Removal of stormwater particulates by disc filter technology

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Publication date:
2013

Document Version
Publisher's PDF, also known as Version of record

REMOVAL OF STORMWATER PARTICULATES BY DISC FILTER TECHNOLOGY

Élimination des particules des eaux pluviales par une technologie de filtre à disques

INTRODUCTION

Combined sewers in Denmark have been flooding increasingly during the last couple of decades, due to growing numbers of impervious surfaces and an increased occurrence of heavy rain events potentially caused by climate change.

Danish water utilities and municipalities are thus keen to disconnect stormwater from the combined sewers and treat the stormwater runoff locally by using the best available technologies (BAT).

Therefore faster, yet efficient, physical and chemical treatment processes are considered for treating source separated stormwater prior to discharges into urban receiving waters.

AIM

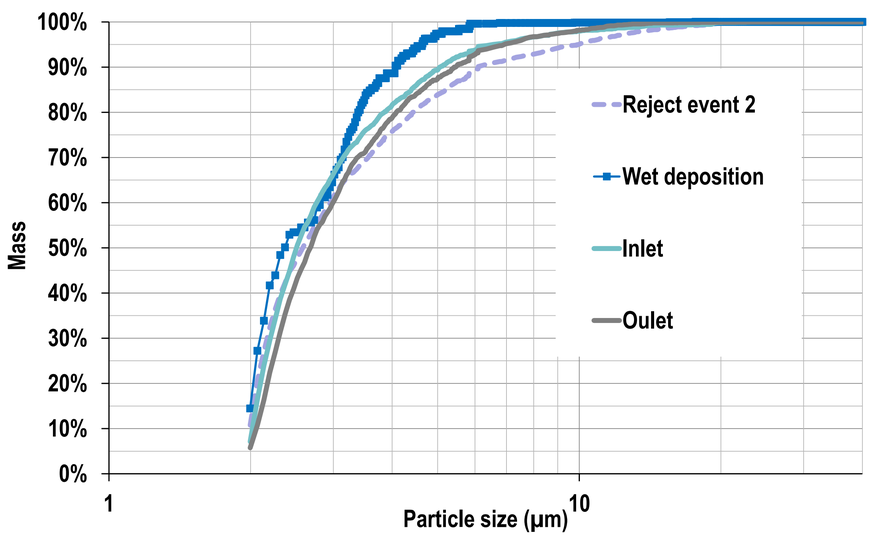
- Assess a Veolia Hydrotech AB disc filter with the filter mesh of 10 µm, for removal of particulate matter in stormwater with emphasis on colloidal and nanosized particles.

Method

- The studied catchment is located in the north-western sub-urban parts of Copenhagen (Denmark). The impervious area is approximately 3.03 km^2 and consists mainly of small roads, driveways, bike trails and footpaths with a separate stormwater sewer system.
- 3 rain events (inlet and outlet), reject water for the 2nd event and wet deposition water were collected over 57 days from September to November 2012, with rain 8.5 % of the time.
- Particle size determination was measured for the 2 – 43 µm particles measured on a Coulter Counter, Multisizer II and the 0.001 – 1 µm particles measured on a Malvern Zetasizer Nano ZS.
- pH, turbidity, Total Suspended Solids (TSS) and electrical conductivity (EC) was measured, using Danish National Standards.

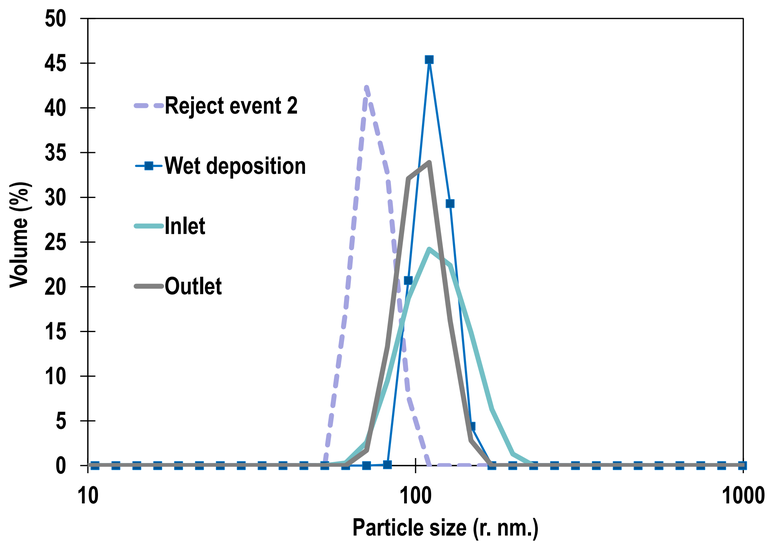
Results

- Particle size distribution showed that about 95 % of the particles were <10 µm.
- The nanosized particles were found to be in the range of 100 nm, and anionic charged.
- Event 3 showed highest turbidity, TSS and EC, probably due to de-icing.



Left:
Coulter Counter measurements, showing the distribution of particles > 2 µm in the samples.

Right:
Zetasizer measurements showing the distribution of nano particles < 1 µm in the samples



	pH		Turbidity (NTU)		TSS (mg/L)		EC (µS/cm)	
	Inlet	*Outlet*	*Inlet*	*Outlet*	*Inlet*	*Outlet*	*Inlet*	*Outlet*
Event 1	6.7	6.4	12	12	<DL	28	64	60
Event 2	7.0	7.1	16	12	<DL	37	61	52
Event 3	6.5	6.6	33	30	659	623	1166	1281
Wet deposition	3.5		0.81		ND		91	
Reject water event 2		ND		195		352		40

<DL: Below the detection limit. ND: not detected

Conclusion

- The physical treatment paradigm for merely particle filtration at 10 µm is not sufficient to remove the small particles identified in this project.
- The consequences of not removing these small particles are yet unknown, but a side effect of not removing them could be transportation of pollutants adsorbed to the particles, thought the treatment facilities and into surface water.
- Hence, coagulation and subsequently flocculation with a cationic coagulant is suggested as one process to add in order to improve the observed removal efficiency.

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