MORE THAN ENOUGH

Norwegian meat processor surpasses requirements with new technology

By Jill Bibby

Nordfjord Inc. of Stryn, Norway, has seen considerable growth as a meat processor and food manufacturer. Recently, the company has taken new steps toward implementing environmentally responsible wastewater treatment processes, far surpassing legislative demands.

A Complex Mixture

Nordfjord's wastewater is a complex mixture that contains blood; excrement; cleaning and flushing water from equipment, curing and smoking; and water from the hygiene systems and daily cleaning of the production line. The effluent from the factory contains dissolved organic components such as protein and fat, wholly or partly dissolved in hot water, often with chemical cleaners. The quantities can vary greatly. On an hourly basis, daily volumes average about 600 to 700 cu meters. The organic load in the effluent is equivalent to the sewage from 30,000 to 35,000 people. It has always been a prerequisite to conduct primary treatment before sending this type of water to the municipal treatment plant, but Nordfjord has implemented more extensive treatment.

Ottar Vinsrygg in front of Bioreactor 1 at the Nordfjord plant

A Logical Process

The treatment process is based on logical steps. While the effluent is still at room temperature, it enters a sump pump, from which an even flow is sent to a Salsnes filter. This is an endless 110-µ wire-cloth filter that removes particles, fur, meat fragments, sawdust and fat lumps that form while cooling. The clean solids from the filter are dewatered and sent to a container, which goes directly to municipal treatment.

The remaining effluent then flows to a large basin where the water cools and rests. Here, the fat rises to the surface and is scraped off. The sediments also are scraped out from the bottom and join the sludge that emerges from final filtering post bioreactors.

After the sediment basin, the wastewater enters a buffering basin of 65 cu meters. From here, an even flow is pumped to the two-step bioreactors. There are two identical and parallel lines with a total volume of 100 cu meters.

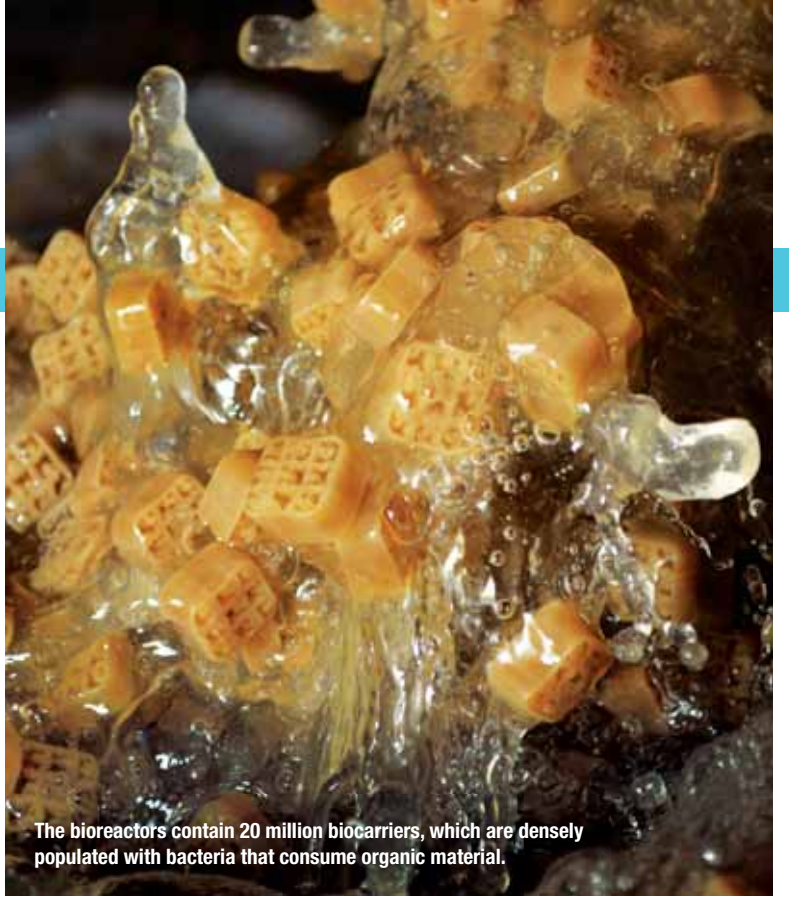
The bioreactors contain 20 million plastic biocarriers with a total volume of 55 cu meters. The biocarriers were developed by Biowater and are unique in shape. With a specific sheltered surface of 650 sq meters per cubic meter, they are densely populated by bacteria that consume organic material.

"The biocarriers are continuously suspended in the basin by a set of air diffusers, giving a vigorous and oxygen-rich environment, all supplied by a solid compressor," said Ottar Vinsrygg, technical manager for Nordfjord.

The addition of oxygen ensures a 100% aerobic environment to bring the organic load to complete decomposition. Oxygen sensors in the bioreactors monitor the condition and adjust the amount of air being fed into the bioreactors accordingly. Surplus oxygen is crucial for bioreaction.

Adding Wood Fiber

As the effluent leaves the bioreactors, all of the dissolved organic matter has been consumed and transformed into CO_2 and biological sludge. This biologically treated effluent enters a small mixing chamber where



The bioreactors contain 20 million biocarriers, which are densely populated with bacteria that consume organic material.

a tiny dose of metal salt is added for the flocculation process, resulting in larger particles. After traveling in a 200-meter flocculator tube, the effluent comes to the final separation, where particles are filtered out in Salsnes filter No. 2, which has a mesh size of 110 µ. The solids caught in this filter join the bottom sludge from the cooling basin, which also ends up there for subsequent dewatering before it is collected in a container where it holds a dry matter content of 15% to 20%. To enhance the separation, sawdust is added regularly in the outlet of the Salsnes filter, bringing more body to the sludge and ensuring a high dry-matter content of the final solids. From the effluent pipe, a continuous sample stream is taken for COD analysis. The sampled water is kept fresh in a refrigerator.

No Particles

The result of this process is an effluent with low biochemical oxygen demand completely void of particles, as required by the municipalities.

"A simple test of performance is to pour a sample of the effluent through a coffee filter," Vinsrygg said. "There are no particles to be seen."

The effluent then goes to municipal treatment.

"There is, strictly speaking, no need for us to take out the dissolved organic material, as only particle removal is demanded; however it is a good practice to treat any effluent immediately," Vinsrygg said. "We like to be proactive rather than reactive, not to mention that we are situated close to a beautiful fjord and the Jostedalsbreen glacier. These sites are of national value and world heritage status."

Simple Waste Delivery

Three types of solid waste emerge from the treatment process. These are the solids from Salsnes filter No. 1, the fat scraped from the flotation, and the sludge from final separation at Salsnes filter No. 2. All three types of solid waste can be delivered to municipal treatment with no extra treatment required.

"The waste is regarded as fully organic and is free of polymers, so it can be treated without any precautions," Vinsrygg said. "The organic load of our effluent entering the municipality has been reduced by 90%, so it can be regarded as equivalent to the sewage from less than 3,500 people. In this way, we hope to make things a lot easier for the municipalities."

Samples from different stages in the process, as well as after treatment, are extracted on a weekly basis and all analysis is carried out externally.

"We are very happy with the results, as they are both stable and well below the limits," said laboratory officer Randi Støyva, who is responsible for monitoring the process. The bioreactors are self-regulating in regard to organic load and well dimensioned.

"The system is extremely compact. The bioreactors occupy an area of only 100 sq meters. [They] are 25% more effective than traditional biocarriers in use in Norway," said Jon Siljudalen of Biowater, who designed the plant.

"We actually pay it little attention as it labors through the days. We focus on making high-quality meat products," Vinsrygg said.

In summary, the benefits of this system include:

- The ability to use existing tanks;
- Consistent under load variations;
- Easy operation with little or no maintenance;
- Potential for future expansion simply by adding more carriers; and
- Energy-efficient operation; and
- Low capital cost. iWWD

Jill Bibby is global marketing manager for Biowater Technology. Bibby can be reached at jill@biowatertechnology.com or 401.305.3622.