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Nitrogen removal from ink-jet textile printing wastewater by autotrophic biological process: first results at lab and pilot scale

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Outline

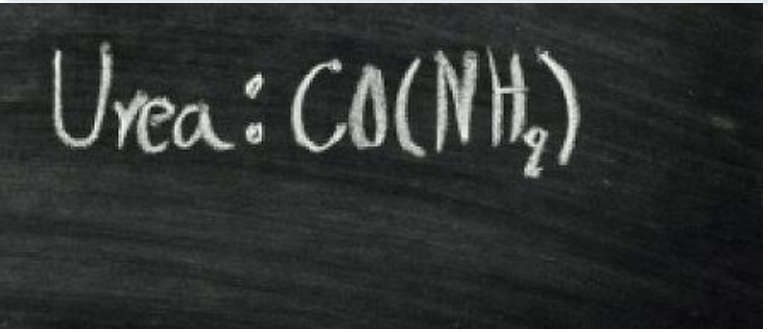
1. Introduction
   - Project motivation and objectives
   - Background on granular Anammox
2. Lab installation
   - Results with different wastewaters
3. Pilot installation onsite
   - Results
4. Conclusions and recommendations

Motivation

Digital textile printing has a globally spread market mainly due to its versatility with respect to conventional printing techniques.

The EU-LIFE DeNTreat project focuses on PN/anammox process as a decentralized treatment for ink-jet textile printing wastewater

Motivation



Urea

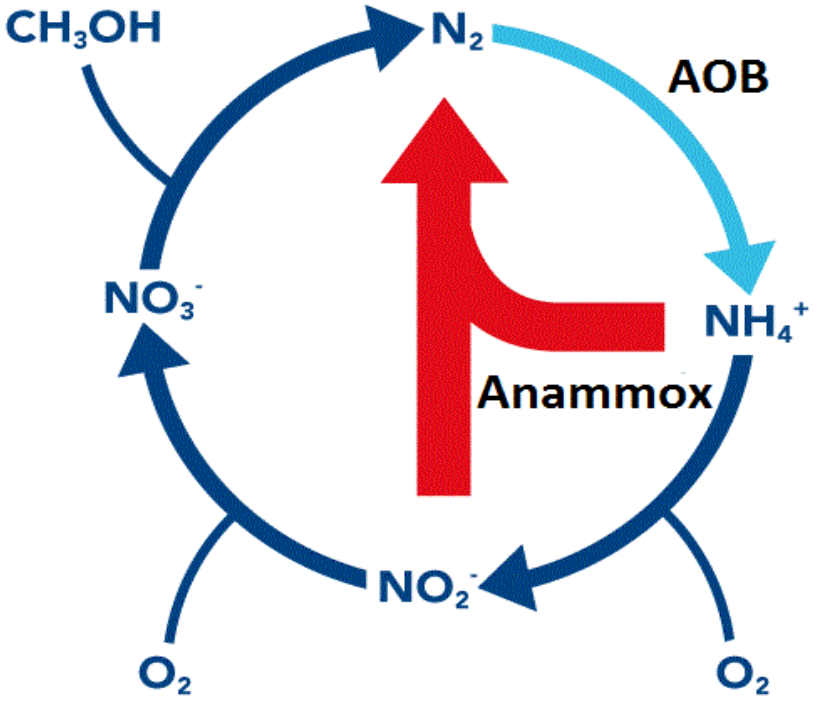
- Increases water solubility of dyes
- Enhances brightness and intensity of dyes

<u>Limited water consumption</u>

BUT

N-rich discharges i.e. <u>150 to 600 mg N/L</u>

Background



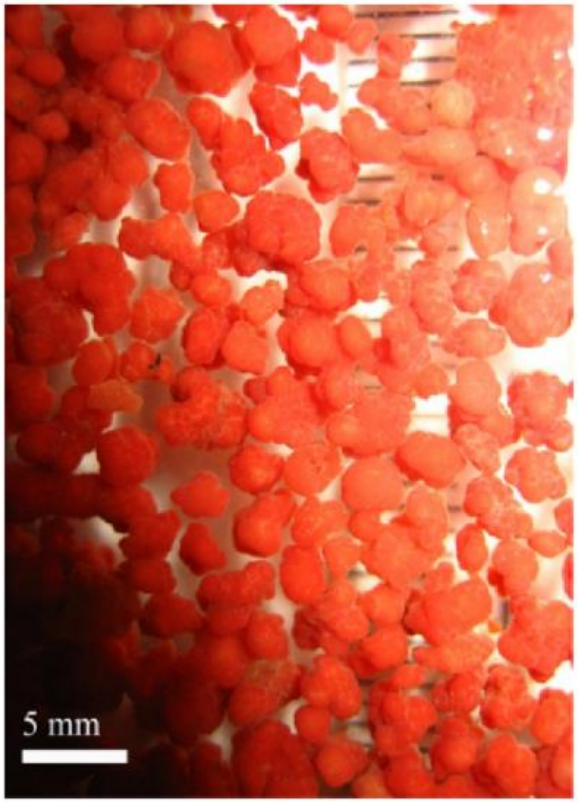
AOB

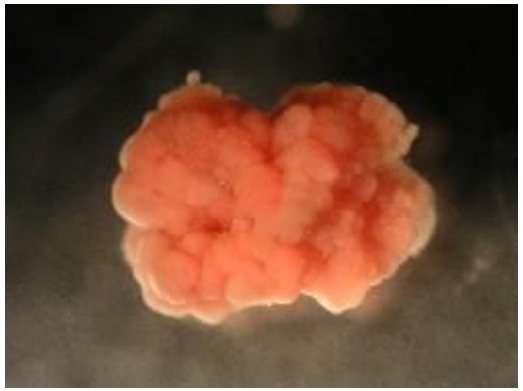
$$2NH_4^+ + 3O_2 \rightarrow 2NO_2^- + 4H^+ + 2H_2O$$

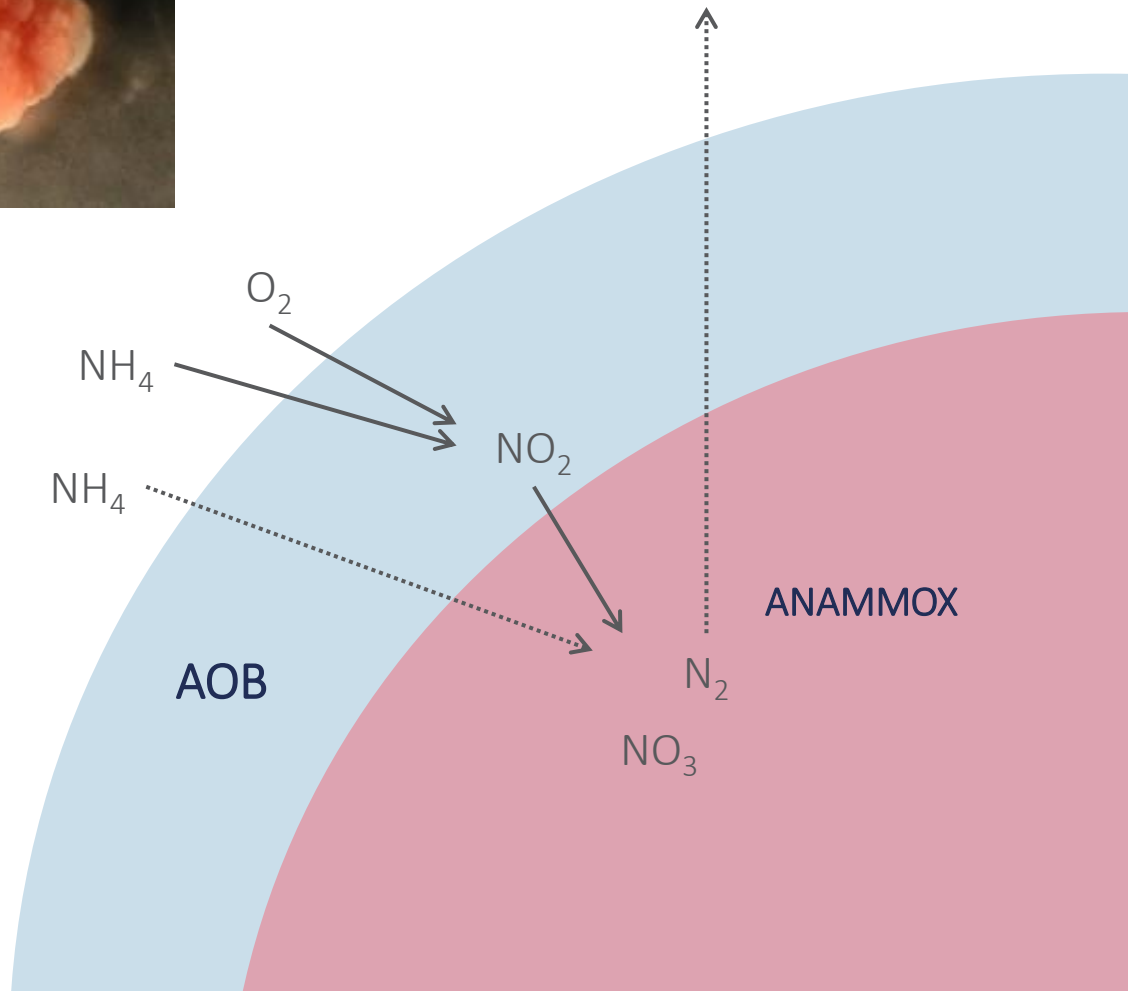
Anammox

$$NH_4^+ + 1.32NO_2^- + 0.066HCO_3^- + 0.13H^+ \rightarrow 1.02N_2 + 0.26NO_3^- + 0.066CH_2O_{0.5}N_{0.15} + 2.03H_2O$$

Background - P/N-Anammox granular biomass







Crucial process variables:
Temperature
DO
pH
NO_2

Lab installation

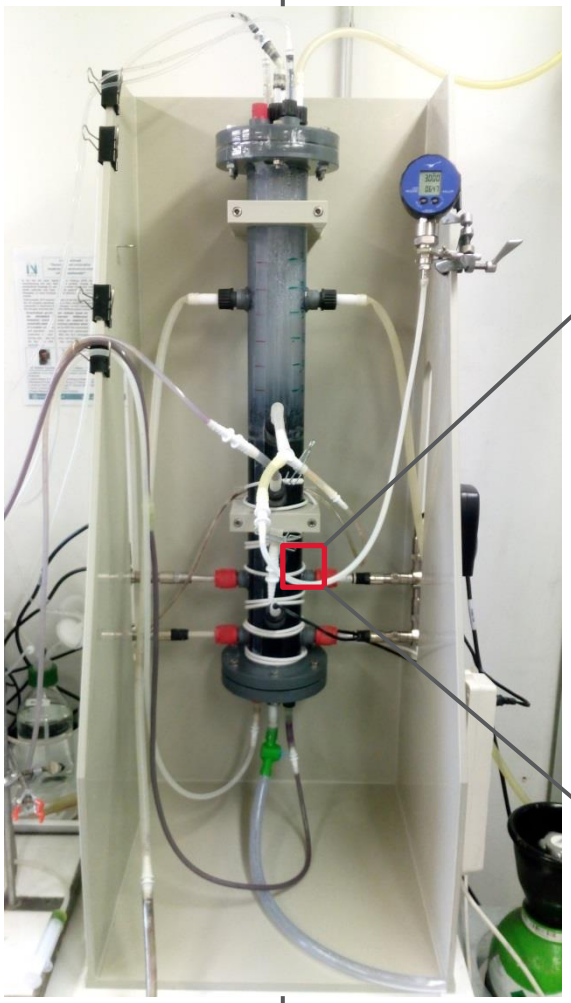
Gas lift - Closed loop

pH

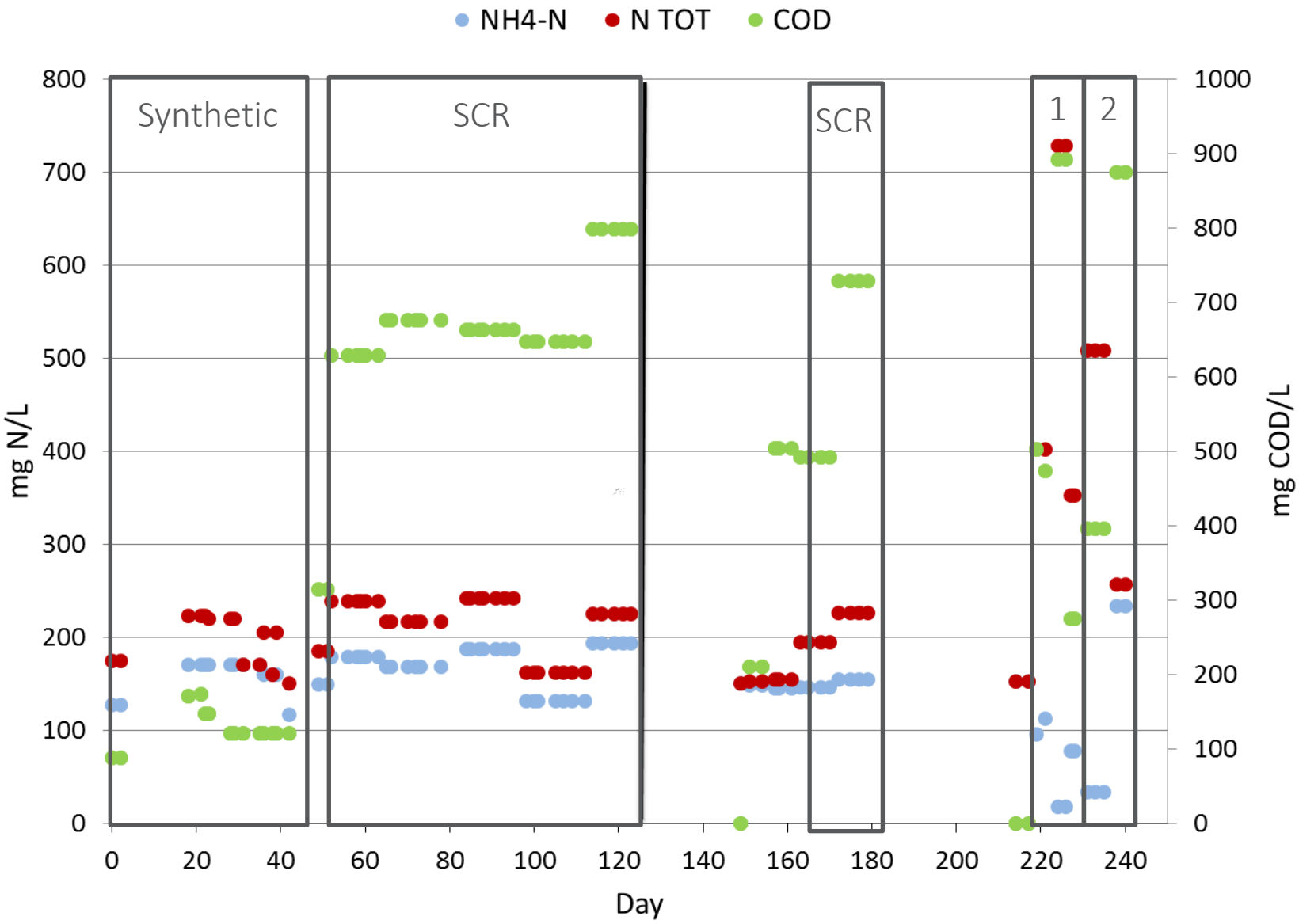
Cond

DO

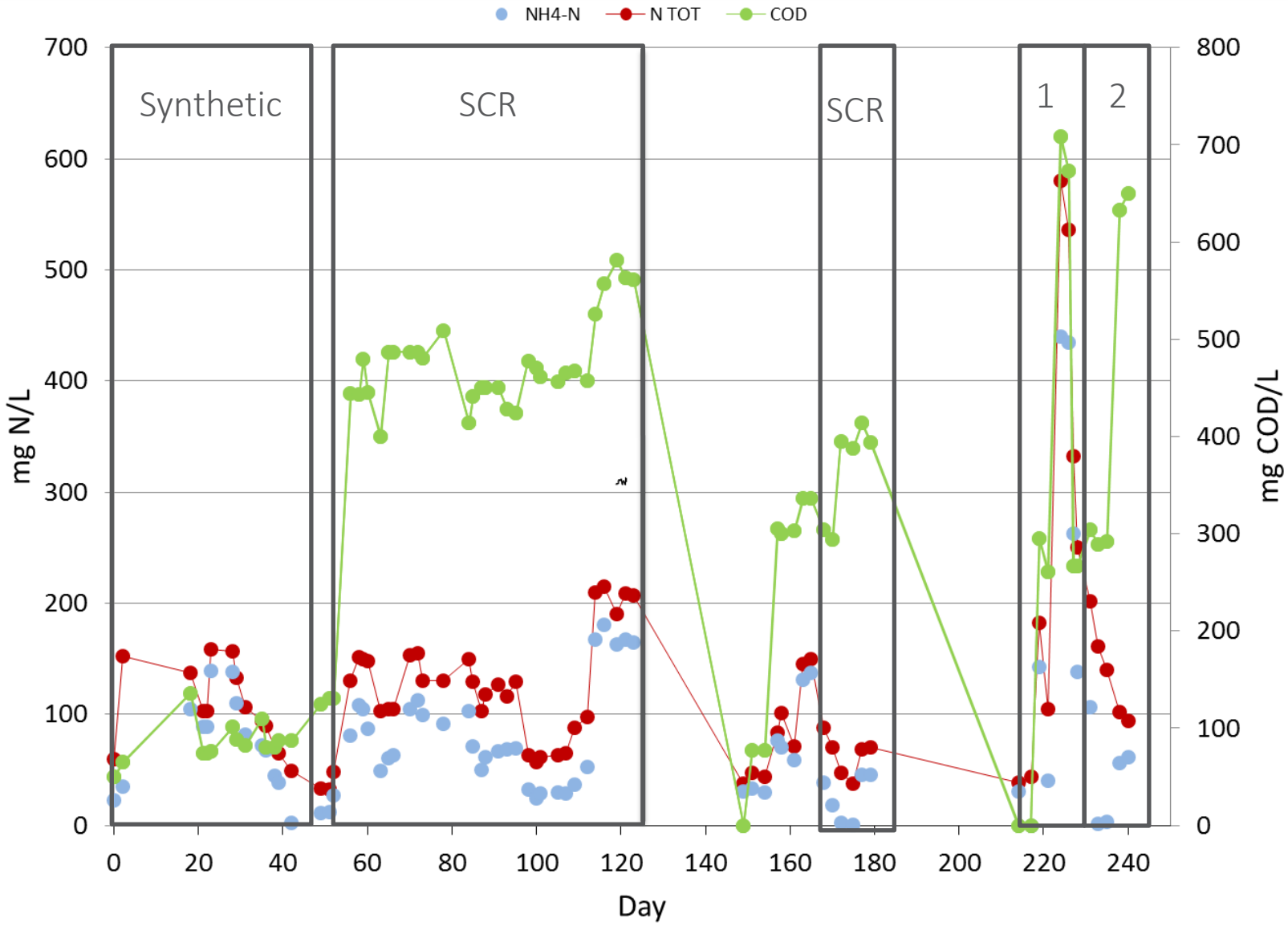
Redox



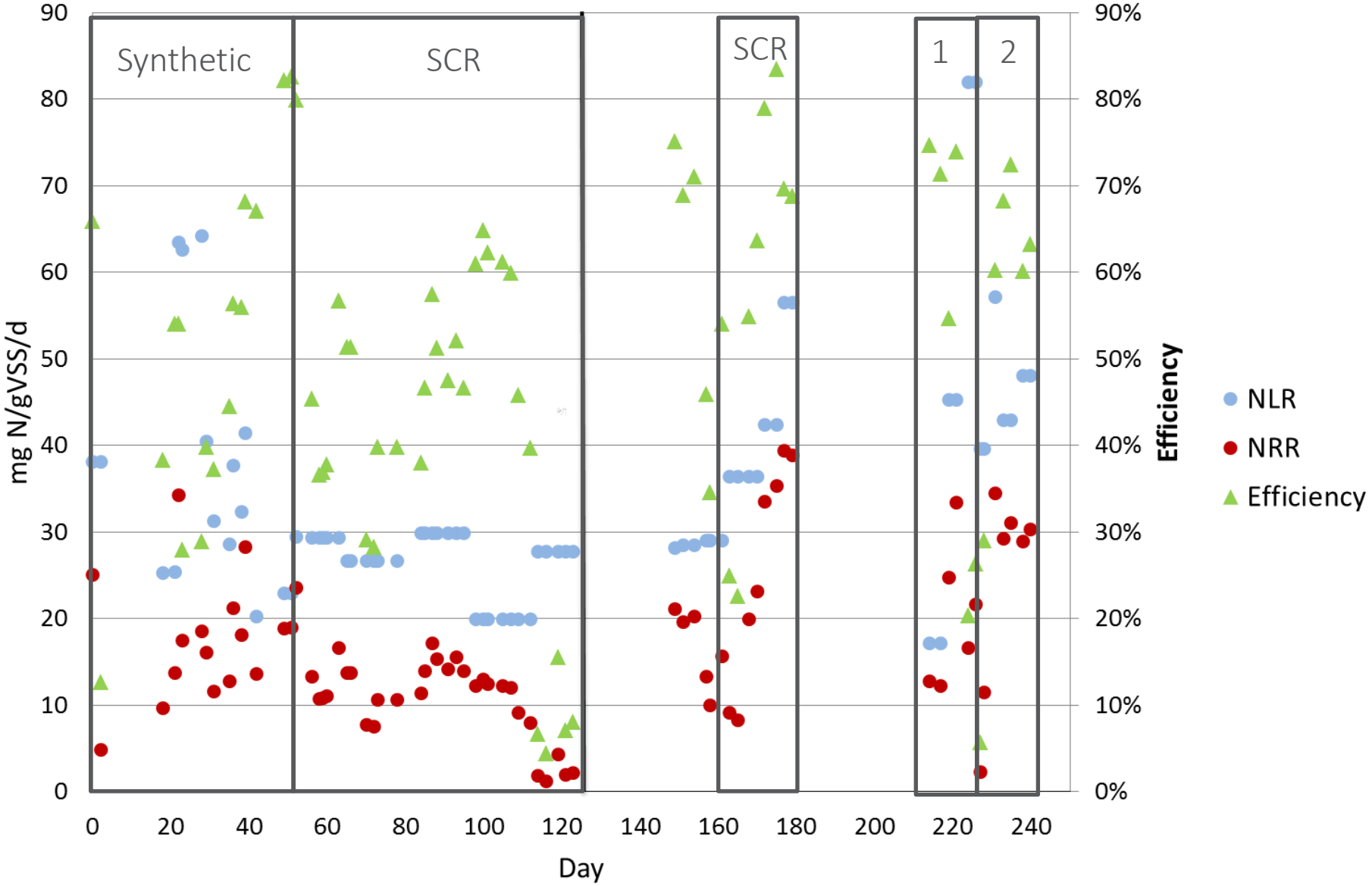
Results - Influent



Results - Effluent



Results - Effluent

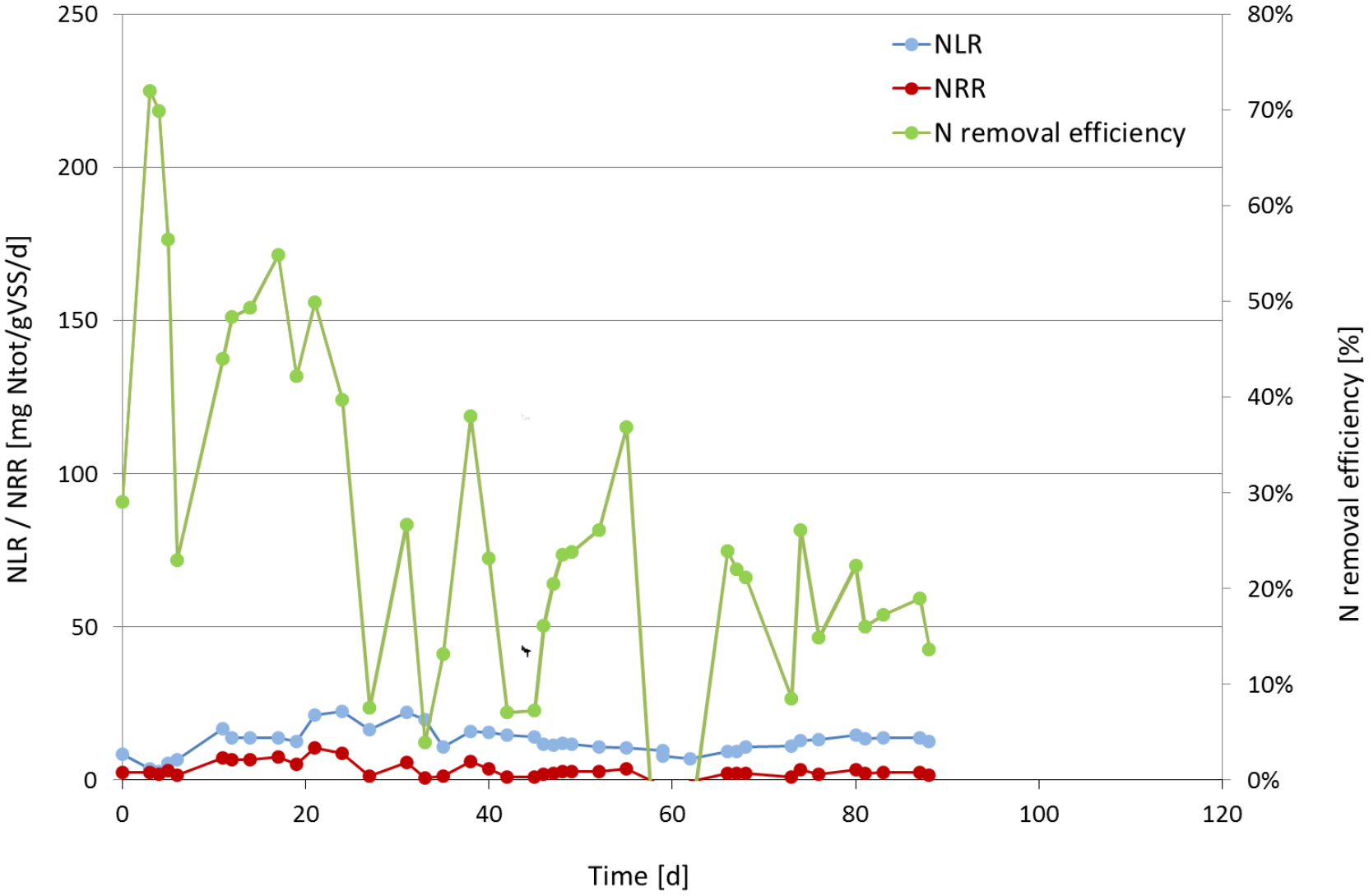


Pilot installation

Operative onsite at

Stamperia di Cassina Rizzardi

Pilot installation - Results



Conclusions

- Strict DO control crucial to avoid development of NOB and OHO preventing:
  - NH_4 oxidation by AOB;
  - NO_2-N use by Anammox
- Pre-treatment to reduce bCOD/N ratio below 3 to avoid OHO;
- A limited OHO denitrification activity may be beneficial, but may compete for NO_2-N with Anammox;
- pH control is essential as the decomposition of urea into NH_4 causes pH increase;
- An Anammox-rich and healthy inoculum is necessary to counteract initial competition for NO_2-N.

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Thank you!

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EU-LIFE DeNTreat project

Additional material