FACULTY OF BIOSCIENCE ENGINEERING

DEPARTMENT OF GREEN CHEMISTRY AND TECHNOLOGY
BIOSYSTEMS CONTROL RESEARCH GROUP

Research mission

Biosystems control... towards a sustainable future !

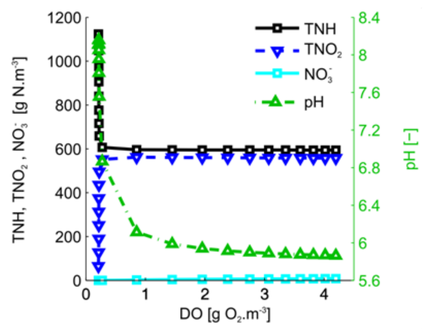
Research focus = **efficient and sustainable process design and process control**.

'Sustainability' is interpreted as meeting the required product or effluent quality while minimizing the use of energy and resources, aiming at reuse and recovery, through compact installations, in an economically viable and socially acceptable way.

On-line gas phase analyzer for monitoring N_2O, CH_4, O_2, CO_2

Application domain:
- **biological wastewater treatment** and other **bioconversion processes**
- **environmental technology**
- not limiting – applied **methodologies** are **generally applicable**

Process engineering aspects, in particular the **actual design and control** of processes and reactors, are studied by means of:
- **physical-based models** (based on conservation of mass, energy, ...)
- monitoring campaigns and **full-scale experiments**, besides **lab-scale experiments**



Numerical simulations based on physical-based models

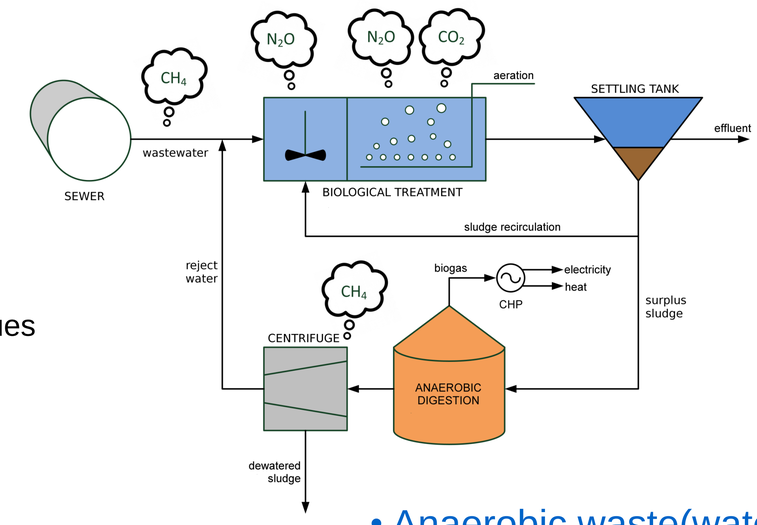
Ongoing research projects

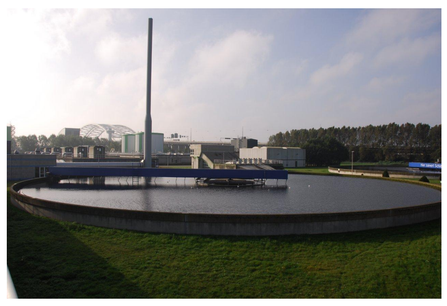
• Controlling greenhouse gas emissions from wastewater treatment plants

Wastewater treatment plants emit greenhouse gases :

- carbon dioxide (CO_2)
- methane (CH_4) greenhouse gas potential 34 x CO_2
- nitrous oxide (N_2O) greenhouse gas potential 300 x CO_2

Even small emissions of CH_4 and N_2O have large effects !



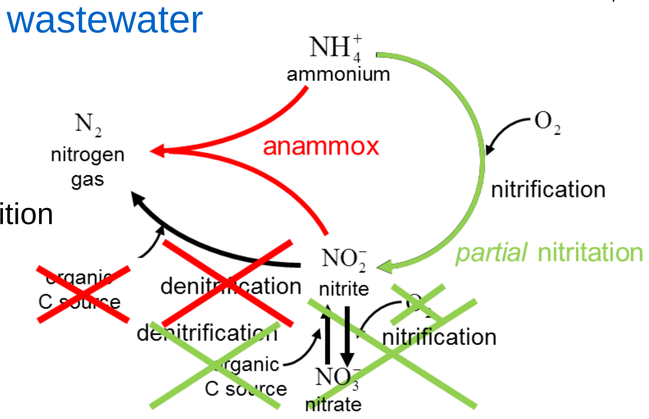


Research objectives
- quantification of emissions – development of measuring techniques
- identification of sources – detection of formation mechanisms
- development of control strategies

• Biological nitrogen removal from wastewater

sustainable pathway:
partial nitritation – anammox
- up to 63% savings in aeration energy
- up to 100% savings in carbon source addition
- almost no CO_2 emission
- less sludge production

in comparison with conventional nitrification-denitrification over nitrate

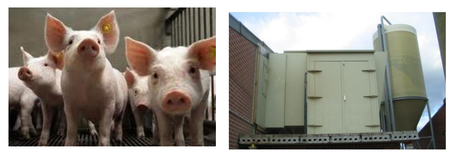


• Anaerobic waste(water) treatment

- control strategies for stable performance
- refinement of measuring techniques
- biogas desulfurization through microaeration
- farm-scale digesters for manure treatment

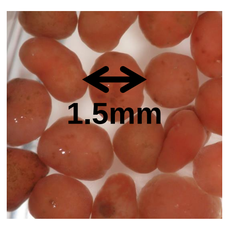
• Design and control of air scrubbers for animal housing

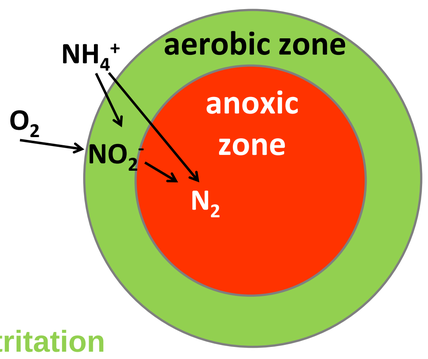
Reduced emissions of
- ammonia (NH_3)
- odour (H_2S)
- greenhouse gases (N_2O and CH_4)



• Granular sludge reactors for compact wastewater treatment

Bacteria grow in granules
- good settleability
- compact installations



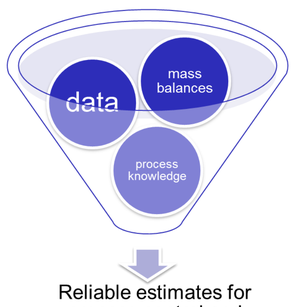


partial nitritation
anammox

• … (examples are not limiting)

• Data reconciliation for wastewater treatment plants

- Improve general data quality
- Optimize data collection strategy



Reliable estimates for process control and minimal sampling effort

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