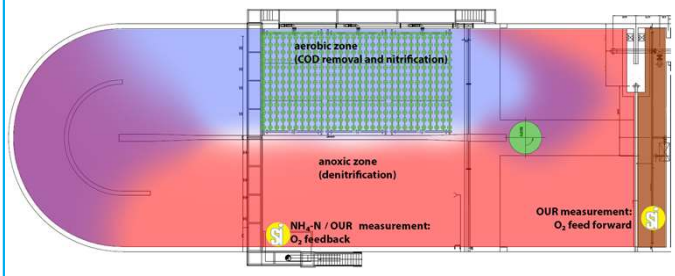
Advanced control of industrial waste water treatment

Ray Cornips, Rick Jansen, Sigrid Scherrenberg
r.cornips@evides.nl; +31 10-293-5000

Introduction

Evides Industriewater operates a waste water treatment plant (WWTP) in Vlissingen (The Netherlands) for the biological treatment of both industrial and sanitary waste water from approximately 60 companies. The influent is a mixture of waste water from the food industry and (petro-) chemical industry. The easy degradable wastewater from the food industry is transported separately and pre-treated in an anaerobic treatment step, after which it is post-treated in an aerobic activated sludge process.
The aerobic process purifies the entire influent flow. The system consists of a carousel-type aeration tank and a final settlement tank. The carousel is operated with an aerated part for biological oxygen demand (BOD) removal and nitrification and an anoxic zone where denitrification takes place.
The composition and degradability of the wastewater can vary greatly, making it a challenge to control the sludge volume index (SVI) and to avoid non-conformities. The objectives are to reduce the energy demand and to reach the lowest possible discharge concentrations of nitrogen components. All of this with a fully automated WWTP whereby the operating personnel only have to intervene on high-priority failures.
In order to realize this, a new measurement and control concept was developed in which the aeration in the carousel is controlled via a multiple parameter monitor including on-line respiration and ammonium analysis. It will be demonstrated that this control system will save 20% – 25% on energy immediately, and, in time, saves 20% on discharge billing.

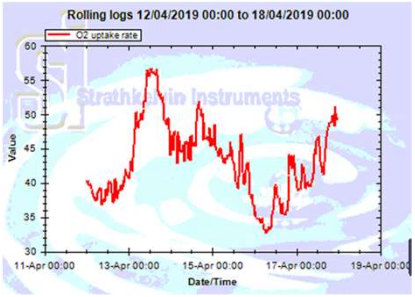
Challenge / problems



- Much attention is needed during performance changes.
- The analysis on grab samples do not provide a 24/7 reliable picture
- It is not possible to observe respiration inhibition and nitrification inhibition caused by toxicity.
- Oxygen overdosing, due to static aeration control

New measurements and control concept

The on-line active sludge process control analyzer



OUR (pseudo-BOD)		NH4-N	Waste water load	Setpoint Oxygen
mg O/l/hour		[mg/l]		[mg/l]
< 20	Or	< 1	Very low	0,6
< 30	Or	< 2	low	0,8
< 40	Or	< 3	high	1,2
> 40	Or	> 3	Very high	1,8

Discussion

- The feed forward and feed backward control will respond better to varying nitrogen loads in the influent. This allows the nitrogen removal to be more effective and ammonium peaks are treated more efficiently. The result is that the effluent discharge limits are more easily achieved and that the discharge billing will be lower.
- The required oxygen input can be calculated by means of the OUR measurement, so that aeration energy is saved.
- With the measurement of the OUR, toxic waste water flows can be detected and the influent can be buffered in time. Next step can be to trace the responsible costumer.
- manual laboratory analyzes can be replaced by online measurements. At the same time, changes and distortions are immediately detected by the online measurements so that - via alarms - remote action can be taken in the process.
- Since the ASP-Con measures many parameters online such as SVI and predicted TSS, waste water data can be compared with other parameters, which eases troubleshooting.

Conclusions

- Online measurement allows advanced treatment monitoring.
- OUR measurement prevents over-aeration, so that energy can be saved.
- By integrating ammonium measurement in the aeration control, nitrogen removal is more efficient.
- Automated aeration needs less operator attention.
- Amount of laboratory work is reduced.
- Optimization is required to be able to perform within the accuracy requirements.

References:
- *Experimental methods in waste water treatment*; Mark C. M. van Loosdrecht, Per H. Nielsen, Carlos M. Lopez-Vazquez, Damir Brdjanovic
- *Advances in Wastewater Management*; Michael Dooley, Strathkelvin Instruments Ltd.