Energy Recovery From Brewery Wastewater

Rothaus Brewery was founded in 1791 by the Benedictine monastery of St. Blasien in the Black Forest, Germany. Currently, the brewery is aiming to achieve net zero operations by 2030, a highly ambitious goal, undergoing a series of steps to achieve it. It became clear that installing an anaerobic reactor at their water resource recovery facility (WRRF) was a key step toward achieving their goal, installing solar panels for electricity generation and reusing bottles up to 40 times.

AQANA came on board to support Rothaus and immediately faced a major challenge: the anaerobic system had to operate at extremely low temperatures because the effluent discharges to an ecologically sensitive area. Rothaus prioritized maximizing the reuse of existing infrastructure to reduce both the visual and carbon footprints. AQANA's Downflow Anaerobic Carrier System (DACS®) technology, whose biomass retention does not depend on sludge granulation, proved stable and resilient at low temperatures, offering greater operational stability than traditional granular-sludge anaerobic systems.

- **REDUCE**
- **RECOVER**

- **GRAFENHAUSEN, GERMANY**
- **WASTEWATER**
- **INDUSTRIAL**

wef | CASE STUDY

CHALLENGES FACED

AQANA's engineering team needed to find a way to convert a concrete tank within an existing operational WWTF into a high-rate, gas-tight anaerobic reactor able to withstand extremely heavy snowfall and freezing temperatures during wintertime. The project faced additional challenges because of harsh winter conditions, which complicated construction and equipment movement within a confined brownfield site. Despite adequate pretreatment (screening and sand/grit traps), the proposed wide-gap heat exchanger kept clogging.

TECHNOLOGIES & SOLUTIONS USED

The project converted an existing sequencing batch reactor concrete tank into an innovative DACS®– high-density polyethylene (HDPE) lining, slight wall raise, new internals, and a gas-tight HDPE cover for safe biogas capture, all protected by an aluminum roof. Wastewater is fed just beneath the roof via nonclogging nozzles and flows downward through the carrier layer to a bottom effluent outlet, while produced biogas moves countercurrent toward the roof, keeping the biomass filled carrier bed in constant movement.

IMPACT & INSIGHTS

While external heating needed to be installed, the DACS® System still achieved an average chemical oxygen demand (COD) removal rate of 77% during winter, demonstrating operational stability, and the ability to run effectively at below-design temperatures. To maintain effluent quality under varying thermal conditions, the COD load was proportionally reduced by approximately 5% for each degree Celsius (33.8 °F) decrease in reactor temperature. This adaptive COD loading strategy has enabled Rothaus Brewery to successfully operate the system within a temperature range of 17 to 27 °C (62.6 to 80.6 °F) without compromising treatment efficiency.

LESSONS LEARNED

Being able to control effluent temperature is essential in anaerobic wastewater treatment–for example, pairing heat recovery (influent–effluent exchanger) with a heat pump to offset losses in wintertime. Heat exchangers are vulnerable to fouling, even at design velocities. Higher-than-assumed influent solids can cause progressive clogging. Always verify actual total suspended solids and solids characteristics against design assumptions and select exchanger types compatible with these solids loads. The DACS® anaerobic moving bed bioreactor does not present any loss of biomass, nor treatment efficiency, within a wide range of lower temperatures.

> **"Rothaus Brewery is located in an area where nature is highly valued and minimal human disruption is strongly appreciated by the community. Aqana's custom-made design blended into its surroundings without significantly altering the existing landscape."**

Water Environment Federation®

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