CIE4485
Wastewater Treatment

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Guestlecture

3. Sieving the wastewater

TU Delft

Sieving the wastewater

Recovery of cellulose

15 november 2011

waternet

Content

Introduction

Full scale sieve installation wwtp Blaricum

- **Project Blaricum**
- **Removal and degradation of cellulose fibers**
- **What to do with the recovered fibres?**
- **Results 2011**

Conclusion

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- Wastewater consist of many components.
- Toiletpaper is a large fraction of the suspended solids

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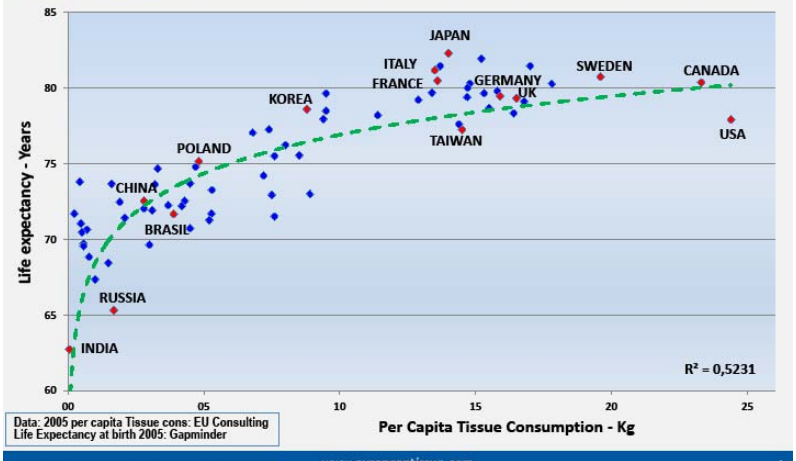
Comparison Tissue Consumption - - Life expectancy



Data: 2005 per capita Tissue cons: EU Consulting
Life Expectancy at birth 2005: Gapminder

www.europeantissue.com 1

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- Wastewater consist of many components.
- Toiletpaper is a large fraction of the suspended solids

- No literature about degradation of toilet paper?
- Recover toilet paper out of the influent?
- Why sieves? Many alternatives like DAF, flocculation, membranes, lamella etc

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Sieve plants; Noorwegen

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salsnes filter

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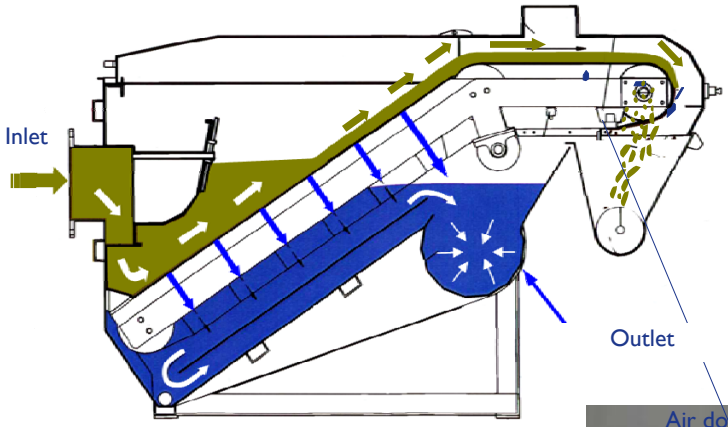
Process description



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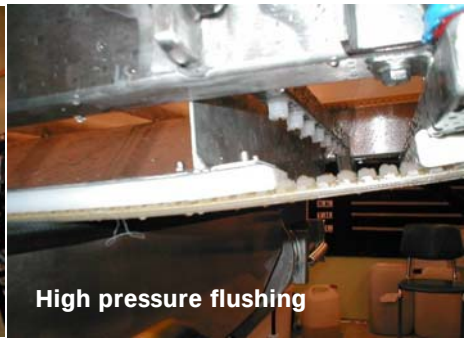

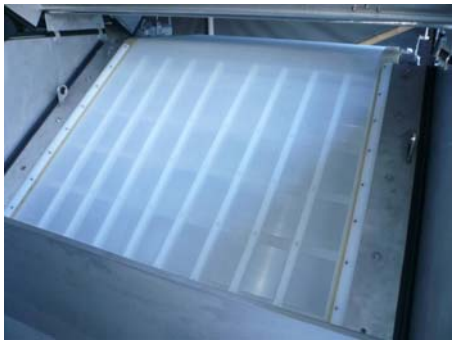

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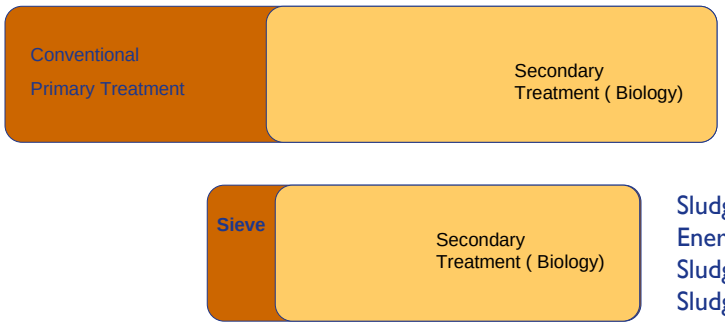
Why is is so interesting?
Footprint
Sievings 25% ds versus primary sludge 5% ds
Removing inert COD?



Sludge production
Energy
Sludge handling
Sludge transport

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Full scale sieve installation wwtp Blaricum

- **Project Blaricum**
- Removal and degradation of cellulose fibers
- Results 2011

Conclusion

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Research location WWTP Blaricum
2008 – 2009
Waternet, Stowa, TU-Delft

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Project WWTP Blaricum, January 2011

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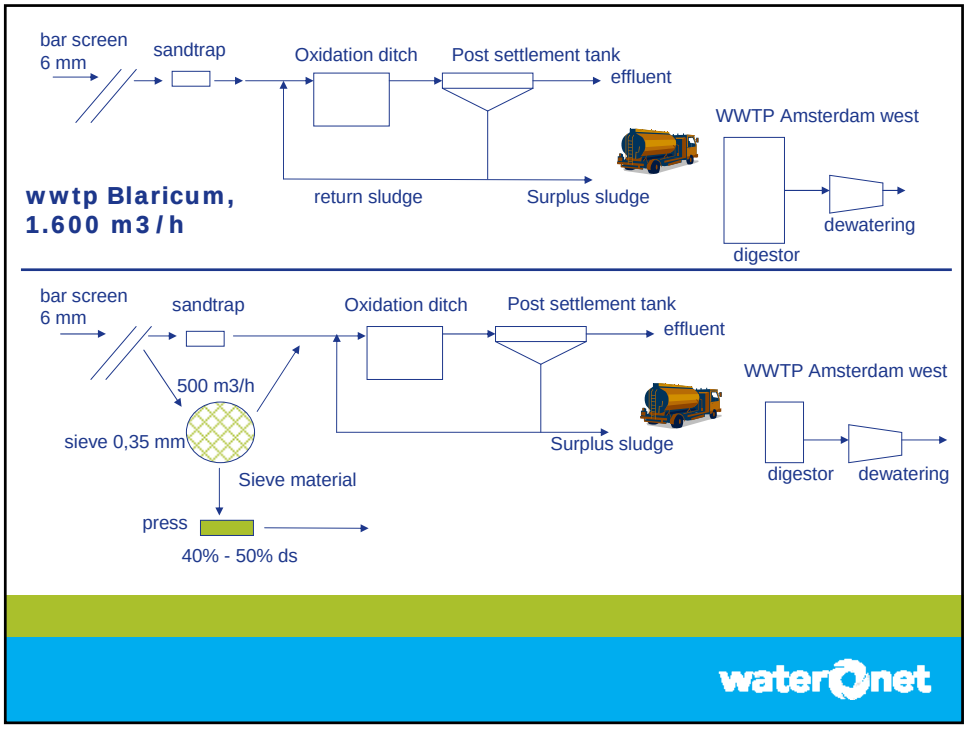

Goal research wwtp Blaricum

1. Improvement in costs & energy
2. Alternative for pre settler?
3. Effects on biological process & sludge treatment
4. Processing of the sieving material
5. Model the biological proces

Sieving the wastewaterSieving the wastewater

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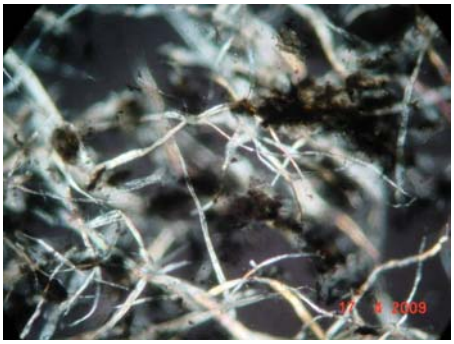
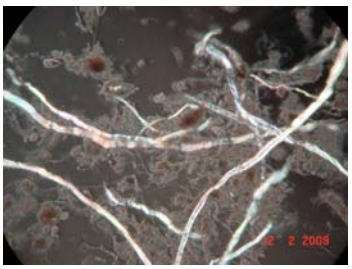
Primary sludge

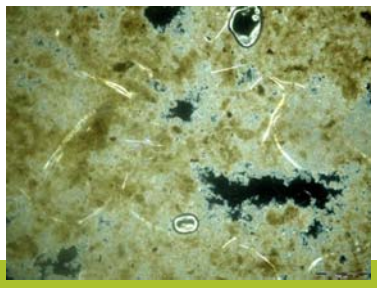
60x



60x

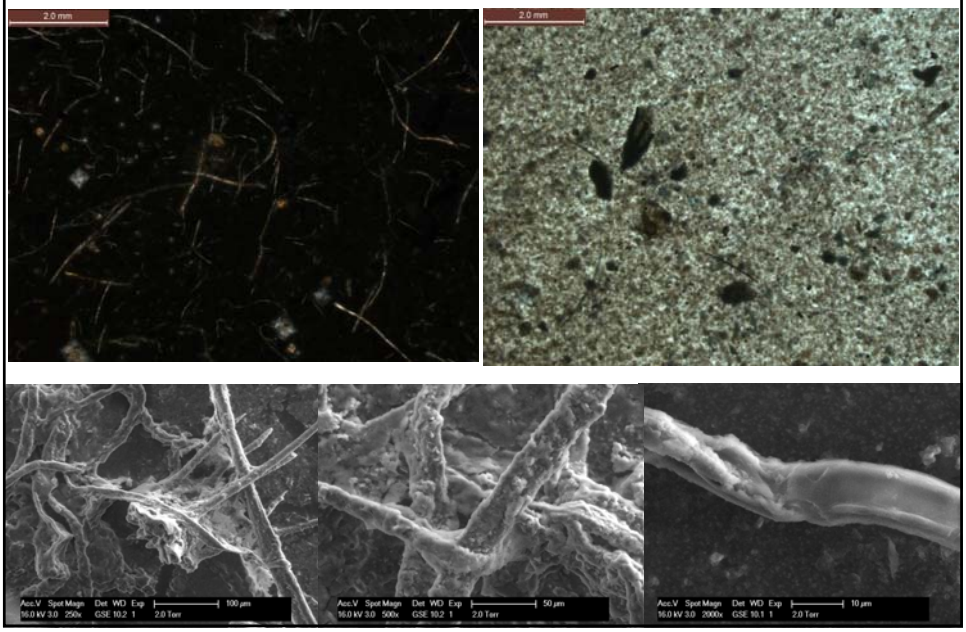
Activated sludge

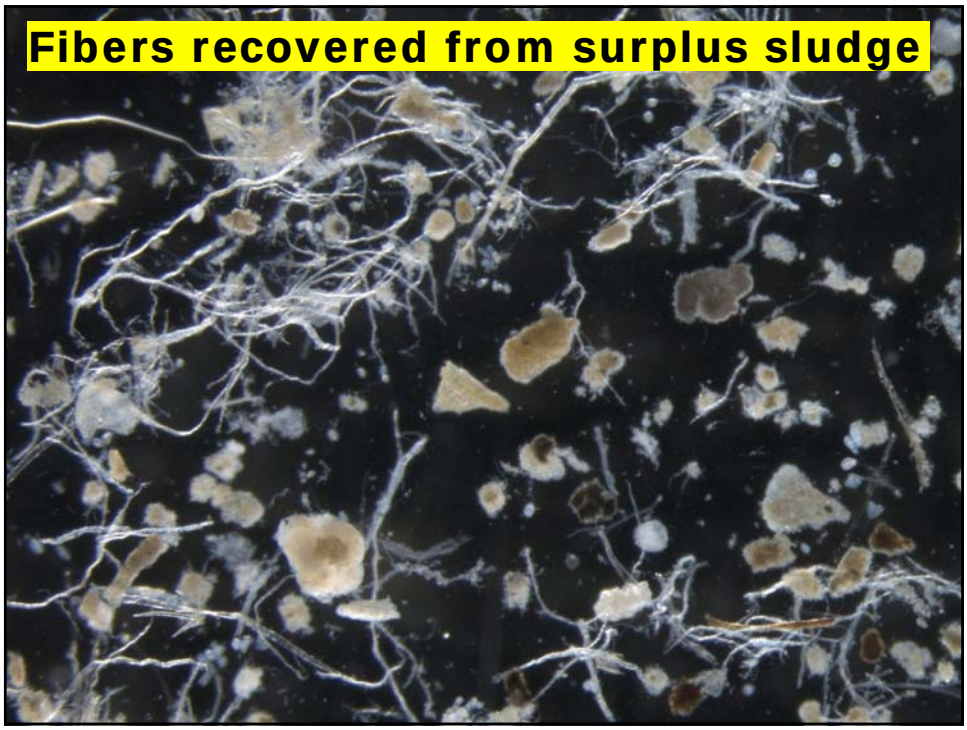




Digested sludge

Same results different wwtp's, 20 or 30 days retention time





Mass balance sludge wwtp, Winter

Degradation cellulose
Winter 10%, Summer 50%

Influent
180 kg COD
100 kg SS inclusing
30 kg cellulose

AT 20 d

Out Surplus sludge
(**0,4** x COD = kgds)
appr 72 kg ds
•18 kg ashes (24%)
•27 kg sludge
•27 kg cellulose

Effluent
2 kg COD
0 kg cellulose

In
25% degrad total surplus.
•Sludge (20% / 0%)
•Cellulose (48% / 70%)

Digester Mesofilic
20 d

Out
54 kg ds total
•18 kg ashes
•22 / 28 kg sludge
•14 / 8 kg cellulose (26%)

Batch test	pH	oC	Type fibre	Rem. %	days
Anaerobic	7.0	30	Toilet paper from recycled paper	100	8

Measuring cellulose fibres

wastewater characterisation and

modelling studies

In influent, sieving material, primary sludge, activated sludge, digested sludge

E. FRIEDLER *et al.*

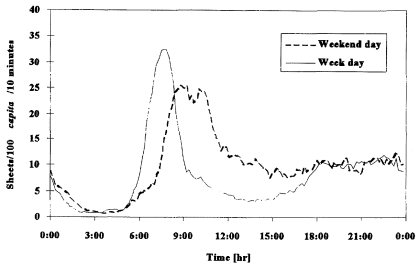


Figure 2. Diurnal pattern of toilet paper disposal *via* the WC.

In modelling of activated sludge (ASM models) slowly degradable and inert COD is used. A considerable part of the inert COD will consist of toilet paper.

Updegraff (1969)
Fibre analyses based on van Soest (1991).
Thermografic analyses
Near Infrared Light (NIR)
Image analyses

Movie

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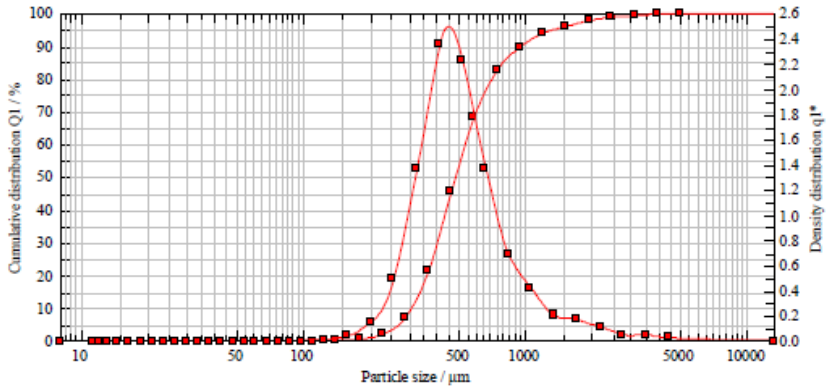
Image analyses

QICPIC (QP0025) & LIXELL, 1.00 63.0 mm - M7 (10...3410µm)
Paper slurrie **2012-10-03, 15:08:03,328**
WARNING: Not enough coarse particles for Miles-Lantuejoul correction.
x_{10} = 302,46 µm x_{50} = 486,08 µm x_{90} = 962,72 µm
x_{16} = 335,29 µm x_{84} = 782,61 µm x_{99} = 2734,79 µm

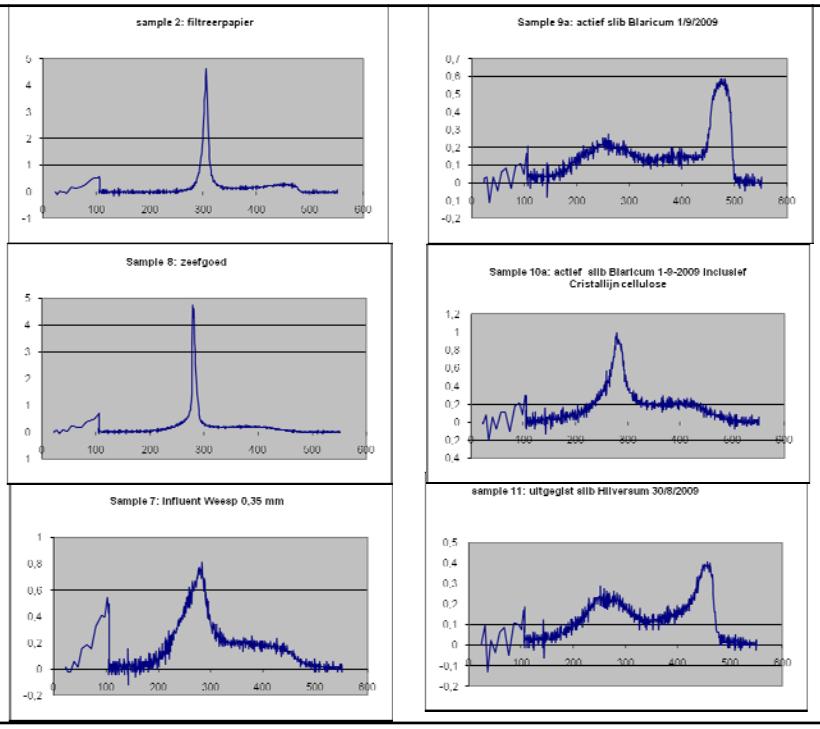


comment:

B : L = < 0,1

user parameters:
user: Waternet
Customer: HvdM
sample nr: AT 1:20 exact lens M7 1:1

TGA



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- **Results 2011**

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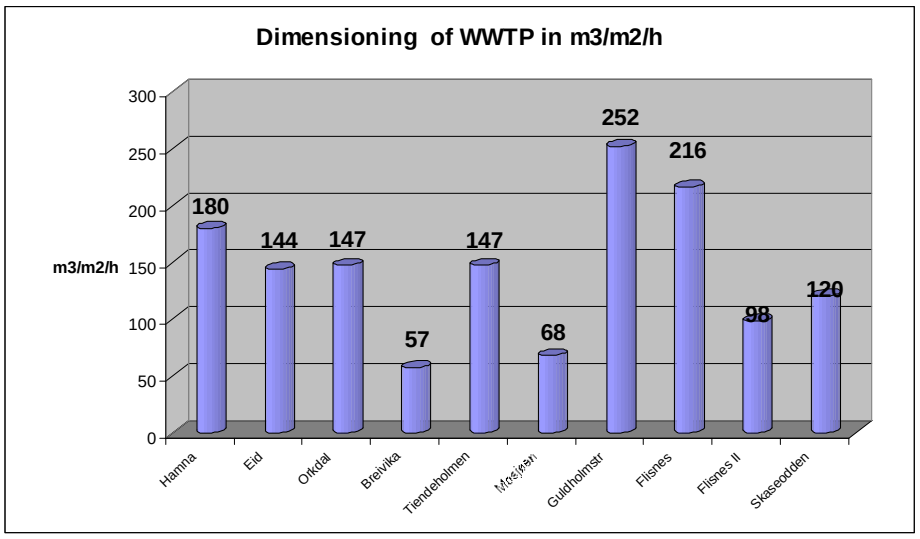
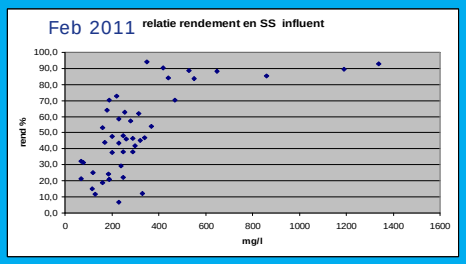


Blaricum 200 – 60 m3/m2.h

Removal efficiency sieve

sieve rate 50 – 100 $m^3/m^2.h$

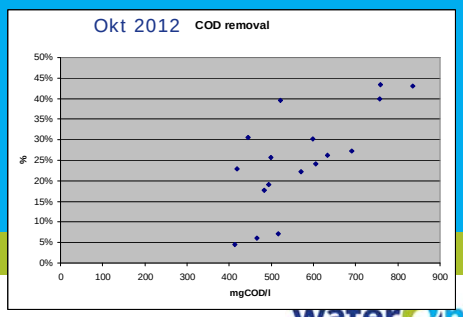
SS average 50%
CZV average 35%



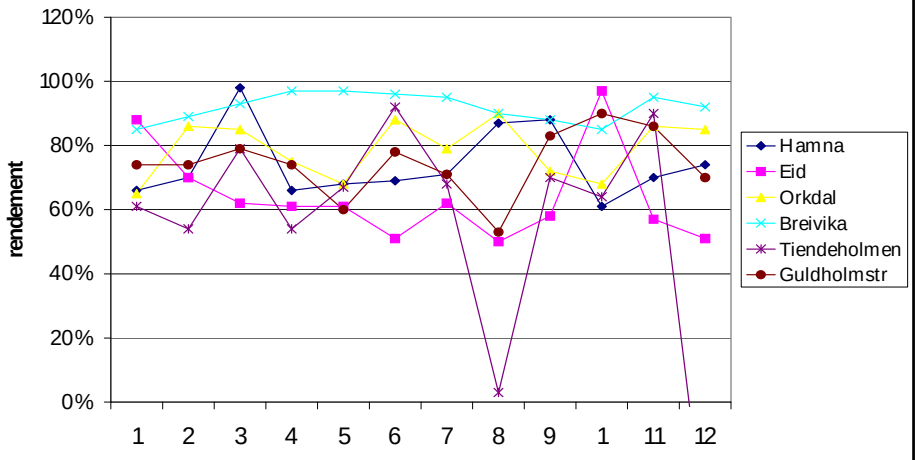
Sieve rate 100 – 200 $m^3/m^2.h$

SS average nb
CZV average 25%

€ Pay back period?



Experiences Salsnes SS removal



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DATA VAN NOORSE RWZI'S (BRON: SALSNES INTERNE BEDRIJFSDOCUMENTATIE)

	hydraulische zeefbelasting [m³/m².h]	CZV influent gemiddeld [mg/l]	BZV influent gemiddeld [mg/l]	SS influent gemiddeld [mg/l]
Hamma	180	N/A	430	348
Eid	288	N/A	364	365
Orkdal	98	705	367	436
Breivika	168	1461	356	784
Tiendeholmen	98	558	278	369
Guldholmstr	252	N/A	328	330
Blaricum:	200	441	177	242

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Sieving material

- >70% cellulose fibre (toilet paper)

Paper industry

- Possible to produce paper again
- total volume NL: 5% total paper
- Imago/hygiëne ‘no go’

Isolation material houses

- Smell and contaminents

Bioplastic lactic acid

- Possible
- Smell, microbes and image problems

Roads

- Roads: afdruipremmers
- Water percentage and
- contaminents

KNN

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Full scale sieve installation wwtp Blaricum

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Conclusions

- Promising technology
- At wwtp Blaricum cost effective?
- Reduced aeration energy?
- Removal efficiency comparable to pre settling tank?
- Reuse options for the sieving material promising

- Surplus sludge production with sieve? (removal of inert COD)
- Degradation % in digester?