inDENSE case study:
increasing hydraulic capacity by biomass densification technology at Søholt WWTP

30% hydraulic capacity increase thanks to biomass densification technology

With growing demand for wastewater treatment and a deep commitment to environmental protection, there was a need to increase the capacity of the Søholt wastewater treatment plant while protecting the precious ecological balance in the Silkeborg area and Gudenå River.

The challenge

Silkeborg Spildevand A/S faced a critical challenge related to the capacity of Søholt wastewater treatment plant, especially during the cold, rainy winter months.

The city of Silkeborg, where the Søholt wastewater treatment plant is located, is characterized by hilly terrain and a sensitive local water ecosystem as receiving body for the treated wastewater. As a result of the local surroundings, the plant receives high hydraulic peak loads during rain events and it is critical to secure high degree of treatment during such events to protect the recipient of Gudenå River.

Solution implemented

To address the issue and rising client's concerns, SUEZ is upgrading the Søholt wastewater treatment plant with the inDENSE solution. It significantly increases the hydraulic capacity enabling to treat 30% higher wastewater flows, especially during rain events, without the need to build new concrete structures.

The implementation of inDENSE addresses specific critical environmental concerns by reducing wastewater overflows into the local lakes and preventing sludge blanket escapes during the winter months, thereby safeguarding the fragile aquatic recipients.

inDENSE implemented in Søholt WWTP (Denmark) in 2024.

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Benefits and value

The adoption of SUEZ's inDENSE solution at wastewater treatement plant delivered significant benefits and added value.

Increased Hydraulic Capacity to handle a 30% higher wastewater flow during rain events, effectively expanding its capacity without costly physical expansion.

Environmental Protection by reducing wastewater overflows and preventing sludge blanket escapes.

Cost Savings minimizes the need for expensive and space-consuming extensions relate to future requirements and reduced use of chemicals for phosphorus removal as inDENSE strengthens biological phoshorus removal.

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inDENSE case

How it works

InDENSE is a sludge densification technology employing hydrocyclones for gravimetric biomass selection.

Sludge, preferably from the extraction line, undergoes external gravimetric selection to concentrate well-formed flocs and biomass aggregates. The hydrocyclones, strategically placed upstream of dewatering steps, allow the recovery of sludge with good settling properties while discarding weak flocs and filaments.

Benefits of implementing hydrocyclones include achieving a stable sludge volume index (SVI) year-round, optimal mixed liquor settling properties, winter nitrification assurance, reduction in float and foam production, enhanced clarifier performance, and potential capacity increase by up to 30% during expansions.

Key advantages:

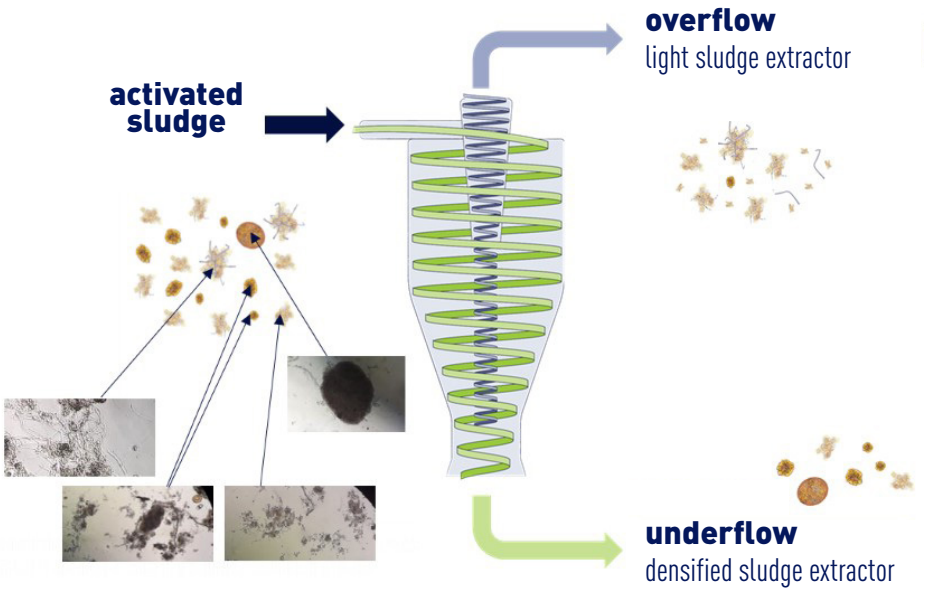
- Stable sludge volume index year-round: ensures a consistent sludge volume index, mitigating seasonal variations.
- Optimal settling properties: improves settling characteristics of mixed liquor, minimizing the impact of filamentous bulking.
- Winter nitrification: secures nitrification during winter conditions.
- Reduced float and foam: diminishes float and foam production, preventing bulking issues.
- Clarifier performance: maintains clarifier efficiency, even during hydraulic peak loads.
- Capacity Increase: allows potential expansion of biological treatment capacity using existing infrastructure.

The technology addresses seasonal variations in SVI, known as "filamentous bulking," caused by colder and more diluted wastewater in winter.

By reducing filamentous bulking, the densification optimizes post-clarification function, enabling efficient wastewater treatment.

Integration into wastewater treatment plants involves abandoning the current waste-activated sludge line, adding a pump near aeration tanks, and establishing a return line for densified sludge. The control logic is simple and adaptable to existing PLC systems, ensuring ease of operation without added complexity.

Process flow diagram



Management and operation

Management and operation of inDENSE are straightforward. Variable-speed control matches sludge pumping to a fixed pressure set point, with hydrocyclones easily turned on or off. Monitoring via flow and MLSS meters simplifies control.

Minimal weekly maintenance, lasting less than an hour, involves adjusting WAS extraction rhythm, changing underflow nozzles, and sensor calibration. System downtime is expected to be a maximum of one hour per month, emphasizing its reliability and efficiency.

The inDENSE control system is simple and robust, easy to understand and implement in an existing PLC. InDENSE does not add complexity to the operation of the treatment plant.

The feed sludge pumping is controlled at variable speed to match a fixed pressure set point at the cyclones' inlet. Hydrocyclones can be turned on and off by using manual valves on the unit to increase or decrease the sludge extraction rate.

Adding or closing a hydrocyclone is instantly compensated in terms of flow by the pressure control. The sludge extraction can be fully monitored via the installed flow and MLSS online meters.

Service and maintenance

InDENSE operates with simplicity and robustness. Only minimal operation and maintenance routines are required for a weekly total of less than 1 hour.

It consists of:

- adjusting the rhythm of WAS extraction by changing the number of hydrocyclones in operation (weekly checks, 5 min per operation),
- changing the underflow nozzle size twice a year (5 min/cyclone with a lightweight, fast, and tool-less mounting/dismounting system),
- check and calibration of sensors (mainly MLSS meter) every two weeks (30 min),
- unclogging/cleaning the feed and underflow nozzles when the automatic system detects it, but can be reduced to zero when the right pre-treatment is implemented.

To ensure this, a macerator not requiring fixed routines is installed before the sludge pumps. The system will only be out of operation when changing nozzles or cleaning the nozzles.

Based on the above, downtime is expected to be max. 1 hour per month, however past experiences in Dijon show that downtime is usually less than that.

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