

Technologies for microplastics removal from urban snow

Marjatta Vahvaselkä & Erika Winqvist
Natural Resources Institute Finland (Luke)



Urban snow and microplastics

During winters, large amounts of snow are collected from roads in Finnish cities into snow collecting sites, up to 300.000 truck loads in Helsinki

Especially during winters with heavy snowfall, part of this urban snow is dumped untreated into the sea in Helsinki, about 60.000 truck loads

In urban snow, microplastics (MP) concentrations up to 10.000 MP particles per m³ of snow have been reported



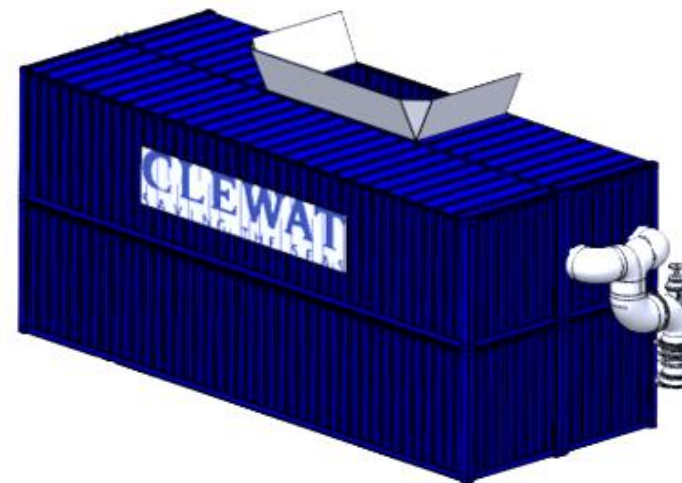
MP removal technologies developed and tested

Pilot 1: Common reed filter for MP removal from stormwaters including snow meltwaters

- Collaboration with city of Kouvola and a local co-operative developing new ways to utilize common reed



Pilot 2: Snow melting and filtering system developed by Clewat Ltd, a cleantech company from Finland



Common reed filter for MP removal from stormwaters including meltwaters of urban snow

Reed filters previously built in Kouvola area have been tested for removal of solid particles and nutrients from stormwaters running in ditches, with promising results

From a local snow dumping site, the snow meltwaters run to a pond and further along a ditch to a river leading to the Baltic Sea

Therefore, a common reed filter was built in the outlet ditch to pilot the ability of the filter to remove MPs and other solid particles released from urban snow

Common reed was harvested at a local lake. About 350 reed bundles were used for the pilot filter and three logs were placed on top of the bundles.



Dimensions of the reed filter: length 3.5 m, width 1.5 m, depth 0.7 m

Common reed filter for MP removal from stormwaters including meltwaters of urban snow

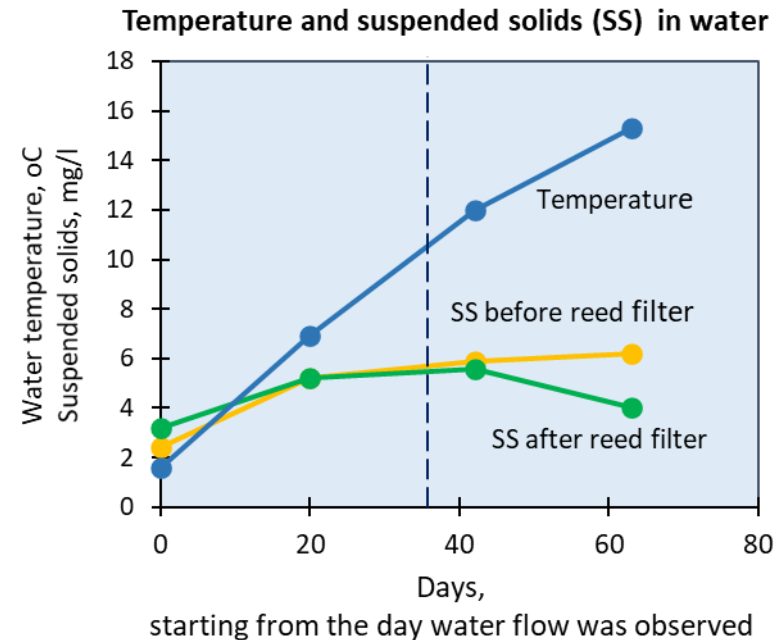
Snow samples were collected from the snow dumping site in March 2021 and samples from the ditch water before and after the reed filter in May (sampling time indicated as a dashed line in Figure)

Additional water samples were analysed once a month

The filter reduced 35% of total suspended solids in the ditch water (effect of water temperature)

Microplastics, e.g. car tire-related particles, in snow meltwater flowing into the pond were retained in pond (sediment), as tire rubber particles were detected in snow but not in ditch water

Efficiency of the reed filter in MP removal needs to be further evaluated



Snow melting and filtering pilot (Clewat)

In the Clewat system, snow is melted by using the power of flowing water and seawater temperature or waste heat from the district heating network

-> more sustainable than other methods used for snow melting, e.g., using fossil fuel

The snow meltwater passing through the process is filtered and the waste is collected:

- macrolitter with a steel filter system
- microlitter with a filter cloth

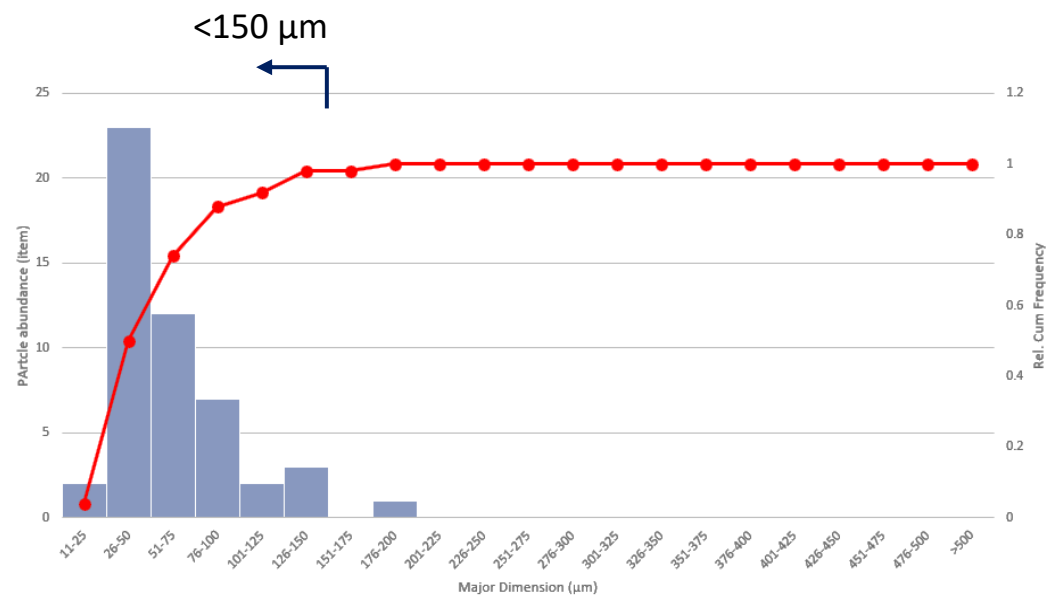


Snow melting and filtering pilot (Clewat)

The mesh size for the filter cloth was optimized

- If too high -> MP particles not captured
- If too low -> restricted capacity in snow treatment
- Mesh sizes 50 μm and 150 μm were tested

Mesh size 50 μm was suitable for removal of major part of snow MP particles as demonstrated in MP analyses



MP particle size distribution in urban snow meltwater

Conclusions

Common reed filter

Easy to build
Sustainable
Cost-effective
Locally adaptable



Role of biofilm formation?

- A period of conditioning is needed for optimal operation of the filter
- Reed filter suitable especially for stormwaters with ambient temperatures (vrs. cold snow meltwaters)

Removal efficiency and operating time depend on local conditions

Snow melting and filtering unit

Sustainable technology for snow melting
The unit can be operated both on land and floating on water
Decentralized system minimizes transport distances
Mesh size 50 μm seems to be efficient in MP removal



<https://clewat.com>

Cost efficiency of technologies tested

Solution	Investment costs	Operational costs	MP removal efficiency
Common reed filter	Low	Low	Improves when the filter matures (surfaces covered with biofilm), expected to be Medium
Snow melting and filtering unit	High	Medium	Depends on the mesh size selected for the filtering unit, expected to be High

Thank you!

