Aerosol removal efficiency of moss
Influence of relative humidity and aerosol size in an experimental chamber

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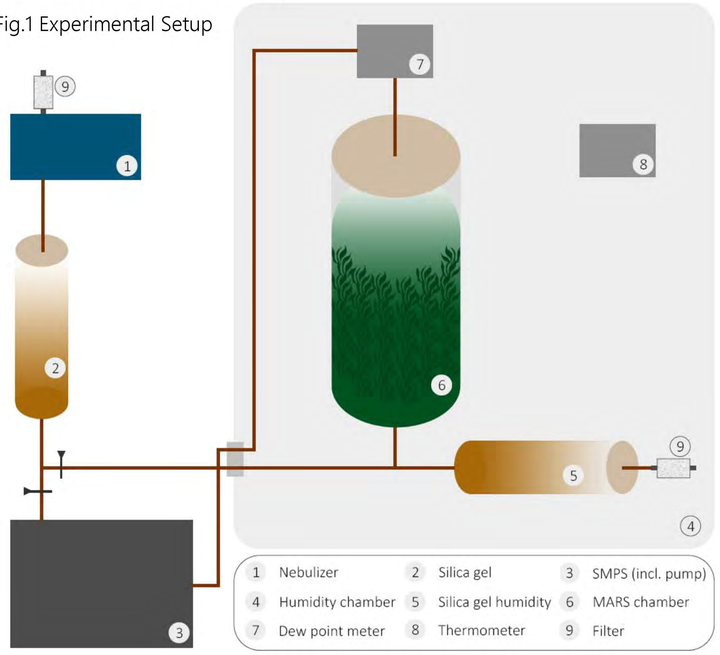
MARS Moss Aerosol ReSearch

Background

- Nowadays decreasing air quality and climate change pose new challenges for society, politics and science
- Anthropogenic aerosols affect climate, air quality and human health
- Reduction measures include among others technical approaches like source oriented emission reductions, such a promising approach could be moss applications
- Moss has been used as a bioindicator due to its properties (Element & nutrient uptake via atmospheric deposition, surface charge) [1,2]

Experimental Setup

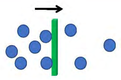
► Fig.1 Experimental Setup



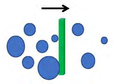
- Generated NaCl aerosols are directed into a temperature & humidity controlled stainless steel chamber (MARS chamber)
- Chamber lined with air-dried moss (*Sphagnum spp.*)
- Experimental conditions:
  - Controlled relative humidities highRH: 60 % lowRH: 20 %
  - Exposure time: 1 h
  - Temperature: 20 °C
- **Scanning mobility particle sizer (SMPS) measurements**
  → Aerosol concentration and size distribution (8-700 nm)
  → Efficiency of aerosol removal by moss $\text{Efficiency: } 1 - \frac{[moss\ sample]}{[background]}$
- **Conductivity measurements** of washed moss in purified water after aerosol exposure
  → Indication of aerosol removal by moss

Research Questions

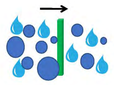
(1) Efficiency of moss to remove aerosols (number of particles)



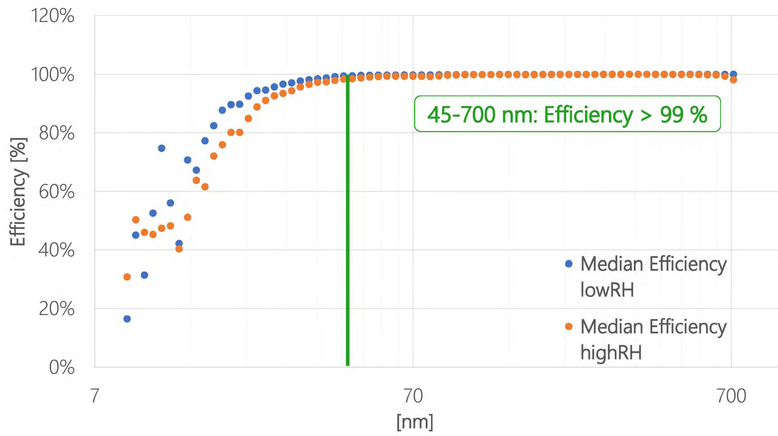
(2) Influence of aerosol size (size range: 8-700 nm)



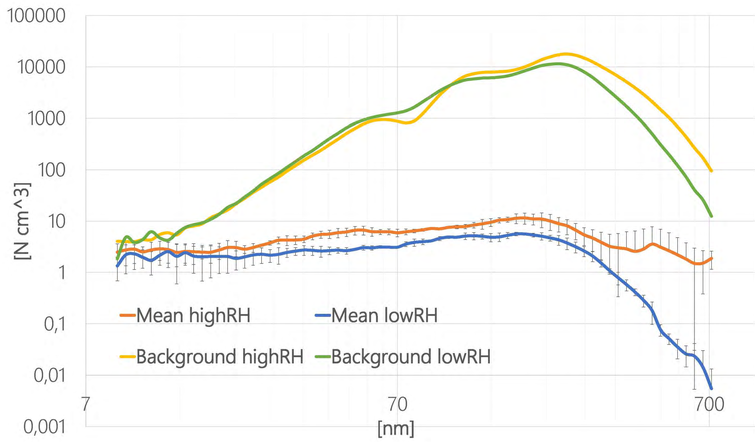
(3) Influence of relative air humidity



Results



▲ Fig.2 Comparison of the efficiency of moss to remove aerosols at high and low RH; from 45 nm to 700 nm the efficiency is above 99 %; below 45 nm the efficiency increases with aerosol size;



▲ Fig.3 Aerosol concentration and size distribution at low and high RH in comparison to respective background concentrations; the effect of moss to remove aerosols is similar for low and high RH;

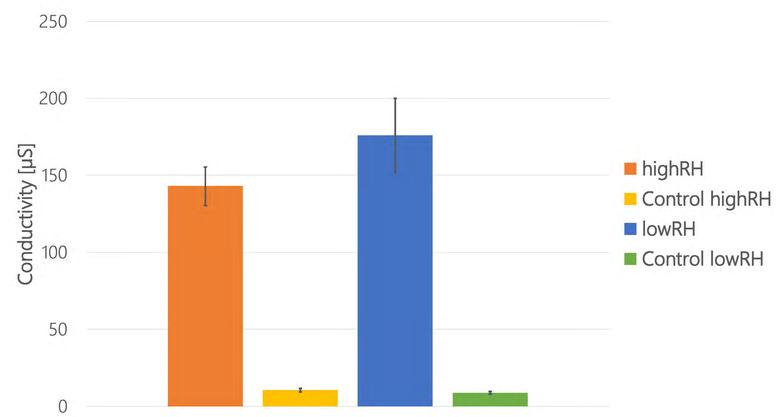
Conclusions

(1+2) Efficiency of moss to remove aerosols
- From 45 nm to 700 nm: > 99 % (*Fig.2*)

(3) Influence of relative air humidity
- Removal of aerosols to a similar extent at both, high and low RH (*Fig.3*)
- No significant difference in conductivity between both RH (*Fig.4*)

→ Aerosol removal by moss is a very promising approach for future reduction measures

Results



▲ Fig.4 Mean conductivity after exposure for highRH and lowRH shows no significant difference

Outlook

- Further experiments that determine influence of other parameters
  - Aerosols (chemical composition, shape, size)
  - Moss species
  - Reduced ratio of moss area to air volume
  - Chamber volume
- Pilot study in urban area

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References
[1]fGonzález, A. G.; Pokrovsky, O. S. (2014) *Journal of Colloid and Interface Science* 415, S. 169–178.
[2]Spagnuolo, V.; Giordano, S.; Pérez-Llamazares, A.; Ares, A.; Carballeira, A.; Fernández, J. A.; Aboal, J. R. (2013) *Science of The Total Environment* 463–464, S. 727–733..

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