Assessment of the Effectiveness of a Hygroscopic Coating on the Conservation of MS2 Viability During Aerosol Sampling with MCE Filters

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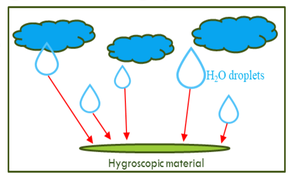
INTRODUCTION

- Conservation of viability of viruses collected on membrane filters has been hampered by inactivation due to desiccation during air sampling.
- Gelatin filters conserve virus viability but can disintegrate in longer sampling hours, at high RH & temperatures.
- Can membrane filters be improved to increase viable virus recovery?

OBJRCTIVE

To determine whether increasing the hygroscopicity of a mixed cellulose ester (MCE) filter by coating it with glycerol

glycerol can improve the conservation of virus viability during air sampling.



MATERIALS AND METHODS

- **Testing virus:** Bacteriophage MS2

- **Filter used:**

MCE Filters

Gelatin Filters

Filter Preparation

- MCE: As-packaged filters (APF) — Used directly
- Gelatin filters (GF) — Used directly
- Glycerol-coated filters (GCF) — APF soaked in 10% glycerol
- PBS-wetted filters (PWF) — APF wetted with 200 µL of 0.1X PBS

- **Experimental methodology**

Benchtop experiments
- Purpose: Impact of glycerol on viability
- Technique: APF and GCF were exposed to 200 µL of diluted MS2 for 30 minutes.

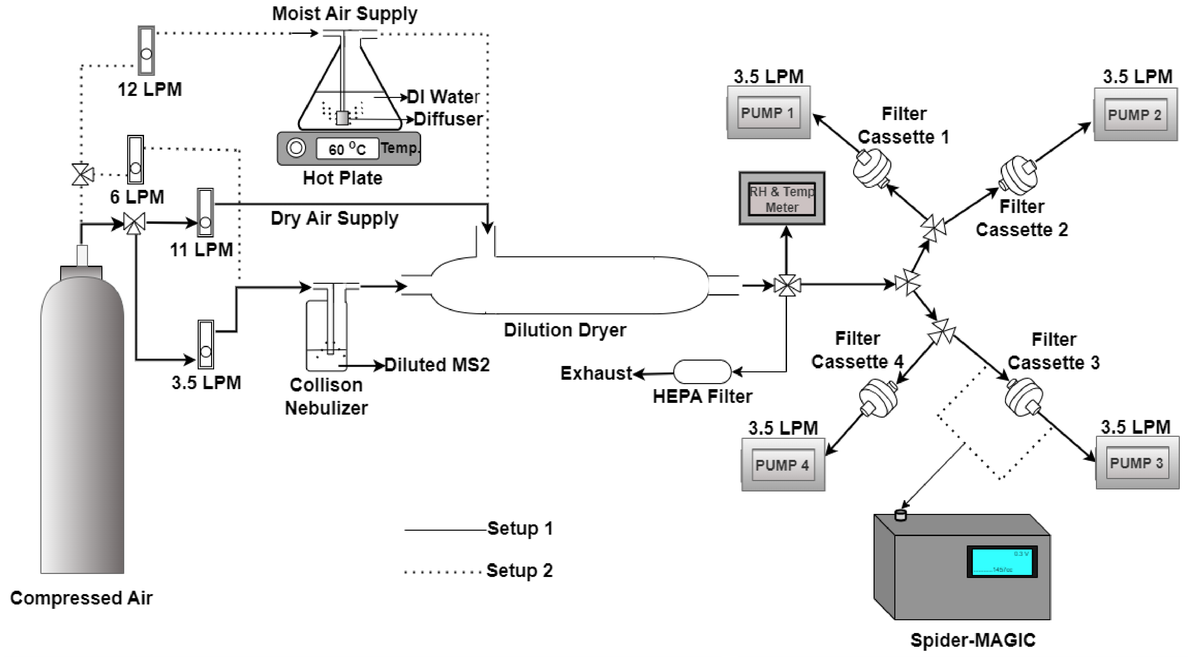
Aerosol Exposure Experiments
- Purpose: Effectiveness of GCF for viability conservation
- Technique: APF, GCF, PWF, and GF were exposed to MS2 aerosols for 30 minutes.

MS2 aerosol collection
- Setup Validation
- At 50 % RH
- At 80% RH
  - With preconditioning of GCF
  - Without preconditioning of GCF

Extraction of MS2
Soaked filters in 10 mL of 0.1X PBS for 15 mins and vortexed for 1 min.

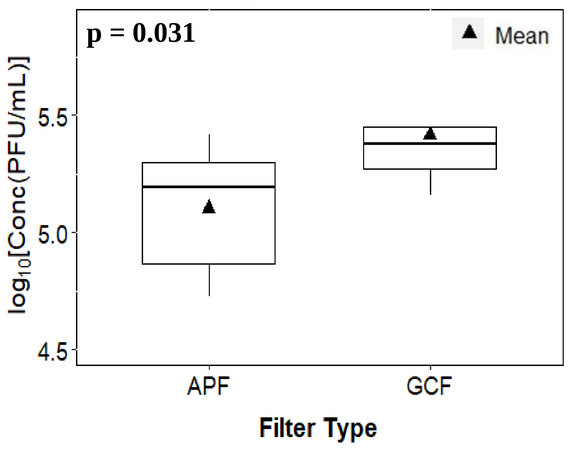
Quantification
- Viral plaque assay (EPA 1984)

AEROSOL COLLECTION SETUP

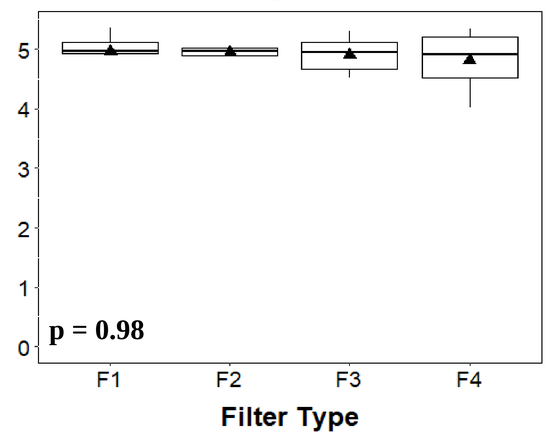


RESULTS

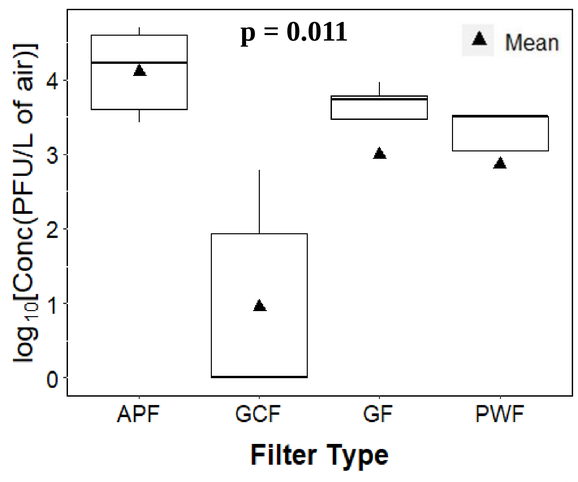
(1) Benchtop experiments results



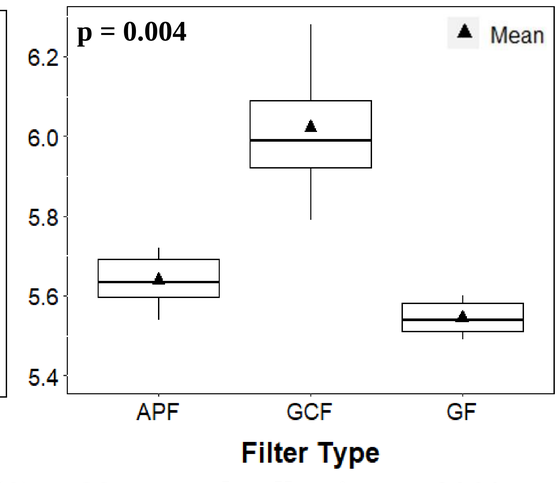
(2) MS2 aerosol Setup validation results



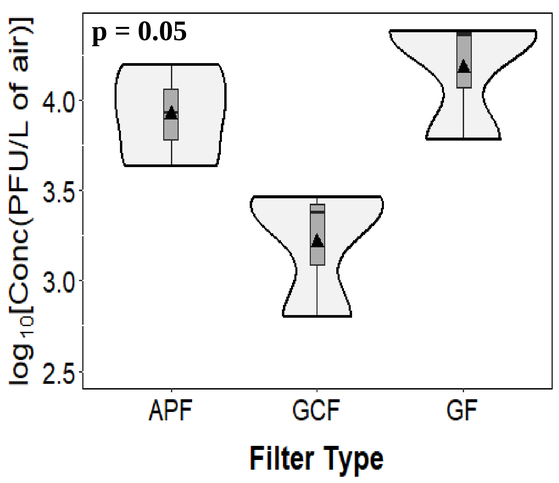
(3) MS2 aerosol collection at 50% RH



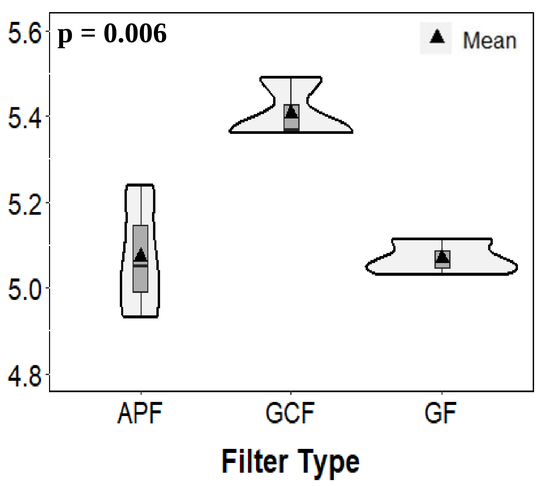
(4) MS2 aerosol collection at 80% RH



(5) MS2 aerosol collection at 50% RH with preconditioning of GCF



(6) MS2 aerosol collection at 80% RH without preconditioning of GCF



DISCUSSION

- *Benchtop trials:* GCF showed more recovery of viable MS2 than APF. No detrimental effects on viability (p = 0.031).
- *Experimental setup validation:* No significant difference in the mean viable virus collection from different ports and pumps (p = 0.98).
- *Aerosol collection trials:*
  - Significantly lower viable virus recovery from GCF than APF (p = 0.011) at 50% RH.
  - GCF showed significantly higher viable MS2 collection than APF (p = 0.00004) at 80% RH with preconditioning of GCF.
  - GCF also showed high viability conservation at 80% RH experiments even without preconditioning.
- PWF failed because increased pressure drop prevented airflow due to direct wetting of filter with water droplets.
- GF dissolved (somewhat) during 80% RH experiments.

CONCLUSION

GCF is able to conserve MS2 viability but only at high RH. High RH condition in aerosol system is more important than preconditioning.

DISCLAIMER

The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

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