Optimization of different biofilm reactors for water treatment in warm climates

Wastewater treatment

A s::can system at a wastewater treatment plant in El Gouna, Egypt is used to enable modeling and dynamic simulation of different biological processes. With the help of the results, innovative solutions allowing capacity increases of existing WWTPs can be evaluated.

Technical University of Berlin (TUB) Campus El Gouna, Egypt

Parameters monitored:

- COD
- CODf
- NO_3
- NH_4
- pH
- Temperature
- TSS

Facts & Figures

Company/Institution:
TU Berlin

Location:
El Gouna, Egypt

Application:
Wastewater treatment

Key Products installed:
spectro::lyser, ammo::lyser oxi::lyser and moni::tool

Background

The wastewater of the growing tourist city El Gouna in Egypt is treated in a central activated sludge wastewater treatment plant. Despite the city's growth and therefore increase in inflow to the WWTP-site, new constructions are not allowed.

Carsten Riechelmann currently works for the Water Engineering Department at Campus El Gouna of the Technical University Berlin to support the city services through a real scale test of different options to increase the WWTP's capacity. Together with Tristan Wilms he is analyzing whether or not techniques that proved applicable in <15°C bioreactors in Europe are also beneficial in >30°C warm Egyptian WWTPs.

Riechelmann is running a comparison between three techniques: an optimization of the conventional activated sludge process, the application of a fixed and also a moving bed biofilm carrier hybrid process. The application of biofilm carriers is an innovative solution because they allow the upgrading of existing WWTPs without building new tanks. However, since it is a relatively new procedure compared to conventional activated sludge systems, there are some uncertainties in their design, transormation processes and performance.

s::can's solution

To actually increase the treatment capacity regarding COD removal and nitrification, it is necessary to understand the influence of different parameters in the biological cleaning process. Using a self-developed sampling system together with the s::can Online Monitoring System, four different sample points are measured.

A spectro::lyser, an ammo::lyser and an oxi::lyser are used to measure COD, TSS, NO_3, NH_4, pH, O_2 and temperature in the inflow and three different effluent streams. The sensors are connected to a con::cube, an operating panel with moni::tool, a software platform, that registers all data in accordance with a time control and makes them available and visible via online access.

With the operator software, moni::tool, relays can be triggered. This function was used to switch four different pumps bringing water from the inflow, effluent of street 1, street 2 and street 3 for 15 minutes each. The water reaches the measurement channel where the sensors are installed, allowing to measure different points with only one set of s::can sensors. After sorting the data it is possible to see correlations between the inflow and the effluent behavior while observing different reactions of the normal activated sludge process and the two hybrid biofilm processes.

The aim of the research project is to use this data to determine ideal process conditions and the maximum capacity of the WWTP with respect to the upgrade option of hybrid biofilm carrier applications. Ultimately, the collected data will be used to calibrate a model in Simba#™ to enable a recalculation of other overloaded plants in Egypt.

"Before I started using the s::can Online Monitoring System it was impossible to observe differences between the three processes. Now I can even see their different dynamic reactions on changing inflow characteristics."

Dipl. Ing. Carsten Riechelmann
(Researcher at Water Engineering Department, Campus El Gouna)

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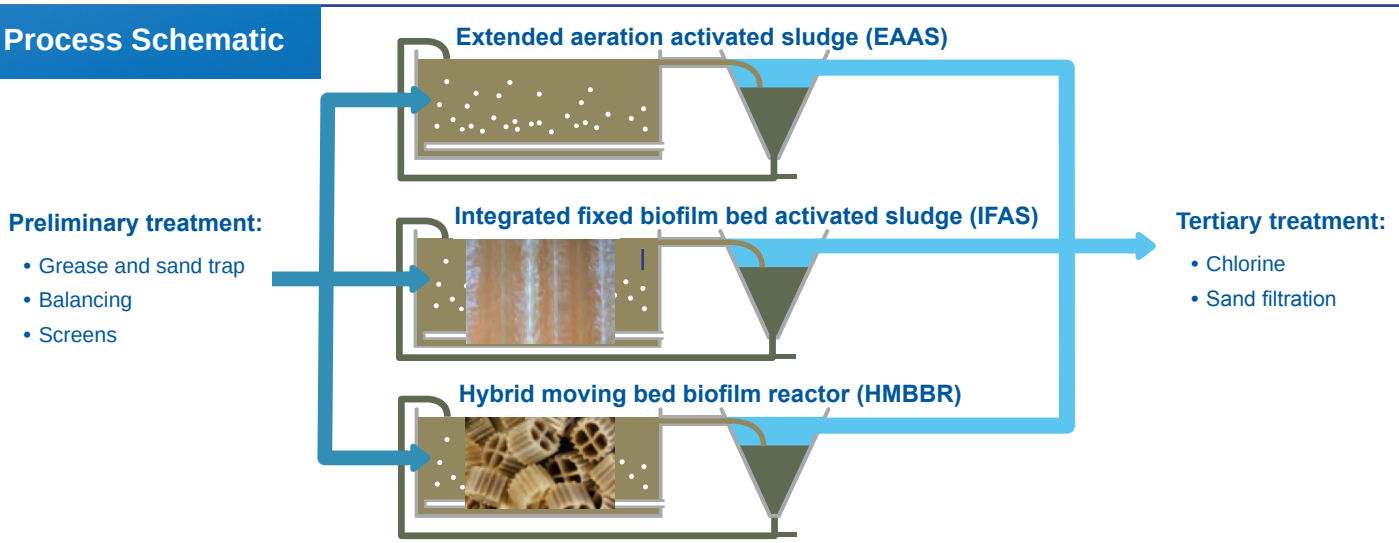
Intelligent. Optical. Online.

Process Schematic



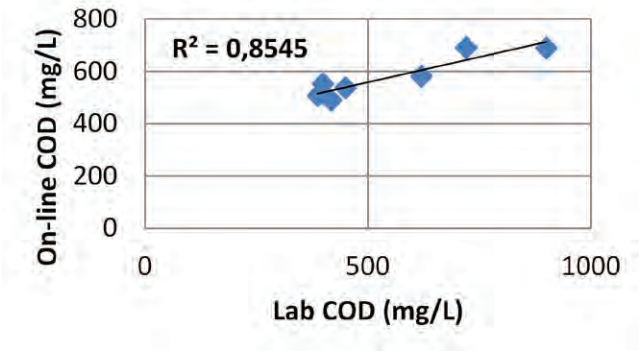
Preliminary treatment:

- Grease and sand trap
- Balancing
- Screens

Tertiary treatment:

- Chlorine
- Sand filtration

TSS, COD and CODf measurements from the inflow, effluent of street 1, street 2 and street 3 for 15 minutes each in moni::tool.



Lab analysis confirms, that there is a high correlation between the measurement results from the spectro::lyser and the laboratory results regarding COD (chemical oxygen demand) in the raw inflow waste water.

The s::can spectro::lyser™ is a fully submersible UV-Vis spectrometer that measures light absorbance between 190 – 750 nm. s::can's proprietary algorithms analyze and decompose the spectral data to provide measurements for many wastewater parameters including: nitrate, nitrite, COD, BOD, TSS, and dissolved H2S. There are no moving parts in contact with the water and no reagents are used, resulting in almost no operating costs.

The moni::tool software is a revolutionary platform for the management of measuring stations, online probes and analyzers. Whether it is installed in a large monitoring network or as a standalone station, moni::tool's intuitive software and state of the art features are an essential backbone for sensor and station management.

The Water Engineering Department of the TUB Campus El Gouna is teaching and researching a water resources management that follows an integrated and interdisciplinary approach, including sustainable capacity building.

More information:

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