Driver and Barriers - Struvite

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GreenTile (NuReSys process)

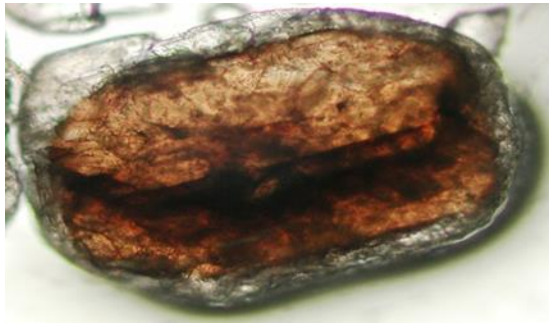
fertiplay

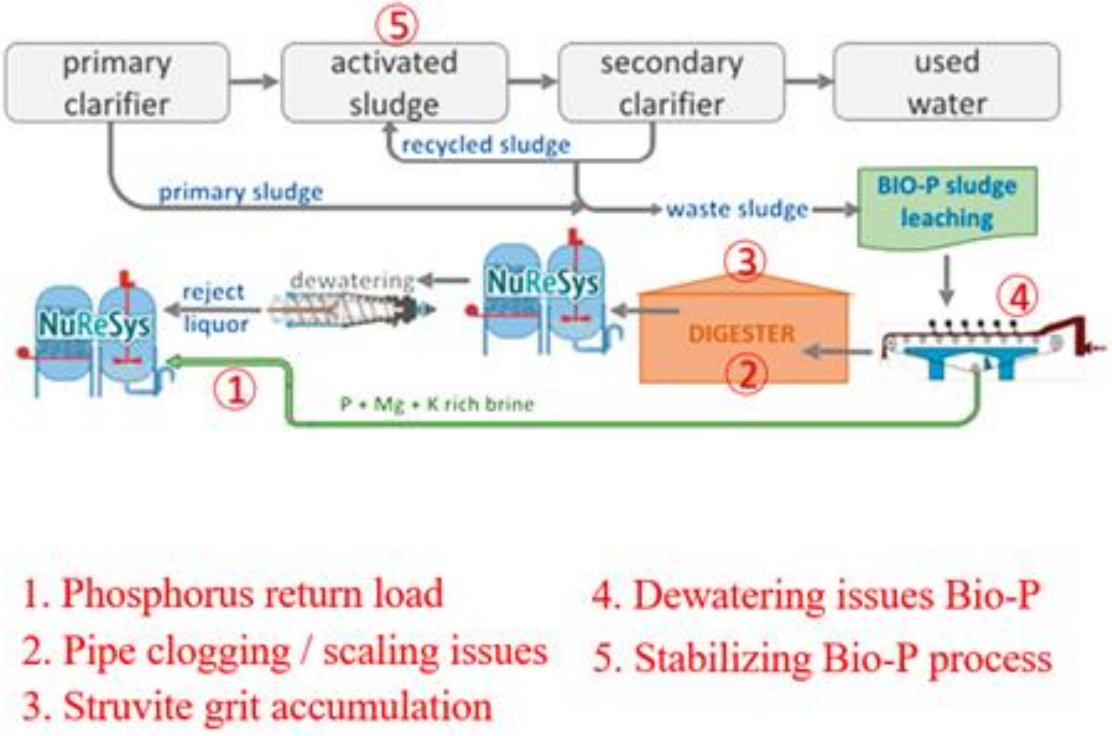
This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement N° 101060426.

Technical - Struvite (NuReSys Technology)

$NH_4MgPO_4 \cdot 6H_2O$ Poorly Watersoluble (pH > 7,0 - 8,5)
Density 1,7
Crystaline Structure

NH_4-N PO_4-P Mg^{2+} pH driven





Fertilizer properties struvite well documented
Also good Flame-redardant
Most common is $NH_4MgPO_4.6H_2O$ Less common (gaining importance) $KMgPO_4.6H_2O$

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NuReSys
recovers nature's essentials

https://www.phosphorusplatform.eu/links-and-resources/p-facts

ferplay

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Technical - Struvite (NuReSys Technology)

Technical drivers

- ✓ NuReSys technology = TRL 9
- ✓ Full-scale references in municipal and industrial wastewater treatment plants
- ✓ Business model = Integral phosphate management
  Not driven by struvite sales / optional and modular
- ✓ Recent research = struvite versus mineral = at least as good or even better

Technical barriers

- Lack of quantities per **production site** to compete with supply of conventional fertilizers = centralized solution for sales
- Variable/uneven granule size. Focus on removal of PO_4-P and not optimization of granule growth. Need for further processing for homogenization?
- Economy of scales
- Only soluble fraction of PO_4-P can be converted to struvite

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Legal - Struvite (NuReSys Technology)

Legislative drivers

- ✓ Struvite is CMC12, and PFC 1(C)(I)(a)(ii)
  (EU) 2021/2086
  Struvite recovered MWWTP and IWWTP
- ✓ Fertilizer Product Regulation for CE mark = process initiated
- ✓ Allows use in organic farming

COMMISSION DELEGATED REGULATION (EU) 2021/2086

of 5 July 2021

amending Annexes II and IV to Regulation (EU) 2019/1009 of the European Parliament and of the Council for the purpose of adding precipitated phosphate salts and derivates as a component material category in EU fertilising products

(Text with EEA relevance)

Legislative barriers

- Lack of financial incentives to use recovered fertilizer
  Competitive conventional fertilizer price
  In Germany, P in solids < 2% = P recovery encouraged
- Struvite formed within digestate = waste
  No separate recognition ≠ CMC12
  Not allowed for land spreading
- Struvite in compost = added value but no separate recognition or validation
- Struvite from manure = huge potential / manure status

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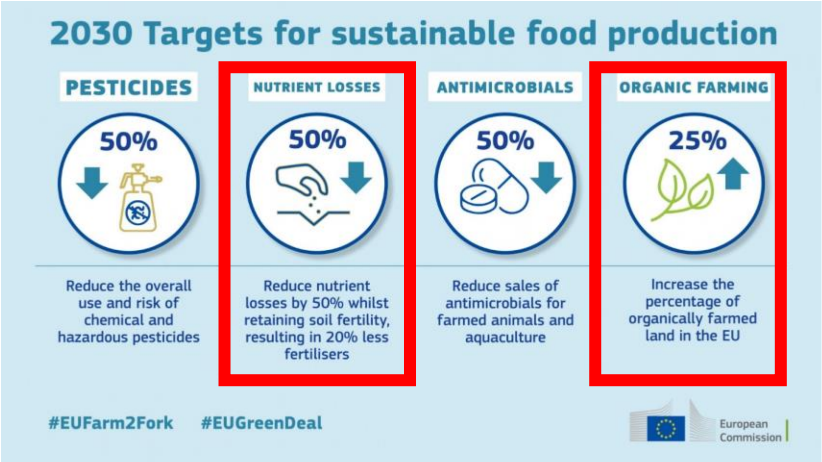
Environmental - Struvite (NuReSys Technology)

Environmental drivers

- ✓ Slow-release fertiliser = no runoff
- ✓ Phosphorus listed as critical substance EU
- ✓ EU Green deal
  Reduced GHG emission = 



Environmental barriers

- o Nutrient content not balanced
  Good P fertilizer, bad N fertilizer
  Need to be applied in combination with other fertilizers
- o Commodity rather versus pure fertilizer
- o Some specific low dosage rates (20-30 kg/ha) as precision fertilizer

Yang, Z., Ferron, L. M., Koopmans, G. F., Sievernich, A., & van Groenigen, J. W. (2023). Nitrous oxide emissions after struvite application in relation to soil P status. *Plant and Soil*, 1-15.
Wang, L., Ye, C., Gao, B., Wang, X., Li, Y., Ding, K., Li, H., Ren, K., Chen, S., Wang, W. and Ye, X., 2023. Applying struvite as a N-fertilizer to mitigate N2O emissions in agriculture: Feasibility and mechanism. Journal of Environmental Management, 330, p.117143.

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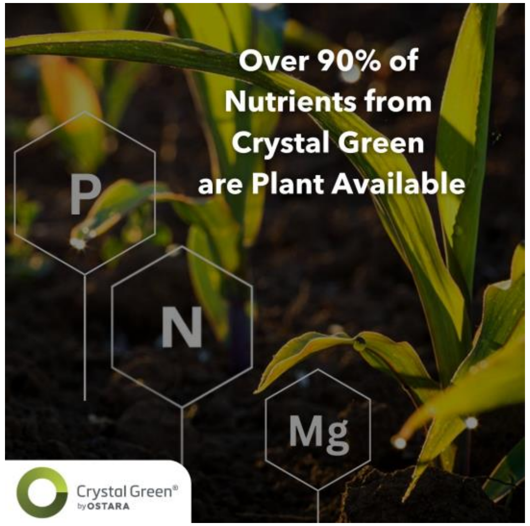
'Of the 39 operational European struvite production sites, an estimated equivalent of 1000–1250 tons P is available that meets legal requirements'

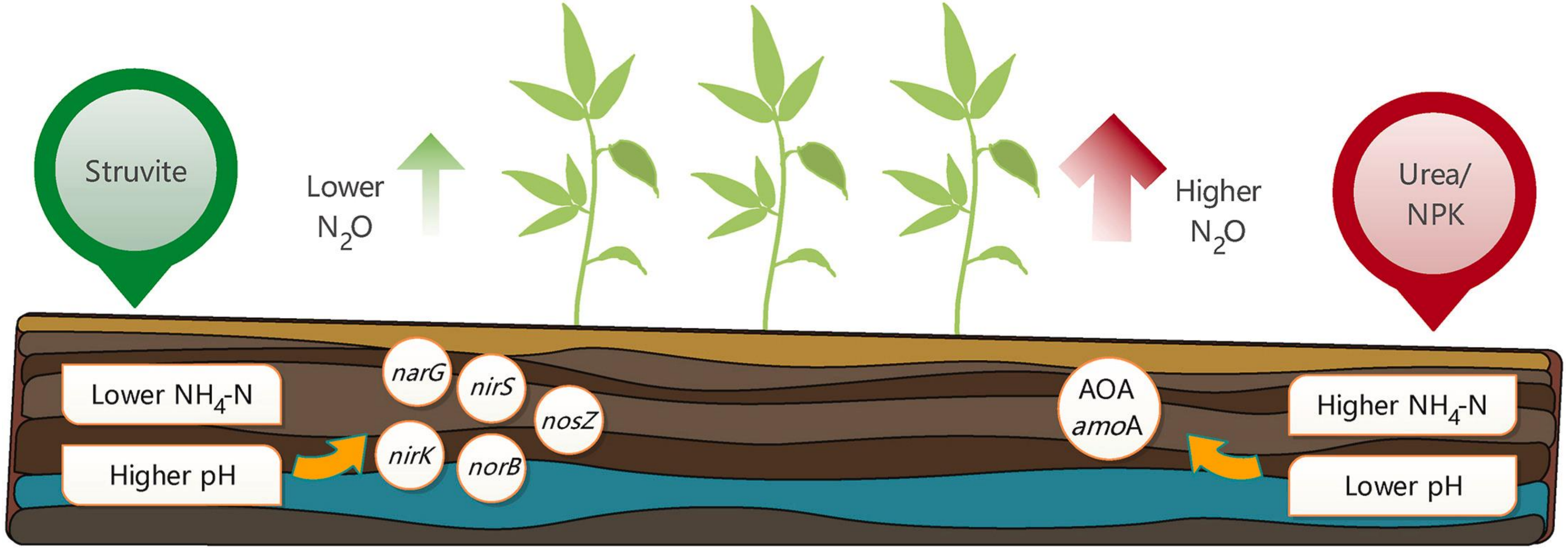
'This corresponds to 0.5% of the total P theoretically contained in EU wastewater or 0.06–0.07% of the EU P imported for fertilizer use in 2017'

'Assuming a maximum struvite recovery efficiency of 43%, this would supply about 13% of the P-fertilizer demand in the EU'

Abstract

Nitrous oxide (N_2O) is an effective ozone-depleting substance and an important greenhouse gas in the atmosphere. Fertilization is a major factor that dictates agricultural N_2O emissions. In this work, as opposed to the commonly-seen highly-soluble nitrogen (N) fertilizers, the feasibility of using struvite as a slow-releasing N-fertilizer and its mechanism for mitigating N_2O emissions were investigated. During the 149-d field cultivation of water spinach (Ipomoea Aquatica Forsk), struvite exhibited comparable crop yields, with a 40.8–58.1% N_2O reduction compared with commercial fertilizers. In addition, struvite fertilization increased soil bacterial diversity and denitrification genes levels (*narG*, *nirS*, *nirK*, *norB* and *nosZ*) effectively, but decreased nitrification genes contents (*amoA*). By conducting partial least-square path modeling, it was found that the use of struvite would satisfy the soil N control and pH regulation, which altered N-





https://www.sciencedirect.com/science/article/abs/pii/S0301479722027165

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Social - Struvite (NuReSys Technology)

Social drivers

- ✓ Biobased product, allowed in organic farming

Social barriers

- End users only happy to use recovered products from food waste industry
  Assumed 'safe'
- Reluctantcy to use product from MWWTP origin

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SWOT Analysis

STRENGTHS

- Slow release
- TRL9
- Low GHGs emissions
- Diversity of technology application

WEAKNESS

- Sub-optimal NPK
- Only PO4-P recovered as Struvite

OPPORTUNITIES

- EU Green deal
- Potential to replace P imports
- Struvite recovery from manure
- K-struvite

THREATS

- Production quantities
- Superior/ranked P recovery technology
- Competitive conventional fertiliser price

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“Struvite technology is a mature process with high potential combining solving P related issues with recovery of high grade and multi-functional end product”

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Bio-Stru®

Sustainable Circular Fertilizer

Thank you for your attention

Contact
aa@nuresys.com
www.nuresys.com

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