


CIE4485

Wastewater Treatment

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4. Research on MBR sludge filterability at MBR Terneuzen





Research on MBR sludge filterability at MBR Terneuzen

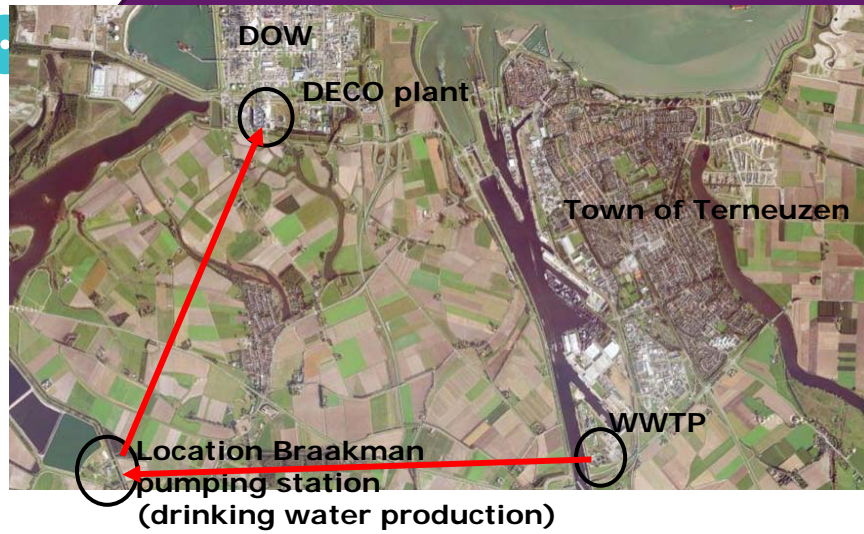
Maria Ferreira - Evides



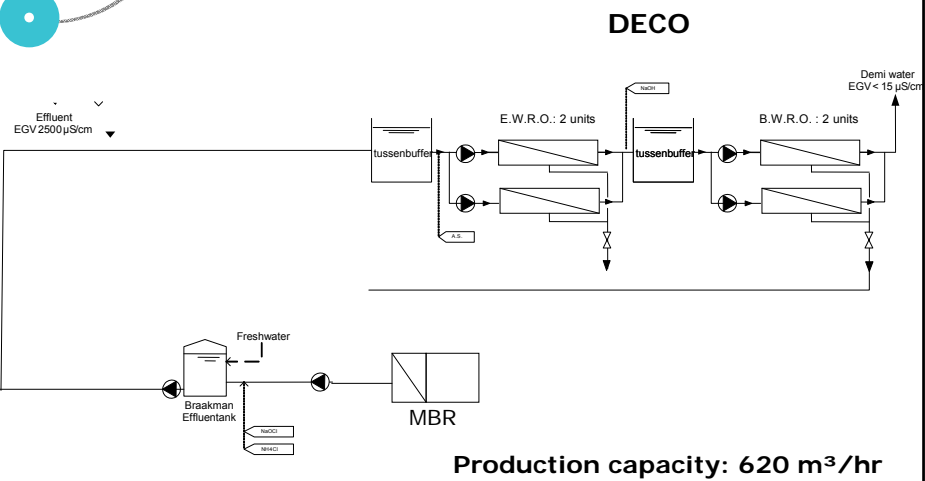
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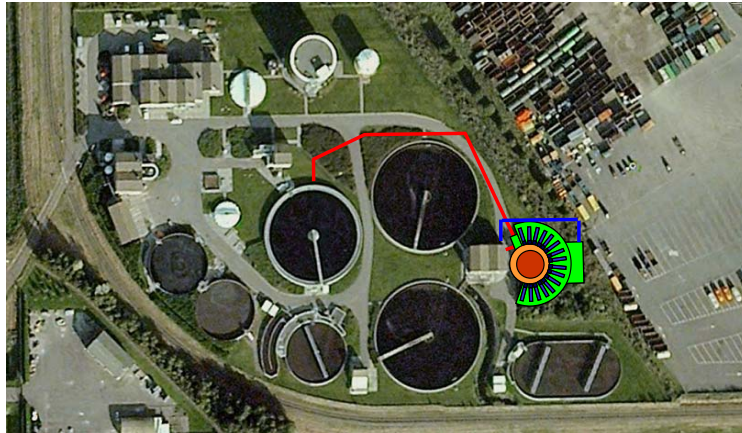
Introduction- MBR Terneuzen



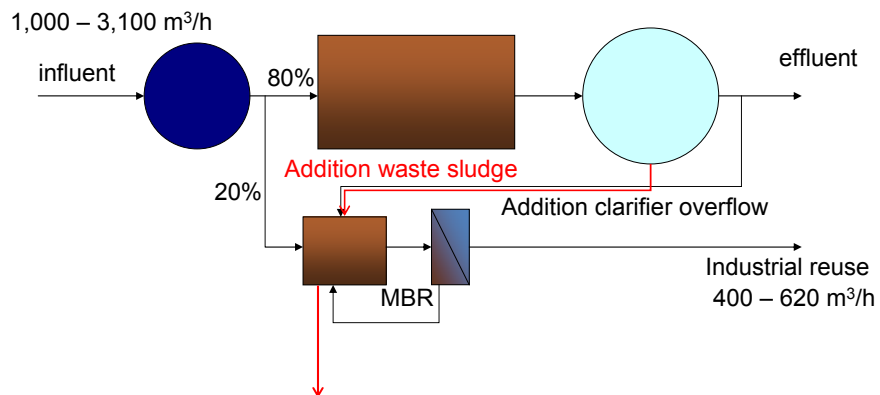
Introduction- MBR Terneuzen



Introduction- MBR Terneuzen



Introduction- MBR Terneuzen



Introduction- MBR Terneuzen

MBR		Terneuzen (The Netherlands)
Population equivalent	-	15,500
Location of the membranes	-	External (Side-stream)
Membrane supplier	-	Pentair (X-flow)
Membrane pore size	µm	0.045 (...)
Total membrane area	m ²	13,860
Volume biological tanks	m ³	784 (aerobic) 652 (anoxic)
Flux (average operation)	L/m ² .h	25-40
MLSS	g/L	8
Sludge age	d	± 20
Cleaning	-	Mechanical and chemical

Introduction-MBR Terneuzen

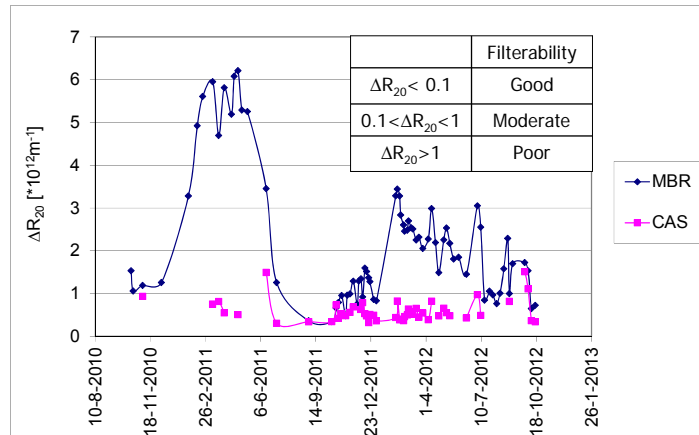


Introduction- MBR terneuzen



Introduction- MBR Terneuzen

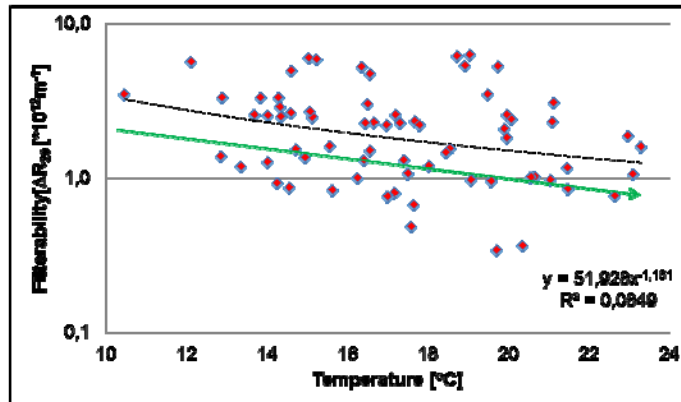




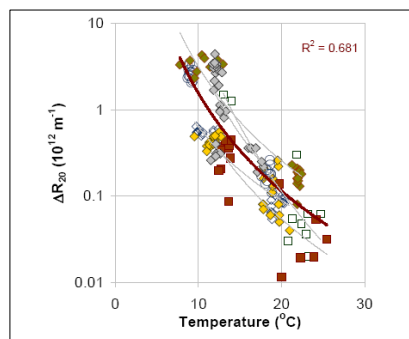
Factors affecting filterability:

- a. Temperature
- b. Substrate
- c. Sludge coagulants
- d. Influent composition
- e. Effluent addition
- f. Mechanical stress

Filterability and temperature

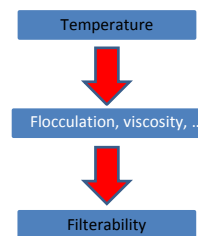


Filterability and temperature



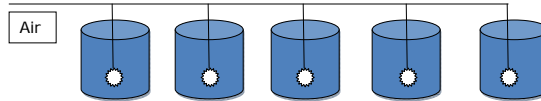
Filterability and temperature in 7 full-scale MBRs (6 with submerged membranes, 1 with side-stream membranes) [Moreau, 2011]

- Relation between filterability and temperature is overall accepted.
- Temperature has an indirect effect on filterability



Filterability and substrate

Batch tests (long term: 4 days)

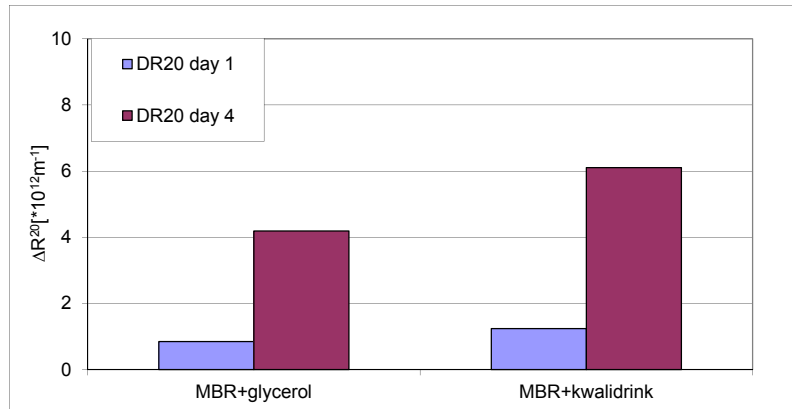


	Flow-Proportional to real MBR situation	Flow-Applied in the substrate batch tests	F/M –Applied in the substrate batch tests [g BOD ₅ /gMLSS.d]	
			Day 1	Day 2 and Day 3
Glycerol	0.25 mL/d	0.25 L/d	1.07	0.24
Kwalidrink	2 mL/d	2 L/d	2.1	0.54

Filterability and substrate

Batch tests: long term (MBR Terneuzen)

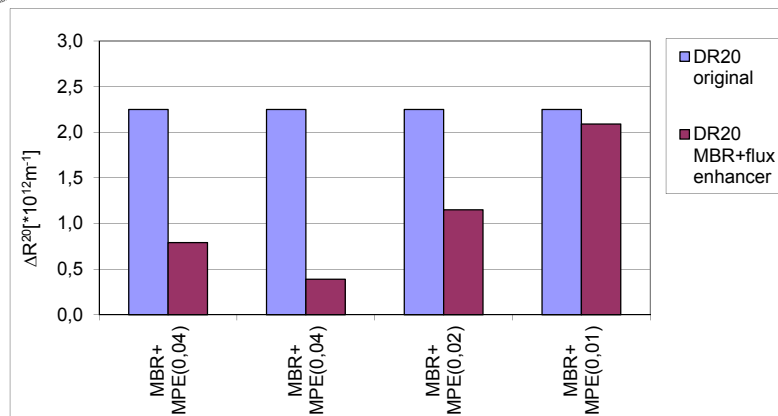
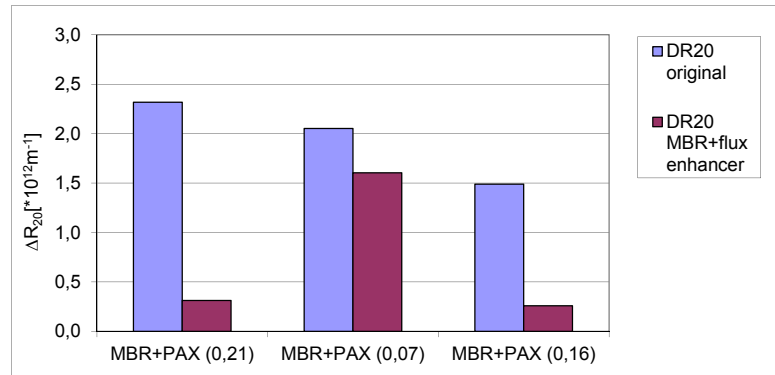




Batch tests (short term: ½ hour)

Commercial name	Company	Composition
PAX-14	Kemwater TM	Polyaluminium Chloride
MPE 50	Nalco	Polymers

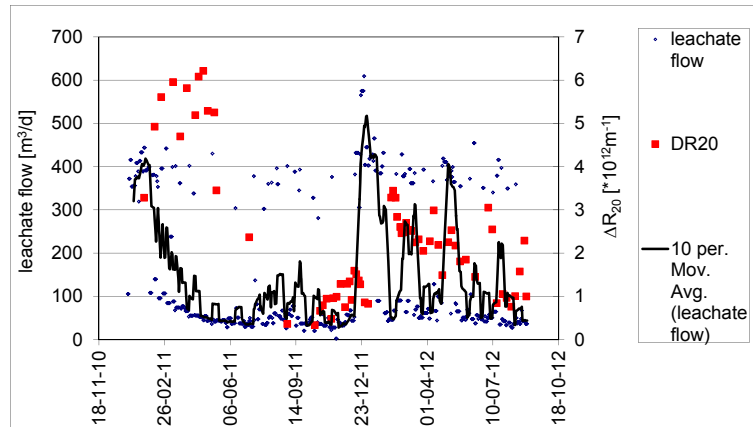
Date	MLSS _{sludge} [g/L]	L Enhancer/kg MLSS
PAX-14		
19-March-12	6.6	0.21
26-March-12	3.89	0.07
24-April-12	6.18	0.16
MPE 50		
14-March-12	6.16	0.04
3-May-12	6.22	0.04
3-May-12	6.22	0.02
3-May-12	6.22	0.01





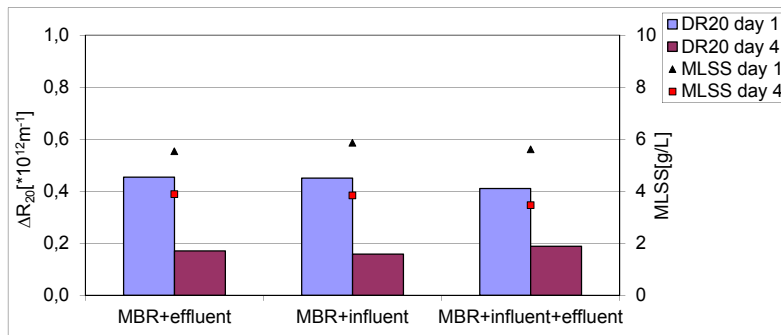
1. Koegors land fill
 1. About 30 years; no longer in use.
 2. Until the 80's: domestic use
 3. After the 80's: non-toxic industrial waste
2. Indaver- Location Hoek
 1. Dangerous waste "Indaver Gevaarlijk Afval"
 2. Transfer location, wastewater treatment plant and cleaning installation for trucks and trains.
 3. Started discharging: 23 January 2012

Filterability and influent composition



Filterability and effluent addition

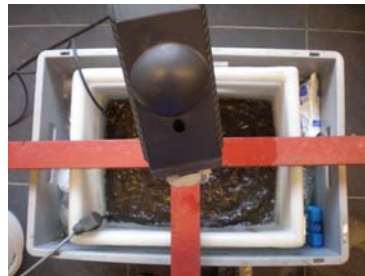
Hypothesis: Effluent addition leads to the accumulation of submicron particles in the MBR sludge



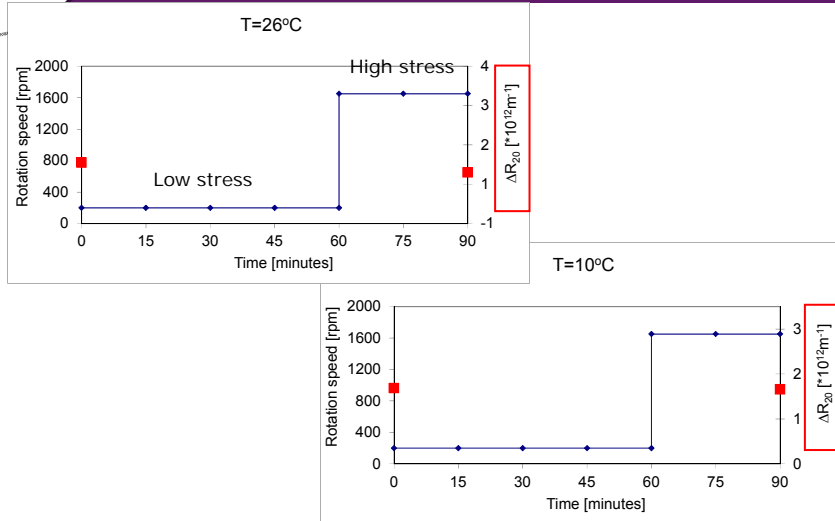
Filterability and effluent addition

	Day 1 [L]				Day 2 [L]				Day 3 [L]				Day 4 [L]			
	sludge	influent	effluent	Super-natant removed	sludge	influent	effluent	Super-natant removed	sludge	influent	effluent	Super-natant removed	sludge	influent	effluent	
MBR+influent	20	5		0	0	5		0	0	1		0	0	0	0	
MBR+ effluent	20		5	0		5		0			1	0	0	0	0	
MBR+ influent +effluent	20	2,5	2,5	0	0	2,5	2,5	0	0	0,5	0,5	0	0	0	0	

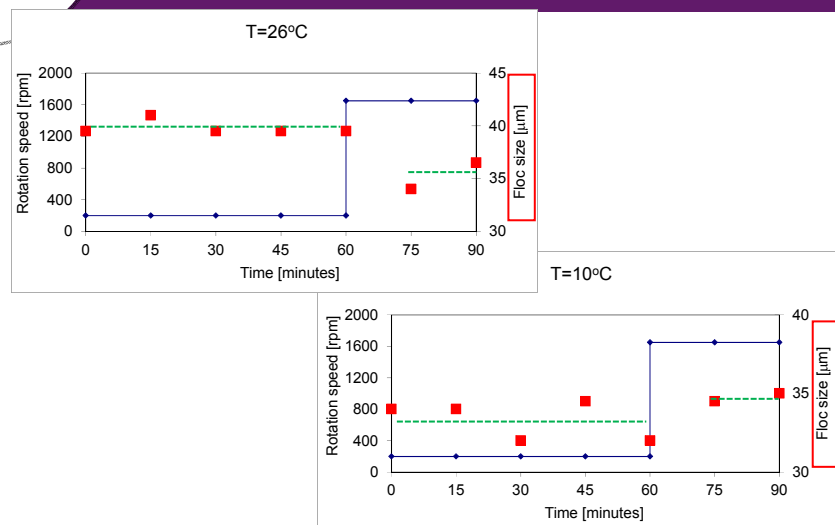
Filterability and mechanical stress

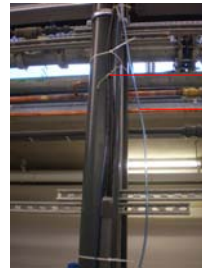


Filterability and mechanical stress



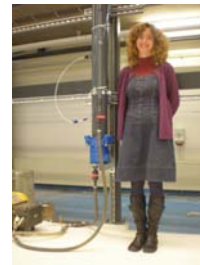
Filterability and mechanical stress





Membranes
Air

Bioreactor



- The effect of different factors in filterability has to be evaluated by analyzing each factor separately.
- The influence of temperature on filterability is always present.
- Excess of substrate can deteriorate filterability; the substrate itself is not toxic but the amount might be.
- Filterability can be improved with coagulants.
- Influent composition, effluent addition and mechanical stress are likely to influence filterability.