NPHarvest

Calcium based P recovery process as a pre-treatment for N recovery

PERM5

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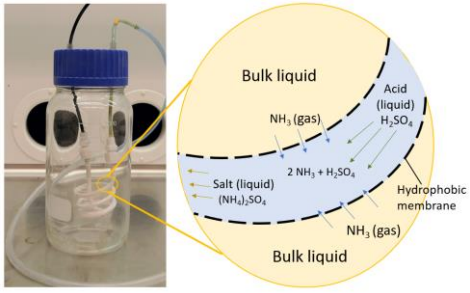
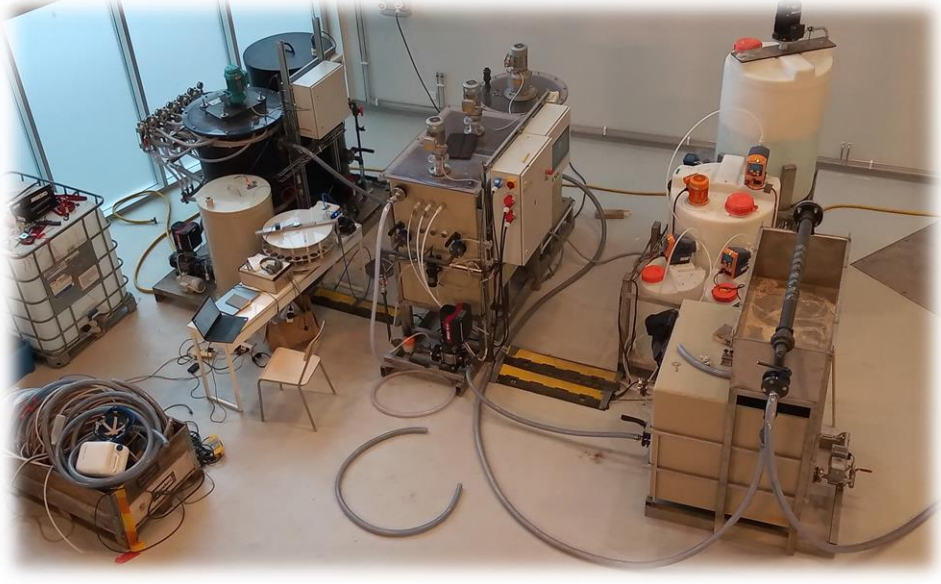
What is NPHarvest?



- **Initially N recovery process**
  - PTFE membranes
- **P recovery came along with pretreatment**
  - Some wastewaters have too high SS for membranes
- **Now we are functional and almost fully optimized process**
  - N and P from liquid waste flows



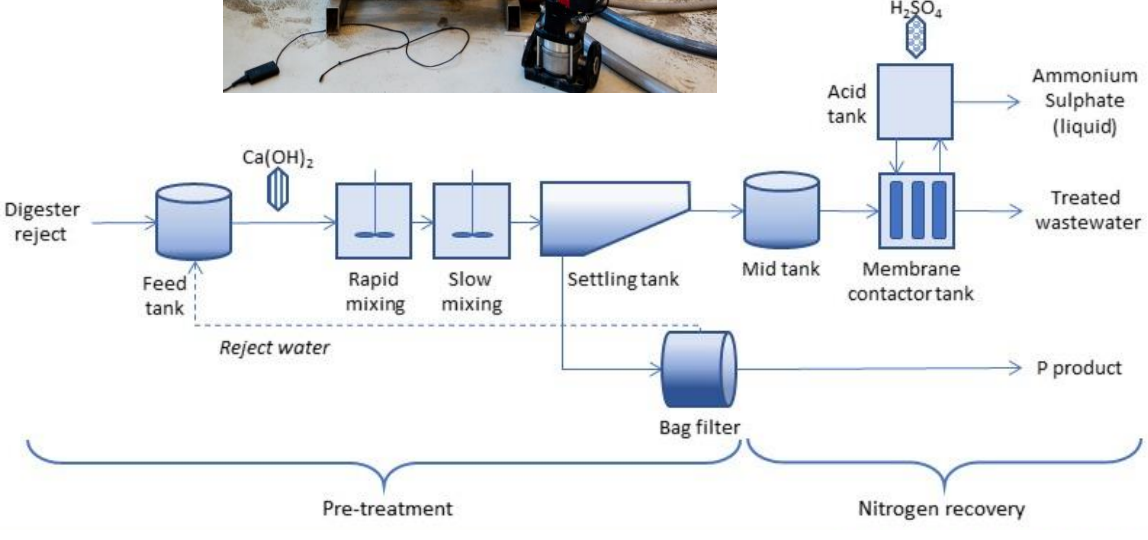
The process

N: membrane stripping

- Low energy consumption
- Contactor design tolerates high SS (up to 500 mgSS/l)
- Recovery efficiency 70-80%
    - Aim to 90+%

P: lime based ballasted sedimentation

- Ca precipitates P and SS
- P recovery efficiency 90+%
- Other chemicals are possible if necessary
- Lime kiln dust (LKD) make flocs heavy
    - Compact settler



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Products

N: Pure ammonia salt

- Ammonium sulfate 20% N
- Alternative salt (nitrate and phosphate)
- Falls under EU fertilizer legislation CMC 15

P-product:

- Hygienic (high pH)
- 1-3% P, 8% Ca, 10% C
- Some of the undesired pollutants may ecape with P-Ca product

In our tests both products have

- Low heavy metal content
- Low emerging pollutant content
    - However, the wastewater has also been low in pollutant content to begin with

Ca-P product deeper analysis

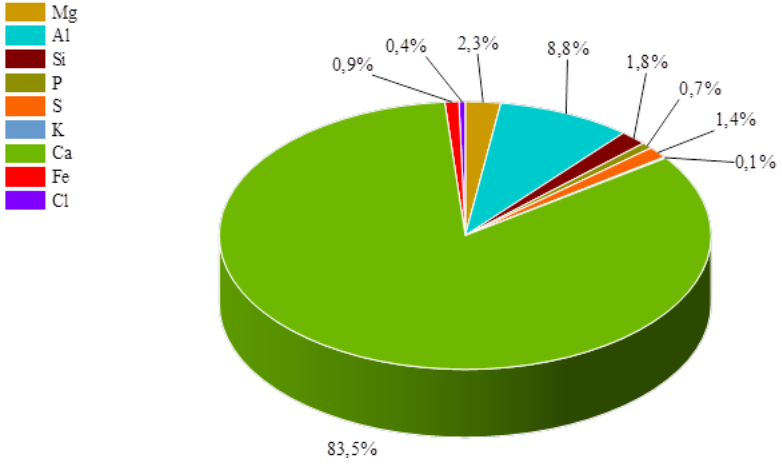
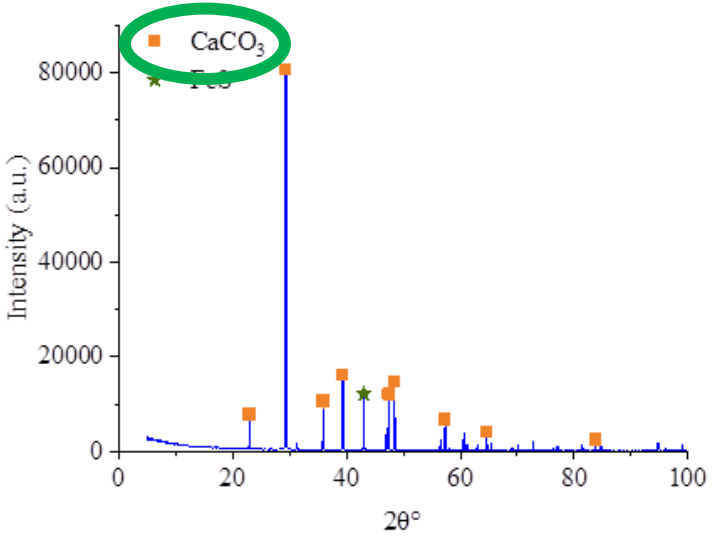


Table 7: Elemental analysis of sludge samples

Elements	PAX/polymer sludge	Starch sludge
Nitrogen (%)	0.65	0.72
Hydrogen (%)	0.91	0.94
Carbon (%)	13.13	14.6



The Future

Commercialization!

- **Final research items**
  - Contactor efficiency up
  - Ammonia salt concentration options
- **Business investigation**
  - How to build a successful commercial enterprise

Long term

- **A screaming need for nutrients**
  - Provide economic pathway for recycled nutrients in 2–3-year timeframe
- **Vision is a society where nutrients are efficiently reused – together!**

Thank you!