Harvesting and valorization cellulose from municipal wastewater

EIP-Water ARREAU workshop Leeuwarden, 09-02-2016
Harvesting cellulose

- **Applying a finescreen**
  - several plants in operation in eg. Netherlands, Norway, Denmark, Poland and Hungary.
  - product is cellulose, contaminated with hair, organics, etc. to be upgraded

- **From primary sludge**
  - In the development phase (not in operation);
  - Objective is more or less clean cellulose

- **From return activated sludge**
  - In the idea phase.
Processing routes

MBR
Impact on downstream processes of an MBR

Waterboard
Screening toilet paper/cellulose from sewage, using finescreen

Consumer
Toilet paper sewer system

Cellu2PLA
Use cellulose as carbon source
Production of PLA
Production of PHA
Pyrolyses

Use cellulose as fiber
Optimisation sludge dewatering

Use cellulose as fiber
Processing in asphalt

Scieencap
Impact on downstream processes

incontinence pads and diapers
WwTP Ulrum
Preliminary results

- **Capacity** 80 m$^3$/h (40 to 110 m$^3$/h)
  TSS 196 mg/l (30 to 625 mg/l)
  Excess sludge average of 2 - 4 m$^3$/h (1.3-2.7 g/l)

- **Efficiency**
  - 62% of TSS (up 80%). - Without sludge
  - 52% removal TSS + sludge (max. 92%)

- **Dewatering without adding sludge:**
  - first dewatering 21% DS (max. 27%)
  - second dewatering 39% DS (max. 53%)
Preliminary results

- **Dewatering with the addition of sludge:**
  - first dewatering 8% SDS (max. 16%)
  - second dewatering 15% DS (max. 23%)

- **Dosage polyelectrolyte:**
  - dosage of excess sludge > flocculation > conditioned sludge > influent fine sieve
  - range during tests 2.5 - 16 g active PE / kg DM
  - optimum of 6-8 g PE / kg DM.

- **Small scale tests**
  - without the addition of cellulose: 20% DS
  - with the addition of cellulose sludge (1: 1 on the basis of DS): 30%
Project partners

This project is co-funded by “Samenwerkingsverband Noord Nederland, the Provinces of Drenthe, Fryslân and Groningen through a subsidy under “Pieken in de Delta, Koers Noord”.

---

[Project logos and affiliations]
WwTP Beemster

Capacity: 170,000 ve
DWF: 1,860 m³/h
FFT: 3,600 m³/h

Screenings 770 ton Ds/y
Small scale tests

**Conclusions**

1. Conversion of screenings to glucose using enzymes is possible
2. The conversion of produced glucose to lactic acid is comparable to use of standard sugars
The research phase of this project was co-funded by the "Rijksdienst voor Ondernemend Nederland (RVO), through a subsidy under the TKI-BBE.

The demonstration phase of this project is co-funded by the European commission, through a subsidy under the LIFE+.
WwTP Aarle-Rixtel

- Long-term research of impact of finescreens on downstream processes
- Construction started January 2016
- Start-up July, 2016
Project partners

This project is co-funded by the European commission, through a subsidy under the Eco-Innovation.
Recovery of cellulose from screenings
The research phase of this project was co-funded by the “Samenwerkingsverband Noord Nederland and the Province of Groningen, through a subsidy under I.A.G-4."
Flash pyrolysis of screenings

Production of
- Carbon;
- Oil
- Fatty acids
- Hydrogen gas
Status valorization of cellulose

- Several research projects show that technically every hurdle can be taken;
- Some large scale demonstration projects are under construction but more appealing projects are required;
- Valorization of cellulose is still too much an activity of the water sector;
- The public perception of resources from raw sewage has to change – focus on social psychology;
How should cellulose be offered to the market

- Technical - What should waterboard do or not do by itself;
- How to fit a variety of valorizing techniques in tender procedures;
- When is a technology sustainable and how do you value that?
So far! Any questions?

"We cannot solve our problems with the same thinking we used when we created them"

- Albert Einstein -