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Let's Solve Water

Application note

pH and O2 sensors ensure water quality in rainbow trout aquaculture

The aquaculture company FREA A / S breeds 25 million rainbow trout a year in two large halls of 4,000 square meters each on a field in Central Jutland (Denmark) far from lakes or large streams. The fish are distributed according to size in a total of 86 open tanks. FREA applies an innovative breeding concept guided by the basic idea of ensuring that the circular economy is implemented one hundred percent in the process. This takes recycling in fish farming to the next technical and ecological level. The mindset here is to implement 100 % recycling throughout the process.

In a recycled plant of this type there is no direct discharge to the aquatic environment. Prevalent particles are removed from the water using biofilters and are being fermented for later use as fertilizer or fuel in biogas plants. The runoff water is channeled into large infiltration basins and later reused for production. FREA fisheries manager Egon Folmer reports:

More than 3,000 cubic meters fresh water per day

We extract clean water for production from our own wells and drainages in the surrounding areas where it also infiltrates after use. The consumed water of the plant is composed of the rinse water used for backwashing the biofilters and the evaporation water from the open breeding tanks. The resulting demand for fresh water is in the order of forty to eighty liters per second and consists exclusively of groundwater.

The extracted groundwater is filtered, purified and oxygenated before being used in the process. Using pH and oxygen sensors from the Xylem brand WTW ensures that the water is always optimal for the fish. The brand WTW is represented in Denmark by Gustaf Fagerberg A / S, which was also responsible for the installation of the numerous sensors.

The production in our plant is based on the purchase of fish roe, whereby the focus is on registered suppliers. They produced fish for sale as fry and juveniles for customers in many countries of Europe and as consumer fish for primarily Danish processing companies.

The plant is divided into hatcheries, facilities for juvenile fish and for portion fish. Within the individual plants there is an additional sectioning, which overall creates a significant reduction in risk for extensive disease outbreaks and the spread of infection. During the process, fish are sorted by size and vaccinated against rubella, which is fatal to the fish.

Our production is ASC certified by Bureau Veritas, which is a requirement from the buyers in the retail chains.

WTW
a xylem brand

Of the 25 million fish produced annually, weighing more than 2,000 tons in total, about 7 million fish are ready for processing - primarily for two Danish smokehouses - and about 18 million are juveniles for further breeding.

900g feed yield 1000g fish

The fish's feed mainly consists of protein and fat, and it is very important that as much as possible of the feed turns into fish. We have achieved in our plant, that approximately 900 grams of feed is converted to 1,000 grams of fish.

The part of the feed, which does not turn into growth but into feces in the form of nitrogen is about 35 grams per kilogram growth. This nitrogen input makes it necessary to purify the process water. The removal of nitrogen from the water is accomplished in biological nitrogen filters. Subsequently pure oxygen from an oxygen tank is added.

Sensor technology in the past and today

In our plant, we previously had no pH sensors and only a few old-fashioned analog oxygen sensors that required intensive maintenance. We also had no individual control of oxygen levels in the tanks. The pH of the water was controlled by manual measurements with pH sensors and regulated by the addition of sodium hydroxide solution.

Therefore, we had the desire to install both oxygen sensors as well as more modern pH sensors that could give us a comprehensive overview of the process parameters in a SCADA system.

For our current system, Fagerberg has supplied twelve digital pH sensors of the type SensoLyt® 700 IQ, which are remarkably resistant to fouling. In addition one calibration- free oxygen sensors of the type FDO® 700 IQ was installed in each 86 basins. This can be used to regulate the addition of oxygen individually via the PLC control system.

All measuring points are divided among five IQ Sensor Net systems. For all IQ systems and sensors there is a remote connection via browser as well as a full overview of all process values in our SCADA system. The IQ Sensor Net system can be easily connected to the PLC via Ethernet IP, Profinet, Modbus TCP, Modbus RTU or Profibus DP.

The WTW instruments have fully met our expectations: They are very user-friendly, and installation was just "Plug - & - Play".

FREA fishing master Egon Folmer shows one of the special rotating brackets, on which a digital pH sensor SensoLyt® 700 IQ and the optical, calibration-free FDO® 700 IQ oxygen are mounted.

Fagerberg sales engineer Martin Kimmer Lemvig (left) and Egon Folmer in front of the troughs, where some 1.5 million trout eggs hatch every 14 days.

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