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Chemical Processing



# Monitoring System Trims Drying Operation Costs

Eastman Chemical Co. applied a vacuum monitoring system, originally designed for power industry steam turbines, to a chemical drying operation. This crossover application reduced overall contract operating costs by as much as $2 million through system optimization.

## Examining the process

Eastman Chemical Co. manufactures specialty chemicals at its plant located near Batesville, Ark. One of its primary product lines involves a water-wet polymer that, when fully processed, contains less than 1 percent volatile material.

In 1996, Eastman retrofitted a single dryer that was rated to handle 82 percent of the contracted polymer volume. Pilot work at the dryer manufacturer resulted in this rating, but the dryer proved incapable of delivering those volumes once production started at the Eastman plant.

"When we started production, the dryer didn't come close to the rates that it was designed for," recalls Gary D. Griffith, a senior chemical engineer for Eastman. "During production runs, our process is up 24 hours a day, nonstop."

## The production dilemma

Because the main dryer was not operating to spec, Eastman needed to run three extra dryers to meet its production targets. This greatly increased operating costs.

"We tried a number of things to fix the situation with the main dryer, but we only saw minor improvements," says Griffith. "For a while, we were sending an operator out every hour — when we thought the product was dry — to check the pressure inside the dryer with a hand-held pressure meter. The pressure findings were related to how dry the polymer was. In other words, this equated to a best-guess method.

"A lot of failed samples occurred, so extra sampling, hence operator usage, was required," continues Griffith. "It was really inconsistent. They saw some minor improvement with this time-consuming sampling, but no breakthrough."

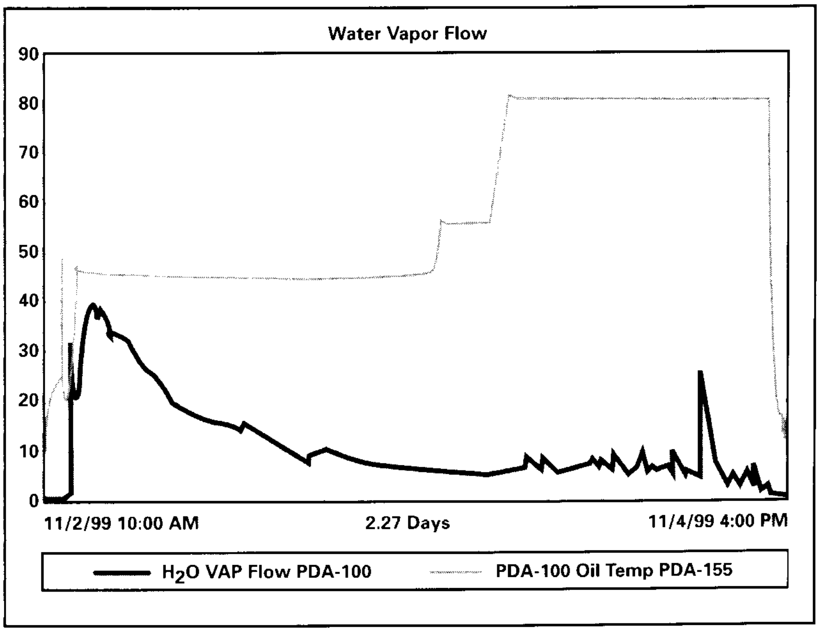
## A search for solutions

Frustrated with the inefficiency of the existing setup, Eastman assigned an engineer to improve the process. The engineer made several calls and conducted several Web searches to find a product capable of sensing water vapor flow.

"After finally coming across and investigating a monitoring system from INTEK, the engineer recommended that we check into the company," says Griffith. "We started looking at their RheoVac instrument in the summer of 1997. Even though it had never been used in our particular industry before, we decided to try it out."

Based in Westerville, Ohio, INTEK Inc. originally developed the RheoVac instrument to measure air in-leakage into power plant steam turbine condensers. The instrument uses a patented technology to make four primary measurements in the vacuum line. From these measurements, outputs are obtained for 10 parameters, including total mass flow, water vapor flow and air (or other noncondensable) flow.

In early 1998, Eastman installed the RheoVac probe on the downstream side of the vacuum block valve for the main dryer vacuum line. By monitoring the flow of air and water vapor under vacuum pressure, Eastman's engineers hoped to obtain a continuous stream of data to evaluate the performance of their dryer system equipment.




**The process information chart shows the water vapor flow rate (according to the RheoVac instrument) prior to discovering the key to the dryer's limitation.**

"Right away the monitor provided a lot more information than we originally had about what was happening," says Griffith, "but immediate improvements were still elusive."

## Turning data into results

After carefully analyzing the information from the RheoVac device, Griffith began to assemble a clearer picture of what was taking place within the dryer.

"Prior to discovering the answer to our dryer's limitation, it occasionally took over 54 hours to fully dry a batch of polymer," notes Griffith. "By carefully



studying the graphed data of the water vapor flow rate from the RheoVac monitor, I noticed a spike just prior to the end of each batch. This is what originally tipped me off that there must be some physical process taking place that blocked the water vapor from exiting the dryer, thus slowing the drying process."

After further investigation, Griffith determined that shocking the filters with a pulse of nitrogen could vastly improve flow rate and drying time. Management backed up the request to test his hypothesis.

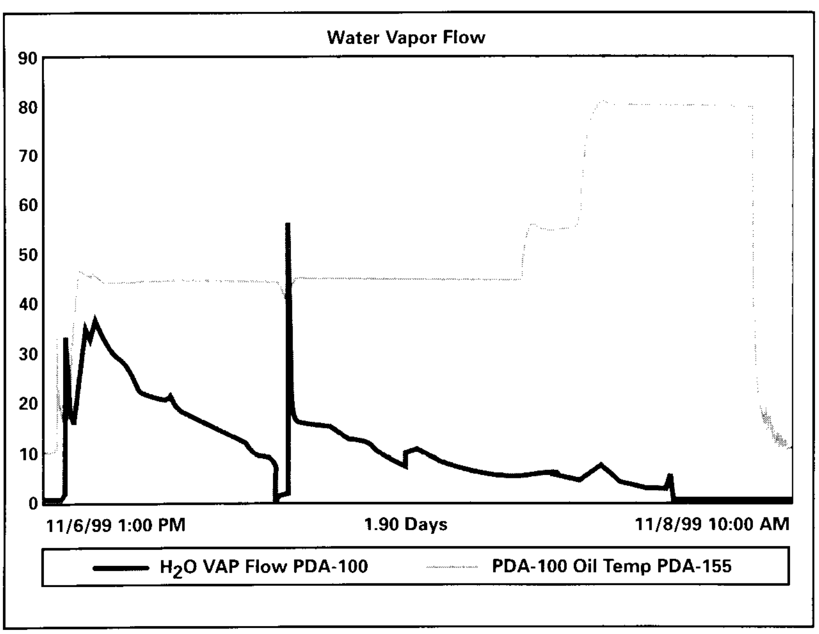
"The water vapor flow spiked from just 10 pounds per hour [lb/hr.] to about 55 lb/hr., and the drying cycle shortened the first time that pulsing of the dryer filter was tried," says Griffith. "After the pulse took place, the water vapor flow rate was maintained at a higher level than before the pulse. It was at this point that we realized exactly what was physically happening inside the dryer. The material was accumulating on the vacuum inlet filters, plugging them. The pressure spike was responsible for clearing them. The RheoVac instrument allowed us to see this phenomenon."

Griffith further discovered the RheoVac sensor could help determine that the time between pulses could be increased as the polymer became drier.

"During the low-temperature [45°C] drying, the pulses are now more frequent than during the high-temperature drying [up to 80°C]," points out Griffith. "The reason for this is that we soon learned that the material is less prone to cling to the vacuum inlet sock as it becomes drier, and therefore needs to be cleaned less often."

"Eastman continues to operate its drying system on a control loop, based on the output from the vacuum flow meter."

The monitor also helps determine when samples should be taken. A distributed control system triggers the sampling process at the end of both the low-temperature and high-temperature drying segments based on the RheoVac's readings.




**The RheoVac instrument allows operators to see what is happening physically inside the dryer.**

## Achieving increased throughput

"When we first installed the RheoVac instrument, it was used for monitoring purposes primarily," says Griffith. "But once we obtained these results, we decided to integrate the instrument into a control loop to automatically determine when the dryer sampling should occur.

"We have found by experimentation that when the instrument's water vapor flow reading drops below 21 lb/hr., the material water content is below the required 3 percent level necessary for continuation to the high-temperature stage," continues Griffith. "This is very consistent and has reduced the number of re-samples tremendously from our previous method. The same is also true for the end of the high-temperature drying stage. Thanks to the RheoVac monitoring system, we currently have average drying time down to a mere 24 hours."

Eastman continues to operate its drying system on a control loop, based on the output from the vacuum flow meter.

"Based on the new parameters allowed by the RheoVac instrument, our main dryer throughput has increased dramatically," says Griffith. "On an annualized basis, dryer capability has increased 81 percent over the original ceiling we ran up against prior to this breakthrough."

"Before these changes, we were drying this material in other buildings because we couldn't keep up," Griffith says. "But once we had the RheoVac in our production control loop, drying time in the main dryer dropped from an average of 38 hours to just 24. So now we are capable of drying all of the material in the main dryer.

"With these improvements, plus the decrease in labor to keep sampling under the old system and the reduced analytical cost, we estimate the savings at about $2 million over the contract cycle," Griffith adds. "This improvement caught the notice of several people in our organization."