Stormwater treatment using membrane filtration with pulsatile fluid flow

Saida Kaykhaii, Inga Herrmann, Kerstin Nordqvist, Maria Viklander, Annelie Hedström

Luleå University of Technology, Department of Civil, Environmental and Natural Resources Engineering, Urban Water Engineering, Luleå, Sweden

Saida.Kaykhaii@ltu.se

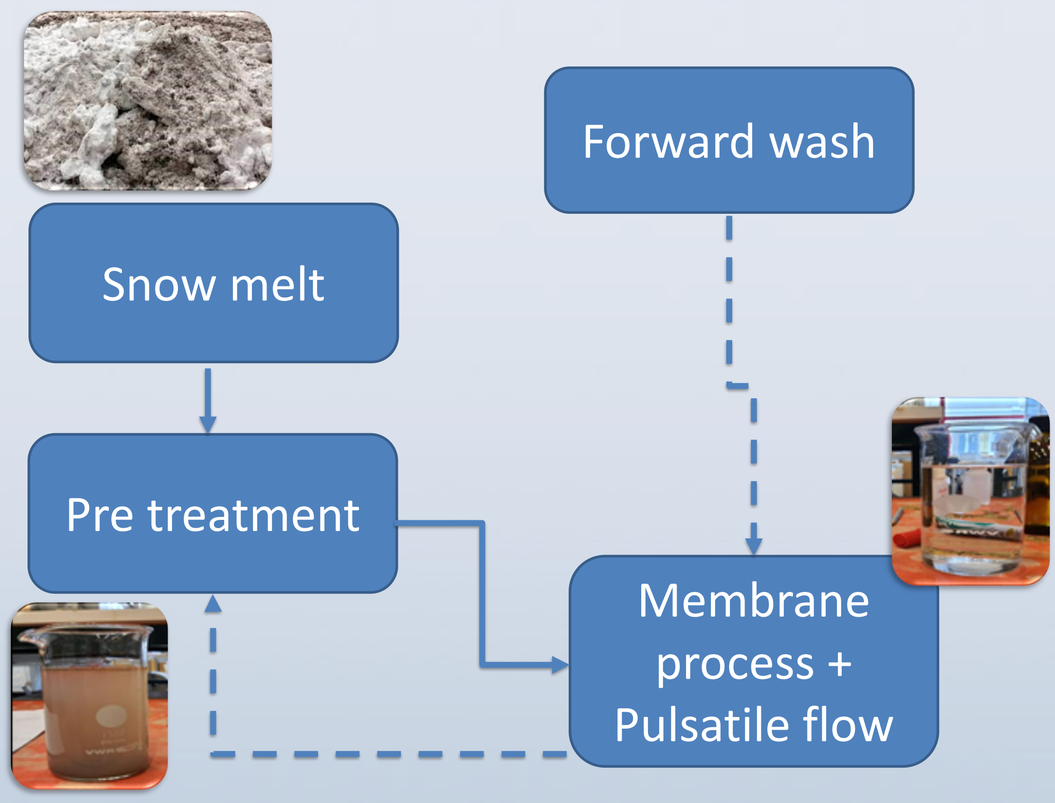
Objective

- To test the ability of ultrafiltration membrane to treat stormwater
- To investigate the effect of different pulse frequencies on productivity of membrane process

Introduction

Stormwater runoff is one of important contributors of pollutants in urban areas. Therefore, stormwater treatment is very important to reduce adverse effects on receiving water bodies and the environment. Using ultrafiltration membranes is an interesting method in treatment of high turbid waters which have low amount of organic material. However, membranes are not common technology in stormwater treatment. In this research work, pre-treatment which is pre requisite of membrane process used in combination with pulsatile flow as a promising method for postponing fouling and increase productivity of membrane process.

Methodology



Result

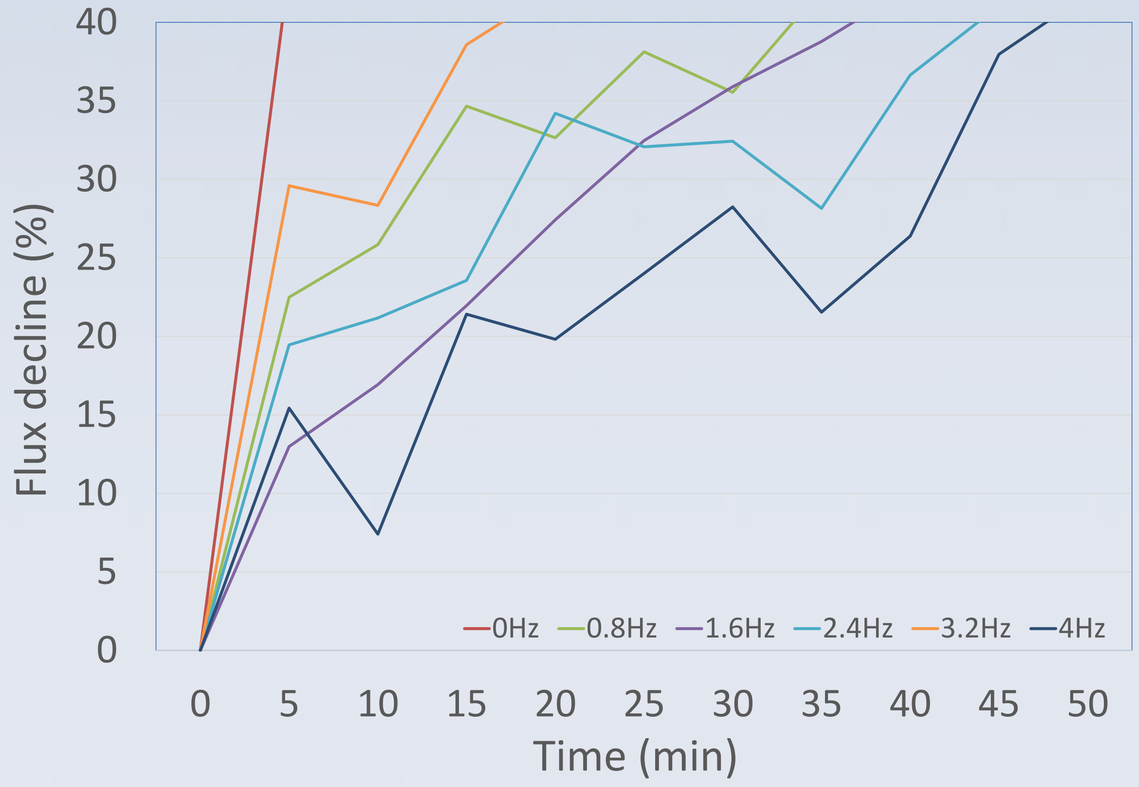


Figure 1. Flux decline over time for different pulse frequencies

Parameters	Unit	Feed Min-Max (Average ± STDEV)	Permeate Min-Max (Average ± STDEV)
TSS	mg/L	210-490 (340 ± 56)	Below detection limit
Turbidity	NTU	157-361 (253 ± 46)	Below detection limit
TOC	mg/L	1.1-20 (10.8 ± 5.7)	0.55-2.4 (1.78 ± 0.59)
Oil Index	µg/L	1130-3670 (2400 ± 750)	<30
As	µg/L	0–0.1 (0.1±0.0)	<0.005-0.1
Cd	µg/L	0.002–0.02 (0.0055±0.0)	0.004-0.06 (0.01±0.02)
Cu	µg/L	1.6–3.9 (2.1 ± 0.4)	1.5-3.9 (2.1±0.6)
Cr	µg/L	0.1 (0.1±0.0)	<0.01-0.1
Ni	µg/L	0.2–0.5 (0.4 ± 0.1)	0.22-0.8 (0.5±0.1)
P	µg/L	2.3–12 (5.3 ± 2.6)	1.2-8.1 (3.5±2.3)
Pb	µg/L	0–0.02 (0.02±0.0)	0.01-0.07 (0.02±0.02)

Conclusion

- **Increasing pulse frequency from 0 to 4 Hz prolonged the process operation time and resulted in higher permeate volume.**
- **Regardless of pulse frequency, ultrafiltration membrane efficiently removed TSS, turbidity and oil fractions. In addition, TOC removal varied between 70% to 91%.**
- **Dissolved As, Cd, Cu, Cr, Ni, Pb and P were reduced by 16, 12.6, 11.8, 23.5, 21, 44 and 73.1%, respectively.**

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