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Nutrient Release from Biosludge

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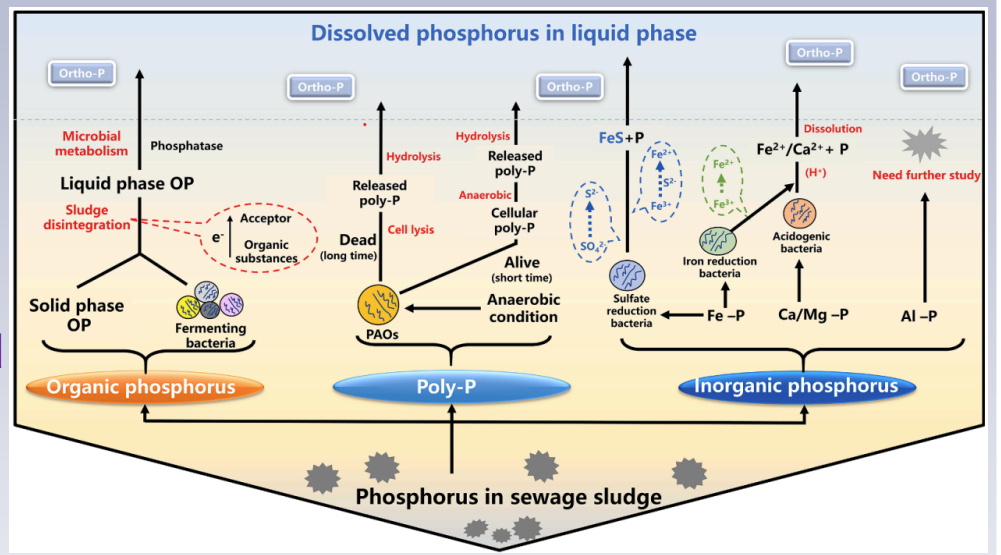
Background

Importance of phosphorus resource:

- Essential for life, phosphorus enters in the composition of DNA and ENA that contain information for the growth, maintenance, and reproduction of living beings.
- It plays an important role in the supply of energy to the organism via the ATP cycle.
- Phosphorus is a limiting nutrient in agriculture and the demand for phosphate fertilizers is increasing with the increasing demand for food.
- Half the phosphorus in Europe is lost as waste, and waste activated sludges accounts for 34.6% of lost phosphorus.



Way to increase phosphorus dissolution: Anaerobic digestion

Purpose of the research: To investigate the best anaerobic conditions for phosphorus dissolution, and understand the anaerobic bioprocess.

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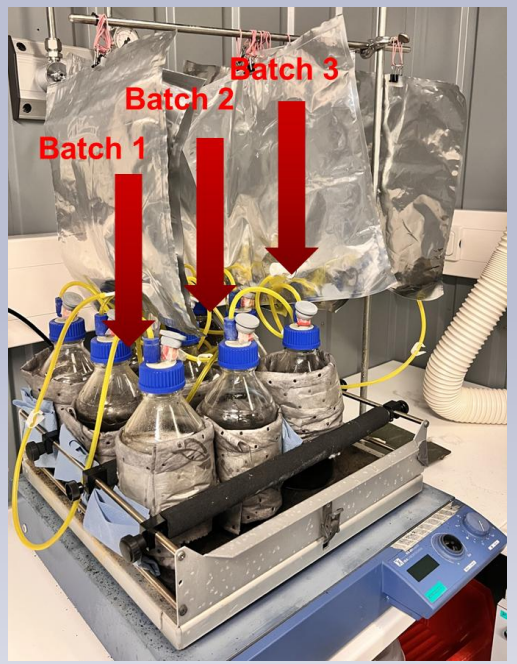
Methodology

Batch experiments:

Batch 1 (Control group): Biosludge

Batch 2 (Digestate): Biosludge + Digested sewage sludge

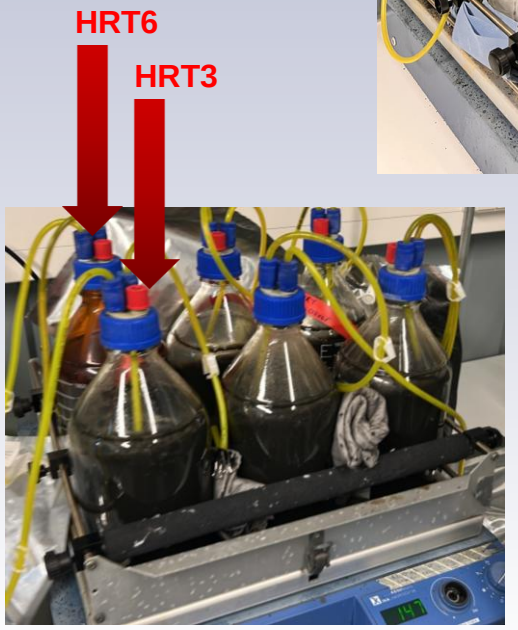
Batch 3 (Heated digestate): Biosludge + Heat-treated digested sewage sludge



Semi-reactor experiments:

Hydraulic retention time of **3 days (3HRT)**

Hydraulic retention time of **6 days (6HRT)**

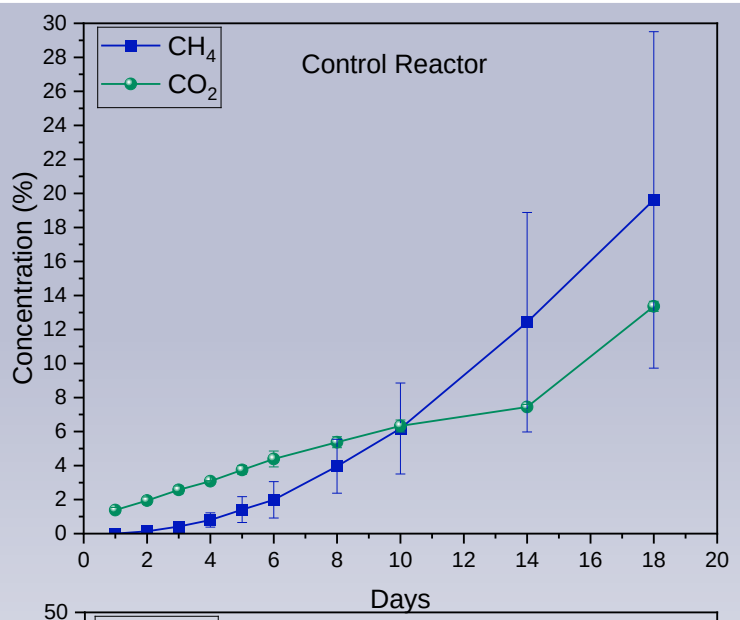


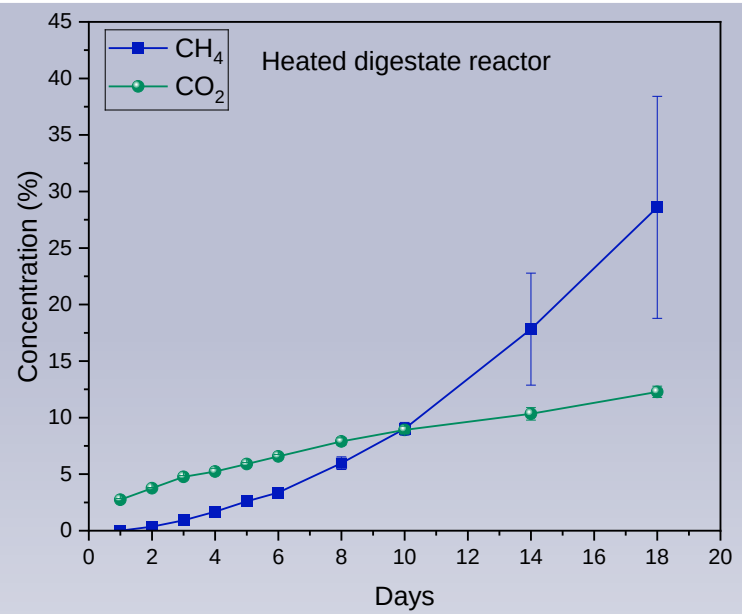
Analysis:

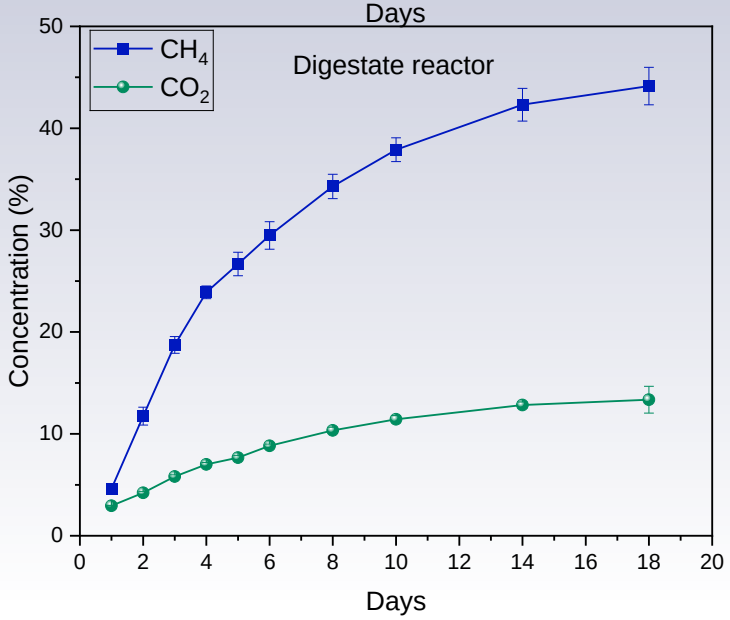
Gas volume; Gas content; Volatile fatty acids (VFA); Phosphate content; Chemical oxygen demand (COD);

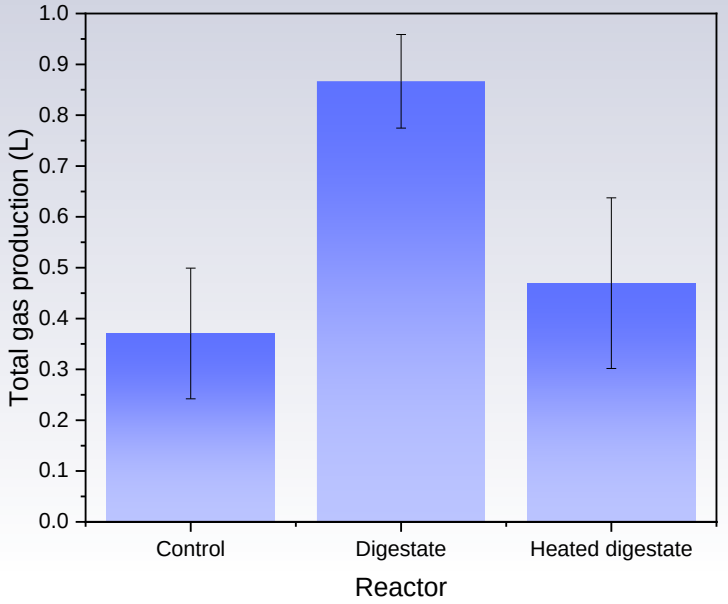
Dry matter; Loss on ignition; pH; Conductivity

Results – Batch experiments: Gas analysis









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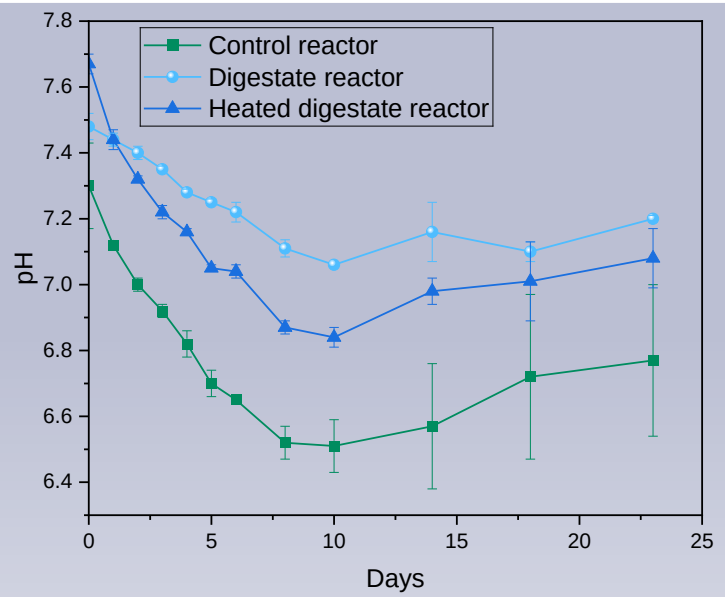
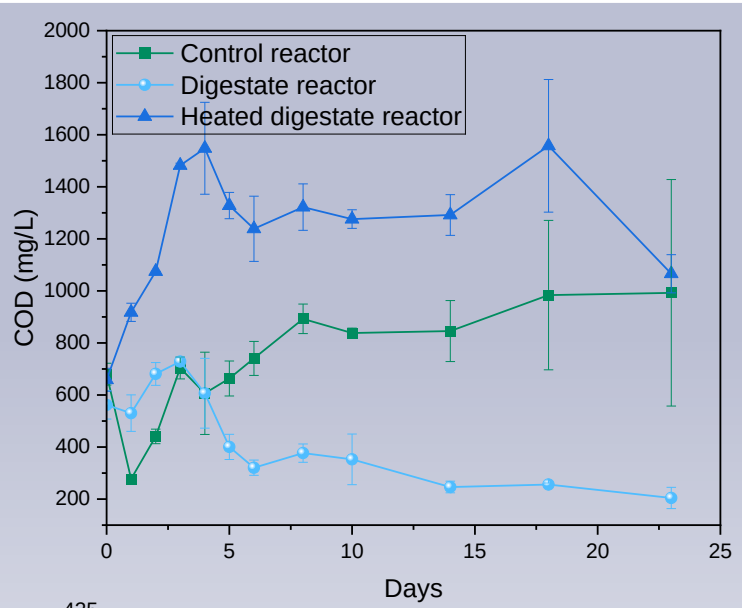
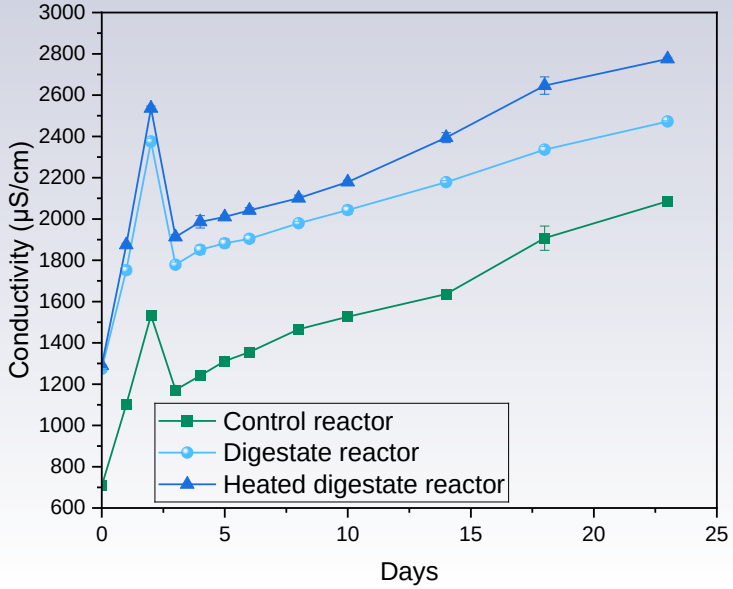
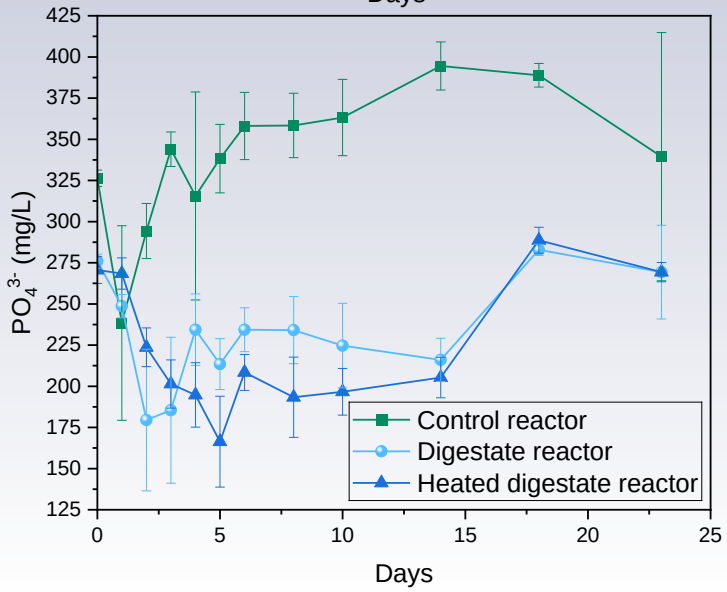
Results – Batch experiments: pH, conductivity, COD, and PO_4^{3-}









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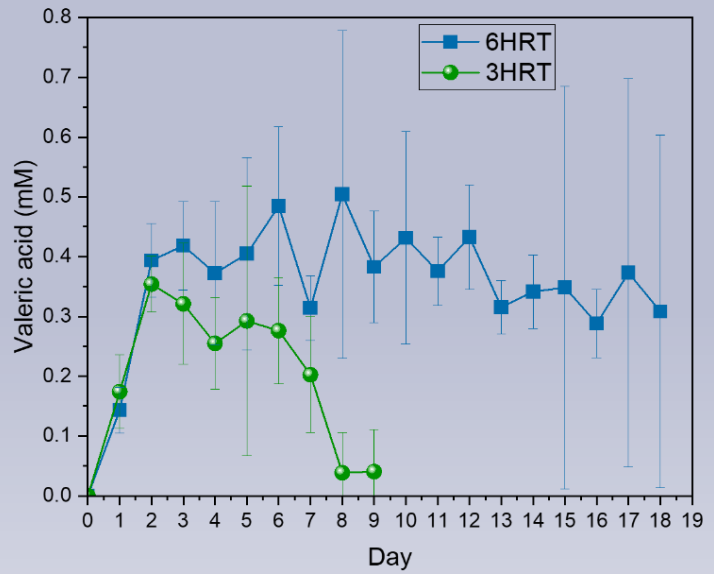
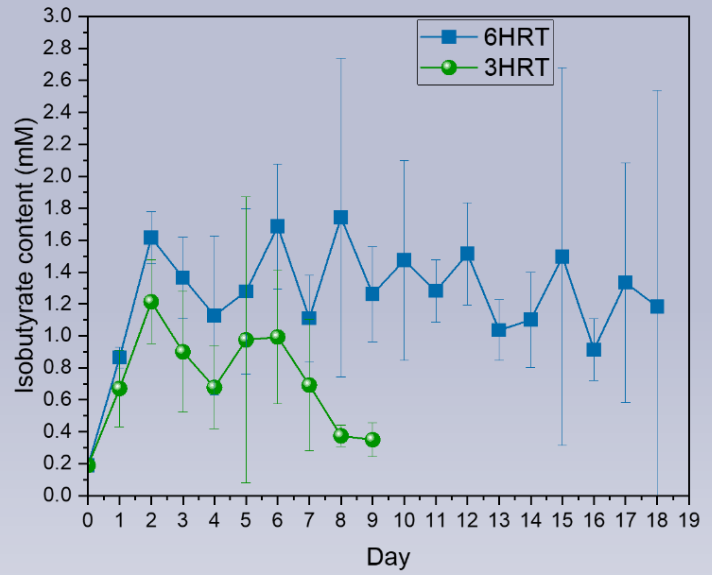
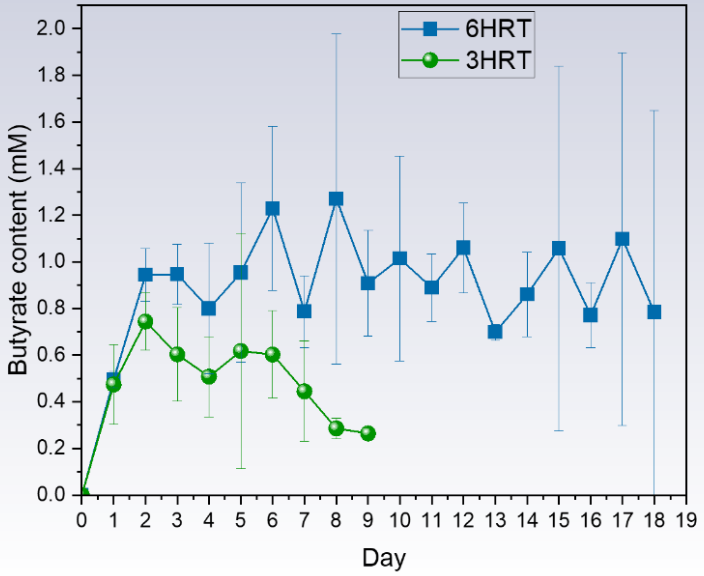
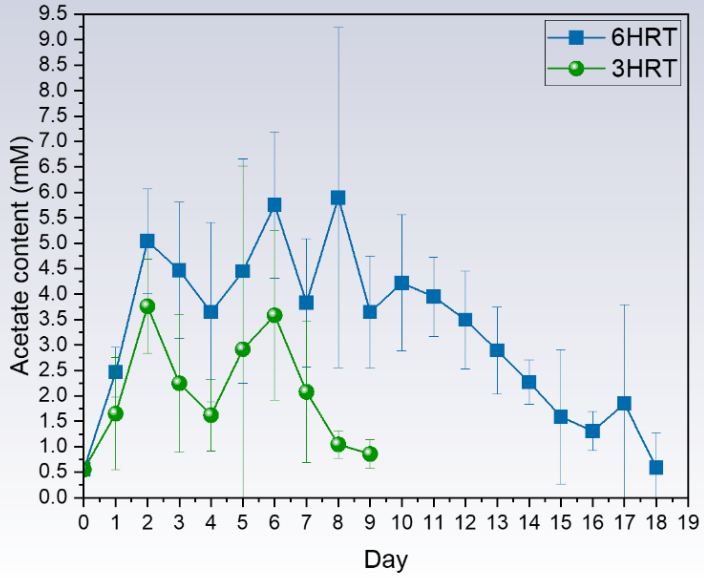
Results – Semi-reactor experiments: VFA

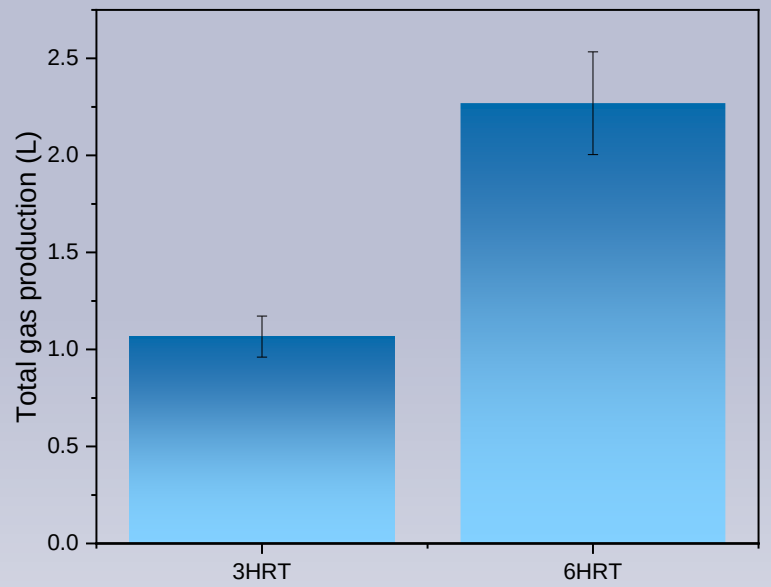


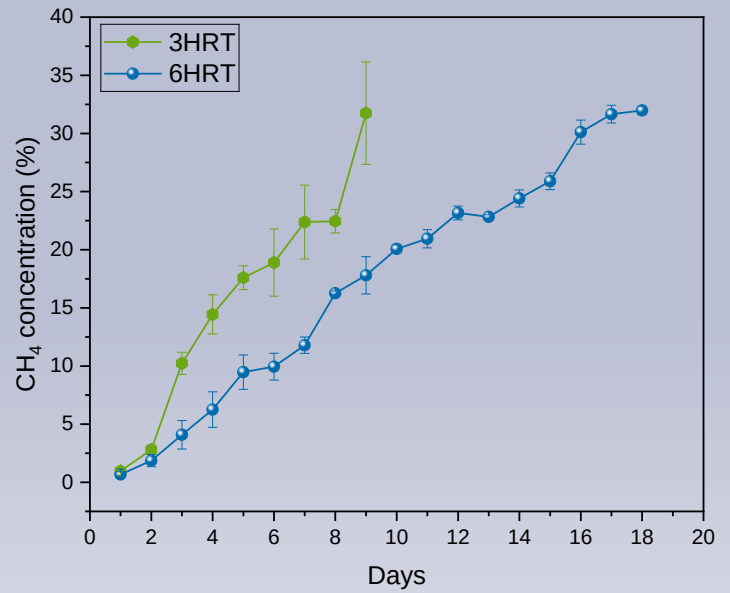


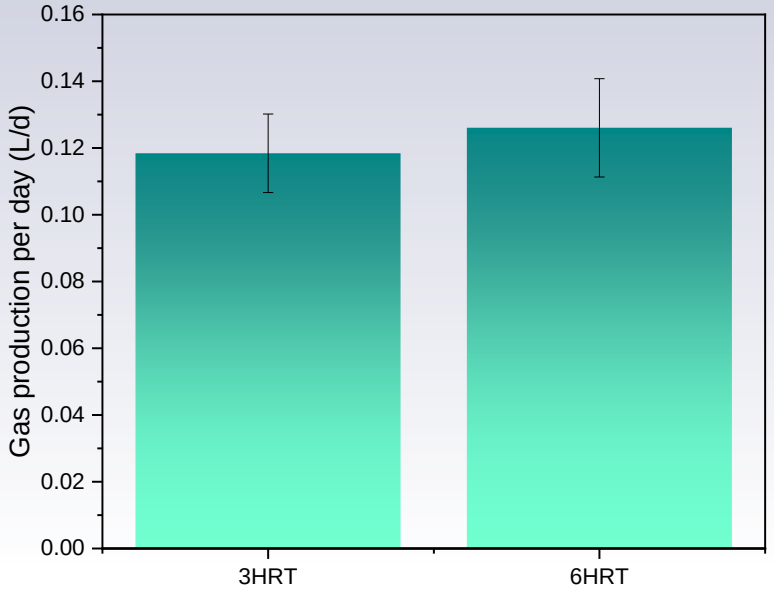


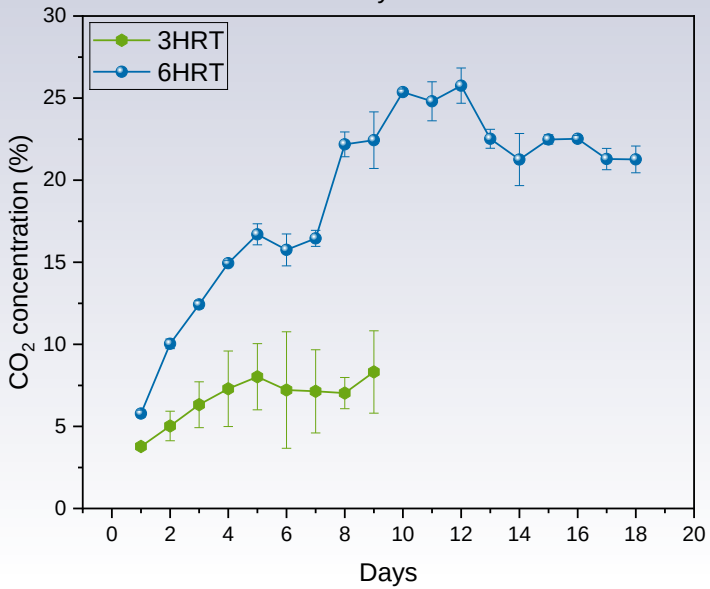


Results – Semi-reactor experiments: Gas analysis









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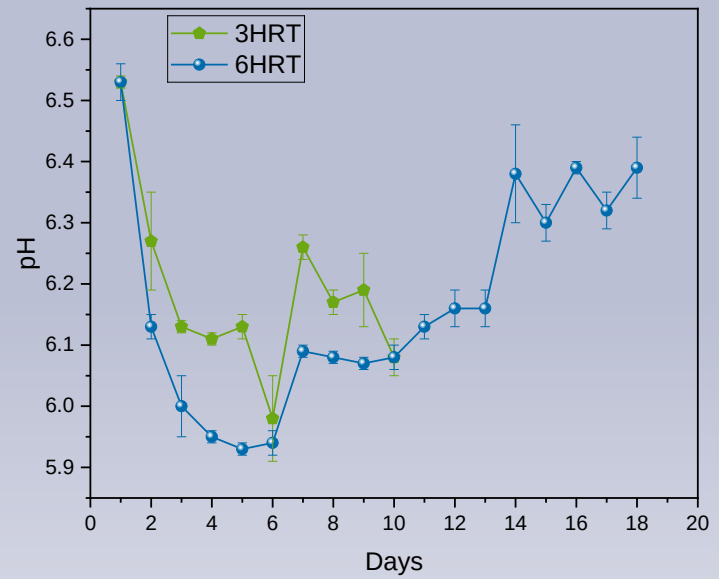
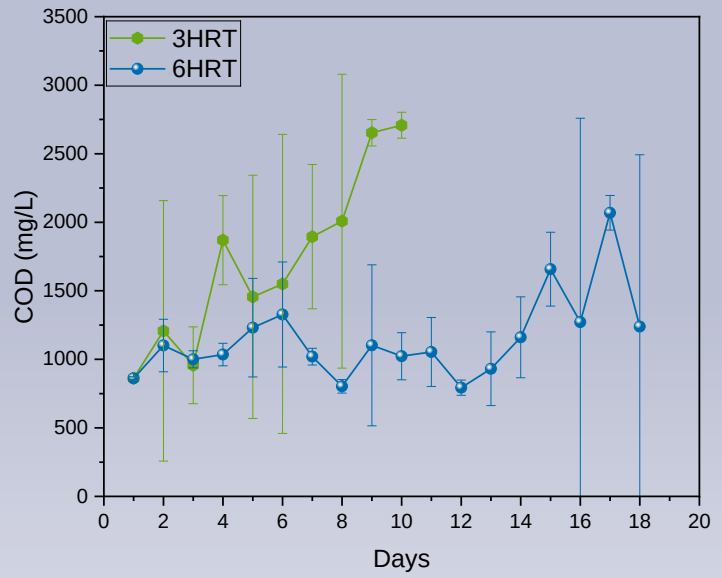
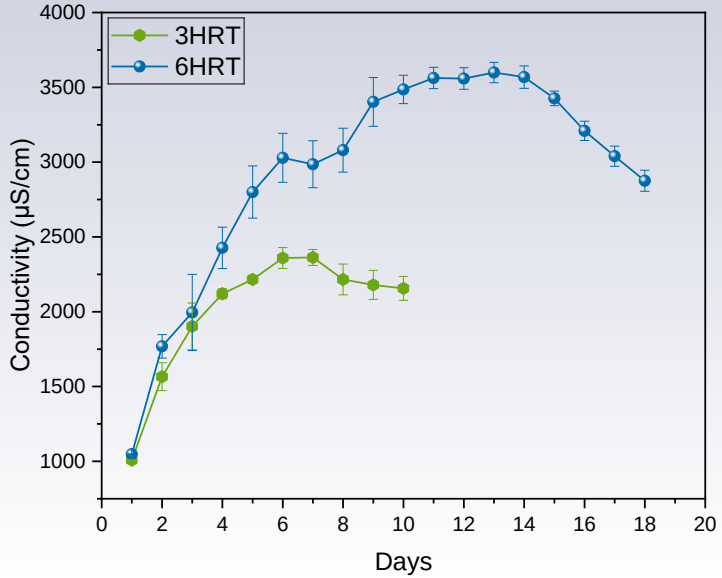
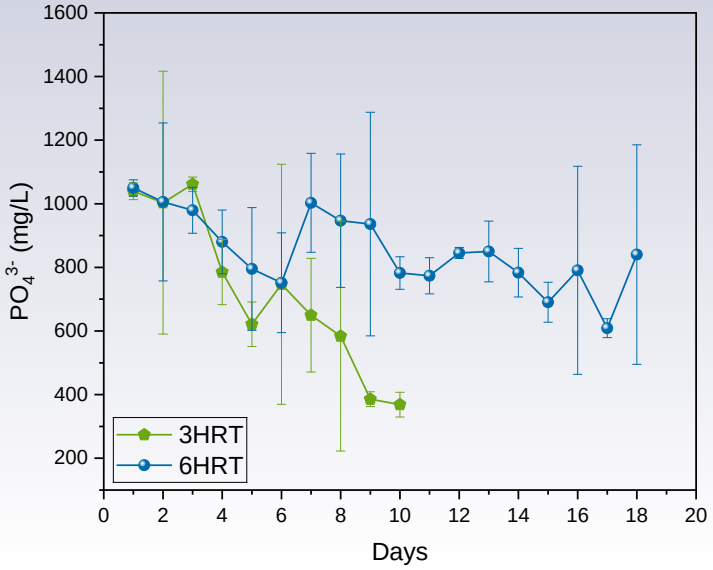
Results – Semi-reactor experiments: pH, conductivity, COD, and PO_4^{3-}









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Conclusions

- Phosphorus release from biosludge depends on hydrolysis under anaerobic conditions
- Longer retention times increased phosphorus dissolution
- Peak phosphate release observed with 6-day retention (~400 mg/d, 280 mg/g VS)
- Soluble COD did not clearly indicate hydrolysis in reactor tests
- Further studies needed with longer reactor runs to enhance hydrolysis and phosphorus release

Thank you for your attention

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