

Turbo blower replaces surface aerator in industrial waste water treatment plant

Biologically and energetically more efficient

The biologically biodegradable waste water from the Leverkusen Chempark and the households of the lower drainage basin for the Wupperverband (Wupper association) is cleaned by Currenta in a community waste water treatment plant. The aeration of the open basin has been carried out since 2007 by centrifugal compressors from Atlas Copco, which replaced the classic surface aerators.

“Our basin biology in the Leverkusen community waste water treatment plant needed an overhaul from the ground up, after 40 years of operation,” Norbert Meier-Külschbach explained. He is a waste water department engineer at Currenta, and is responsible for the engineering of three waste water treatment plants in Leverkusen, Dormagen, and Uerdingen, Germany. The disposal of biological biodegradable waters, originating from households as well as from chemical processes, is an important task for Currenta. “Our plant cannot be compared with either classic industrial waste water treatment plants or typical community waste water treatment plants,” Meier-Külschbach said. This makes it difficult to compare the biological purification potential or energy consumption with other plants.

In Leverkusen there are four closed clarifying towers as well as two open clarifier basins. The basins were 3 m deep and were aerated with large agitators, which was state of the art in the seventies, Meier-Külschbach emphasized. As it became necessary in 2007 to service the existing installation, Currenta used the opportunity to invest in two new cascade basins, which are 8 m deep. This reduces the space required and increases the pressure on the bottom of the basin at the same time, so aeration of the basin from below can dissolve the air in the water better. This was already used 25 years ago in tower



Fig. 1: Model of the Currenta waste water treatment plant in Leverkusen

biology designed for chemical waste water, utilizing a nozzle system patented by Bayer. At that time, the exhaust gases from the chemical waste water purification had to be collected in a closed system and burned at a central location.

Speed-controlled Low-pressure Compressors Operate Around the Clock

Currenta decided to use the innovative low pressure centrifugal compressors from Atlas Copco for the new cascades. Due to oxygen requirements, four ZB machines were installed, of which two or three will operate around the clock, depending on the degree of contamination of the waste water, and the fourth one serves as a contingency reserve. “We are running 365 days a year in 24-hour operation,” Meier-Külschbach emphasized, “and bacteria can only maintain their activity for a few hours without oxygen. Its availability is extremely important.” Con-



Fig. 2: Four of the innovative ZB low-pressure centrifugal compressors from Atlas Copco ensure the oxygen requirements of the new cascade basins in the Currenta waste water treatment plant in Leverkusen. Depending on the degree of contamination of the waste water, two or three run around the clock; the fourth serves as contingency reserve. Centrifugal compressors are single-stage, speed-controlled type ZB 160 VSD machines. The motors have a contactless electromagnetic bearing system, so they operate wear-free.



Fig. 3: Two employees of the waste water treatment plant at the “first water travel” of the new cascade biology in the waste management center of the Chempark in Leverkusen.

sequently, Currenta signed a maintenance agreement for five years with Atlas Copco and installed the remote maintenance system Air-Connect. Any malfunctions in the installation are reported to the central office at Atlas Copco immediately. They can access the control system externally or send a technician to the installation if needed.

Higher Level Control Optimizes Energy Consumption

The turbo compressors are single-stage, speed-controlled type ZB 160 VSD machines, which are controlled for energy optimization using the ES 130T higher level control unit. This separate control unit can also be retrofitted for existing installations. The motors have a contactless electromagnetic bearing system, which ensures “free from wear”, according to a statement by Thorsten Poggenmüller, product manager for low pressure systems at Atlas Copco Compressors & Compressed Air Technology GmbH in Essen. “The impeller is also mounted on the motor shaft itself,” Poggenmüller emphasized, “which omits the gear completely, allowing for outstanding efficiency.” Additionally, this drive design does not require any extra lubricant, so that oil cannot get into the blower. Compared with conventional rotary lobe blowers, this new type of drive achieves a possible energy saving of 30 to 40 percent, which may even be significantly higher in individual cases

According to a statement from Meier-Külschbach, Currenta also needs turbine technology because normal rotary lobe blowers can only provide 1 bar of overpressure. In the waste water treatment plant, the water depth and the special membrane pipe system on the bottom of the basin require a significantly higher pressure. “The compact design of the machines was also important to us, especially considering the construction situation in Uerdingen where we wanted to use new compressors,” Norbert Meier-Külschbach said, “and we wanted one supplier to provide the equipment for both locations.”

The first construction step for the new cascade biology was commissioned in November 2007. An energy analysis has yet to be performed: “We want to record the current power con-



Fig. 5: “We are running 365 days a year in 24-hour operation,” Norbert Meier-Külschbach emphasized, “and bacteria can only maintain their activity or a few hours without oxygen. The availability of the compressors is extremely important.”

sumption as soon as possible to have an assessment of the situation”, the waste water department engineer said. The air is blown into the bottom of the basin using silicone membrane pipes and Meier-Külschbach suspects that the aeration equipment will clog over the years. This is something that other waste water treatment plant operators have already experienced. This would mean that the blowers would need to work against a higher resistance, and the power requirement would increase. Fortunately, this is not necessarily the case.

Connectivity With the Process Guidance System Would Be the Icing On the Cake

The goal to optimally network the compressors with the process guidance system used at Currenta. This would come very close to the objective of having a constant oxygen content in the basin. Although it is constantly measured, the air quantity currently blown into the basin is varied using a control valve. “The ZB compressors adjust with a time delay,” Meier-Külschbach said. As soon as the signal from the oxygen measuring system is routed to the PLC and can be accessed directly from the compressor control unit, the adjustment to Leverkusen local conditions will be “perfect for the moment”.

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Fig. 4: The four speed-controlled (“VSD”) centrifugal compressors are controlled using the ES 130T higher level control unit, optimized for energy. This separate control unit can also be retrofitted for existing installations.