Start-up strategy for the nitrite pathway

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N-cycle

nitrification

\[
\begin{align*}
\text{NH}_4^+ & \xrightarrow{\text{25\% O}_2} \text{NO}_2^- \\
\text{NO}_3^- & \xrightarrow{\text{40\% BOD}} \text{NO}_2^- \\
\text{NO}_2^- & \xrightarrow{\text{60\% BOD}} \text{N}_2 (g)
\end{align*}
\]

denitrification

75\% O_2
Objective

**Case: slaughterhouse wastewater**

- **pretreatment:** DAF
- **biology:** step-feed SBR

**effluent**

- **COD:** $1200 \pm 470$ mg/L
- **$NH_4^-$:** $165 \pm 60$ mg/L

**COD/N:** $7 \pm 2$
Challenge = to get rid of the NOB

1. Starting from sludge

low DO, high pH, high T, aeration control, selective inhibitors...
2. Starting from wastewater

\[ N\text{-substrate} = NH_4^-N \]

Aeration phase length control + step-feed regime

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Starting from wastewater

\[ > 80\% \text{ COD} \text{ removal in} < 18 \text{ days} \]
\[ > 80\% \text{ N} \text{ removal in} < 60 \text{ days} \]
\[ \text{Degree of nitritation} (\%ND) > 90\% \]
3. Strategy to keep the nitrite pathway

![Graph showing nitrite concentration over time.](image)

*Aeration phase length control in a step-feed SBR*

Conclusions & perspectives

Novel nitritation start-up strategy

- starting from wastewater only (no inoculum)
- in combination with aeration phase length control
- rapid & stable...

- ... but what about N$_2$O?
Pilot-scale demonstration