how fast and efficiently it can cool – pinpointing the optimization of the quality of the green liquor
- Simulations calculate steam production from gas cooling and predict thermodynamic properties of the gas
- Integration between existing gasification process simulation model to UniSim gas cooler now a reality
- Simulation can predict what the quality of the raw gas will be and influence design of downstream units
- Provides design criteria and data for mechanical equipment such as pipes, heat exchangers, pumps and filters
- Simulates process performance for a specific pulp mill in a much shorter time and at less cost
- Know-how and process design for improved plant performance and production capacity is easily retained in-house, with engineers and staff more efficient
- Built a future-proof concept for plant design even though pre-existing conditions will vary
- Design data from UniSim Design is used for rebuilding parts of the existing pilot plant
Chemrec Uses Honeywell UniSim at its Biofuels plant to Improve Processes

Background
Chemrec is a Swedish company providing technology for black liquor gasification, which is integrated into pulp mills and provides the opportunity to produce large quantities of renewable motor fuels or electricity from biomass. Chemrec is helping pulp & paper mills transform into biorefineries with a unique, proprietary black liquor gasification technology.

With headquarters in Stockholm, Sweden, and a development plant located in Pitea, Sweden, Chemrec has some 20 years of experience in the field of black liquor gasification technology. During these years, the company has developed iterations of the technology in demonstration plants and a commercial plant in New Bern, North Carolina USA. The second generation, high-pressure oxygen-blown technology has now matured into a proven concept, which is offered on commercial terms to mills looking to expand their operations and enter the new pulp mill paradigm – the biorefinery.

Challenge
With a unique proof-of-concept, Chemrec was looking for a way to test, design, monitor and review its processes for its patented gasification technology. Based on the ability to use black liquor, a by-product at pulp mills, Chemrec’s gasification technology would enable mills to be able to produce large quantities of renewable motor fuels or electricity from the biomass at their plants.

“Our in-house process modelling tools were not efficient enough to cover all aspects of the process and provide us with a detailed picture for an entire commercial plant,” said Erik Furusjö, process design engineer, Chemrec. “We needed to work with someone who had a proven simulation solution and could meet all our needs to help improve our current processes, and also help plan for our future growth and development in this innovative field.”

Solution
Chemrec compared various software solutions and performed a thorough evaluation. After using a test license for a few months, the company was convinced of the benefits of Honeywell UniSim Design and installed it to help with engineering a new plant in Domsjö, Sweden, and process development of the pilot plant in Pitea, Sweden – home of the world’s first BioDME plant.

Honeywell’s UniSim process modeling enables engineers to create both steady state and dynamic models for plant design, and performance monitoring and testing. It provides users with best-in-class technologies and comprehensive features, along with Honeywell’s domain expertise in process simulation and operator training. UniSim Design enables steady-state simulation of chemical and other processes and empowers the user to make decisions by getting immediate responses to assumptions using a high-speed engine with backward calculation capabilities. In addition, UniSim’s dynamic simulation capabilities enable steady-state models to extend to transient models, allowing consistent thermodynamics and model configurations to be used for process transient analysis, controllability studies and operator training applications.

By using its patented gasification technology, Chemrec is able to turn black liquor produced at its pulp mill into a high quality syngas. Syngas, a gas mixture that contains mainly hydrogen and carbon monoxide, can be processed into a variety of fuels and chemicals. The syngas produced in the Chemrec process is the feedstock for the synthesis of a number of potential biofuels – e.g., Dimethyl Ether (DME) and methanol – two outstanding biofuels that meet criteria for product cost, environmental performance and process maturity.

Together with Volvo Trucks and a number of other companies, Chemrec is involved in the BioDME project (www.biodme.eu), which is a project developing and demonstrating the entire chain from renewable forestry biomass to the use of BioDME in heavy trucks.

“We have built a new DME plant next to the gasification pilot in Pitea. It will transform syngas from the gasifier into
BioDME and includes gas cleaning, gas conditioning and fuel synthesis,” continued Furusjö. “The Chemrec plant produces more than four tons of BioDME per day, which is used in Volvo fleet tests planned through 2012.

“UniSim Design is one of the tools we used to design the full-scale commercial plant and it can also be used to conceptually evaluate alternative uses of syngas,” said Furusjö. “By trying out different process configurations, processes and products, Chemrec is now better able to answer questions such as ‘What can we use the syngas for?’ and ‘What is technically and economically feasible?’ Chemrec takes this all into consideration and is able to adapt the design of the gasification unit to the feedstock liquor and the intended product.”

UniSim can handle simulation of concentrated electrolyte solutions at high pressure and temperature, thanks to the OLI Electrolyte integration. “With one solution we can simulate both the petrochemical part of our plants and the pulp & paper part as well. The gasification unit is positioned at the interface between two industries with very different demands,” commented Furusjö. “By using Honeywell’s solution in combination with our in-house gasification simulation tools, we are able to simulate experiments, for example, to see how varying quality in black liquor feedstock can lead to different properties of raw gas, and most importantly, to understand why it happens. Honeywell’s team was very easy to work with and provided us with the expertise and knowledge we needed to make this unique technology a reality.”

For More Information
Learn more about Honeywell’s UniSim® Design visit our website www.honeywellprocess.com or contact your Honeywell account manager.

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