



FOCUS: State-of-the-art wastewater treatment for Sugar Factory Osijek in Croatia

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Individual solutions for industrial water treatment

With over eighty years of experience in industrial process water and wastewater treatment, H+E has established itself as one of the leading companies for holistic water management.

Our individual approach in the wide range of industries we serve worldwide allows us to develop highly customised and economically advantageous solutions that are specifically designed to meet your needs.

Benefits for our beet sugar clients

- We recover more than 90% of the COD (organic contamination) in wastewater as valuable biogas
- Our anaerobic/aerobic treatment complies with the strictest effluent limits
- Our compact plants need 10 times less space than aerobic ponds
- We have installed more than 40 plants in the sugar beet industry



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Sugar Factory Osijek

Sugar Factory Osijek is a Croatian company with a long history of producing sugar from sugar beet in the town of Osijek in Croatia. Osijek is situated on the right bank of the river Drava, 25 km upstream of its confluence with the Danube.

When production started in the sugar factory in 1906, the production facilities were located outside of the town. Over the years the factory capacity was increased several times (to currently 8000 t/d), while the town continued to grow and nowadays surrounds the factory almost completely.

With the accession to the European Union in 2013, Croatia had to comply with the EU guidelines for environmental protection. As a consequence, the wastewater treatment of many manufacturing facilities had to be upgraded to comply with the new effluent limits. Since Sugar Factory Osijek discharges wastewater to the river Drava, which adjoins a large system of natural wetlands, the management decided to invest in a state-of-the-art sludge dewatering and wastewater treatment plant (WWTP) in order to protect the quality of the river water.

After a detailed planning process that included visits to reference plants from several suppliers, Sugar Factory Osijek awarded H+E GmbH with the contract for the construction of a sludge dewatering and wastewater treatment plant. With more than 40 installed wastewater treatment systems worldwide – including plants in Germany, Poland, Lithuania, Turkey, Egypt and Chile – H+E GmbH has extensive experience with the treatment of wastewater from beet sugar production.

Characteristics of wastewater from beet processing

Beet processing is a water-intensive process, with almost all of the water supplied by the sugar beet itself (60 – 75 % water content). Therefore large quantities of wastewater with high organic pollution need to be treated prior to discharge. Since the wastewater is easily biodegradable, a combination of anaerobic and aerobic treatment is the state-of-the-art solution.

In a beet sugar factory, two types of wastewater are generated:

- Flume water (high-strength wastewater from beet washing)
- Factory wastewater (low-strength wastewater, mostly excess condensate)

The sugar industry uses flume water circuits for the washing of sugar beet. Flume water contains high amounts of suspended solids (soil particles) as well as organic material (from the beet). In many factories, lime milk is added to the flume water to keep the pH value between 10 and 11 (so-called alkaline operation). Without the addition of lime milk, the pH would drop rapidly due to fermentation reactions, resulting in corrosion of the pipelines.

The practice of adding lime milk to the flume water and also its use in juice purification produces wastewater with a high calcium content and a strong tendency towards precipitation of CaCO_3 . These precipitates lead to operational problems in anaerobic wastewater treatment and to clogging of the submerged membrane diffusers in aerobic wastewater treatment.

Table 1 shows the typical composition of wastewater from sugar processing.



Parameter	Unit	Flume water*	Factory wastewater
COD	mg/l	10.000	500
TSS	mg/l	200	0 - 100
TKN	mg/l	100 - 150	100 - 150
Ca	mg/l	500 - 3,000	0

* After suspended solids separation with pre-clarifier (so-called Bruckner)

H+E GmbH offers wastewater treatment systems that have been developed specifically for the sugar industry and provide reliable and very efficient treatment for wastewater with high to very high calcium content.

Sludge dewatering plant

The sludge separation step is integrated in the flume water circuit. Flume water enters a flat settling tank, where all the soil particles settle and are collected with a heavy-duty sludge scraper system. The overflow goes back to beet washing and the underflow is sent to a sludge dewatering step.

Sludge dewatering can be carried out either in ponds or with centrifuges. The centrifuge solution has the advantage of a very small footprint. In the case of the Sugar Factory Osijek this proved to be a decisive advantage, since there was no land available near the factory to construct ponds on. After sludge dewatering, the press water is sent to the wastewater treatment plant, specifically to the anaerobic stage.

Wastewater treatment plant

After passing the acidification tank, where organic material is broken down, the wastewater enters the anaerobic reactor ANAFIT®.CS, which works as a contact sludge process and can operate perfectly even at a calcium concentration of up to 4000 mg/l. In the anaerobic stage, COD is reduced by 90 – 95 %. The produced biogas can be used either in a co-generation plant (CHP) or for firing a boiler.

Treated flume water is mixed with the low-strength factory wastewater and is sent to the aerobic BIOFIT®.N treatment stage for nitrification and denitrification. If additional COD is needed for denitrification, it can be provided by bypassing the anaerobic stage with a small percentage of the high-strength wastewater flow. In the aerobic stage, specially developed aerators are used which, even at high calcium concentrations, reliably supply oxygen over years without requiring any maintenance.

Acidification and ANAFIT®.CS (below) and aeration tank BIOFIT®.N (top right)



Installation and operation of the plant

After Sugar Factory Osijek awarded the contract for the construction of the WWTP to H+E GmbH by the end of 2015, the project started with the first stage, the sludge dewatering plant. The clarifier tank (Bruckner) and the centrifuges were installed and started up with the beginning of the campaign 2016/17. The operation during the first campaign was very satisfactory.

The wastewater treatment plant is currently in the start-up phase and will operate at full capacity during the 2017/18 campaign. Due to the excellent execution of the project, the plant has already been used as a reference to win another project in the same region.

Table 2 shows the typical effluent requirements in the European Union (and the corresponding treatment efficiency in the case of Sugar Factory Osijek) after treatment in a combined anaerobic and aerobic WWTP.

Parameter	Unit	Effluent WWTP*	WWTP efficiency
COD	mg/l	< 125	> 98,4 %
BOD ₅	mg/l	< 25	> 99,5 %
Total N	mg/l	< 15	> 92 %

* Typical effluent limits for direct discharge in the European Union

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