

Evaluation air samplers and filter materials for collection and recovery of airborne norovirus

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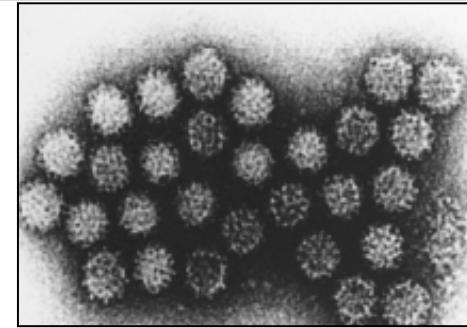
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Norovirus



[Green et al., 2000]

- Small non-enveloped ssRNA viruses with icosahedral structure (~30 nm in diameter)
- Norovirus (NoV) is the one of the most important causes of gastroenteritis in humans of all age groups
 - 60-80% of all outbreaks in industrialized countries
- Symptoms:
 - Vomiting, mild to moderate non-bloody diarrhea, nausea and abdominal cramps
 - Illness lasting 24-48 hours
- Low infective dose of NoV (10-100 particles)

Transmission

- NoV is transmitted via the fecal-oral route:
 - Person-to-person contact
 - Contaminated food and water
 - **Aerosols**
- NoV has been detected in the inhalation zone of 1 of 4 workers at a wastewater treatment plant (WWTP) (Uhrbrand et al. 2011)
- More knowledge on occupational exposure to airborne NoV and its association with disease is warranted

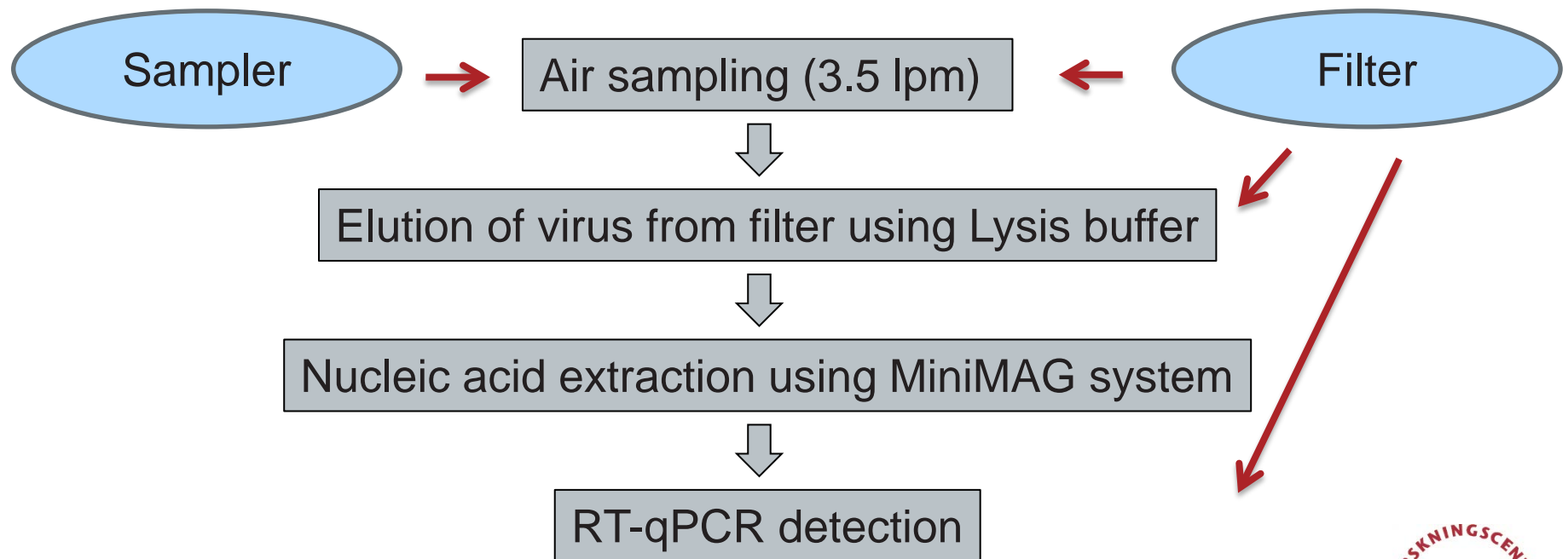


Objective

- Aim of study was to identify the most suitable method for sampling of airborne NoV
- To study the exposure to airborne NoV it is imperative to have efficient sampling methods
 - High collection efficiencies
 - High recovery efficiencies from collection medium
 - Compatible with molecular-based detection (RT-qPCR)
 - No inhibitory substances
 - Compatible with prolonged sampling time

Sampling methodology

- Filter-based sampling chosen to allow personal sampling throughout a working day:



Aerosolization experiment

Sampling (30 min) using murine norovirus (MNV) as surrogate for NoV:

(A) 4 samplers with a nylon filter:

- GSP sampler (GSP)
- Triplex-cyclone sampler (TC)
- 3-piece Millipore cassette (3P)
- 2-stage NIOSH sampler (NIO)

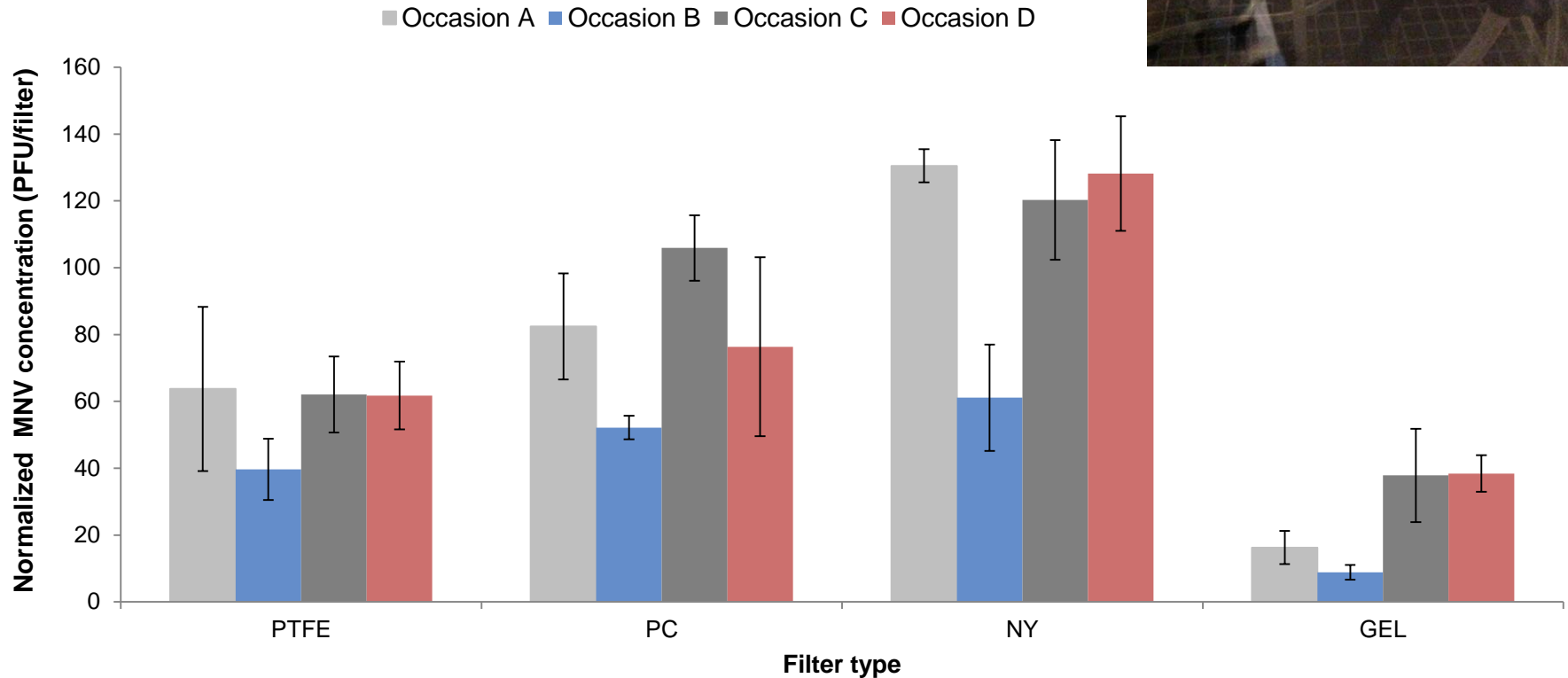
(B) GSP with 4 filter types:

- Nylon (NY)
- Polycarbonate (PC)
- Polytetrafluoroethylene (PTFE)
- Gelatine (GEL)

Particle concentration and size distribution was monitored using ELPI+.

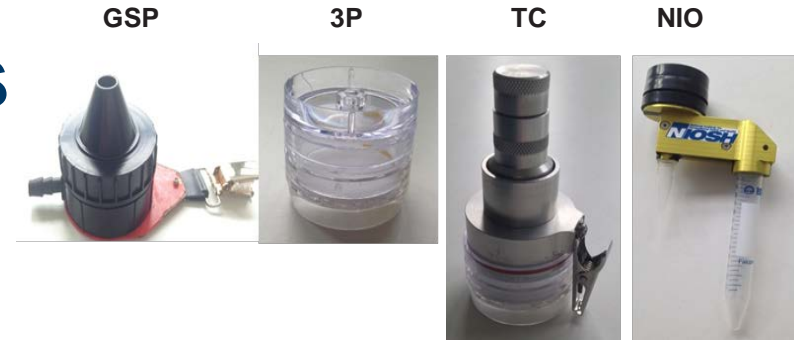


Comparison of filters

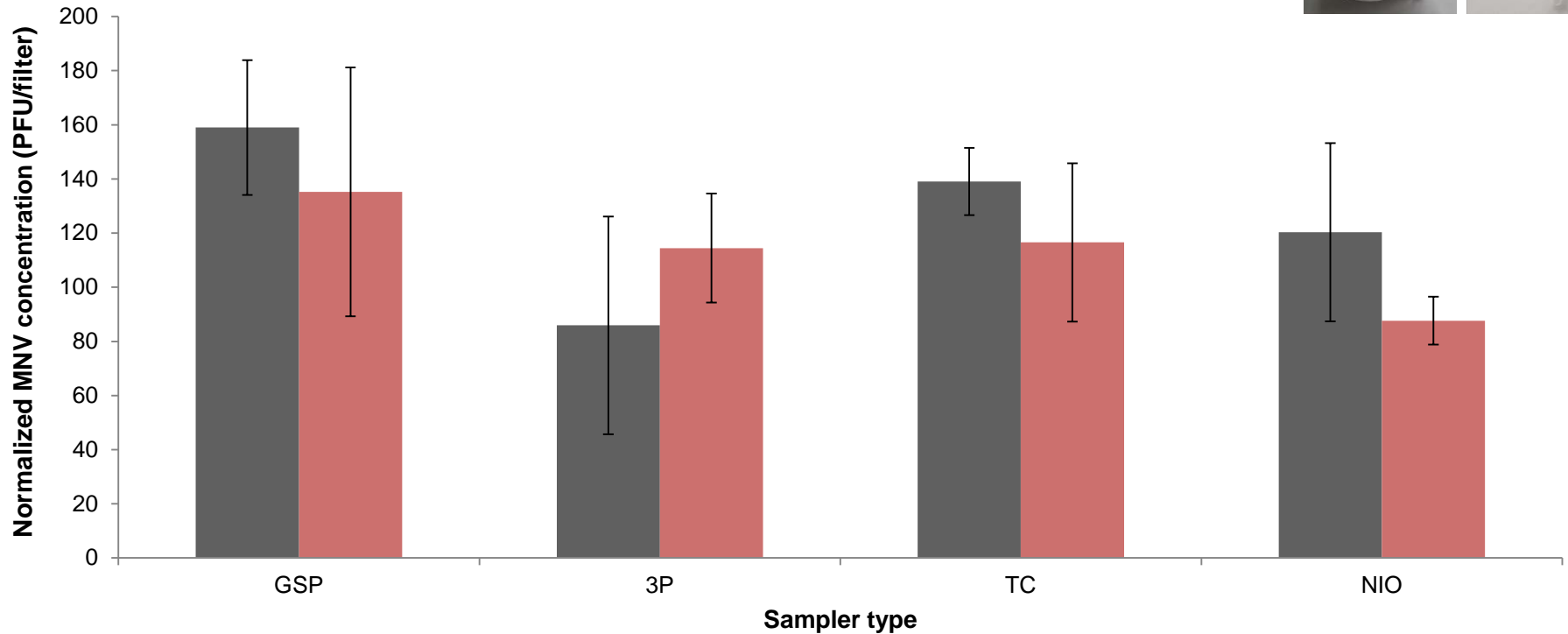


- MNV recovery significantly higher for NY than for PC, PTFE and GEL filters
- Recovery efficiency of mengovirus were $62 \pm 26\%$, $86 \pm 18\%$, $62 \pm 13\%$ and $21 \pm 3\%$ from NY, PC, PTFE and GEL, respectively.

Comparison of samplers

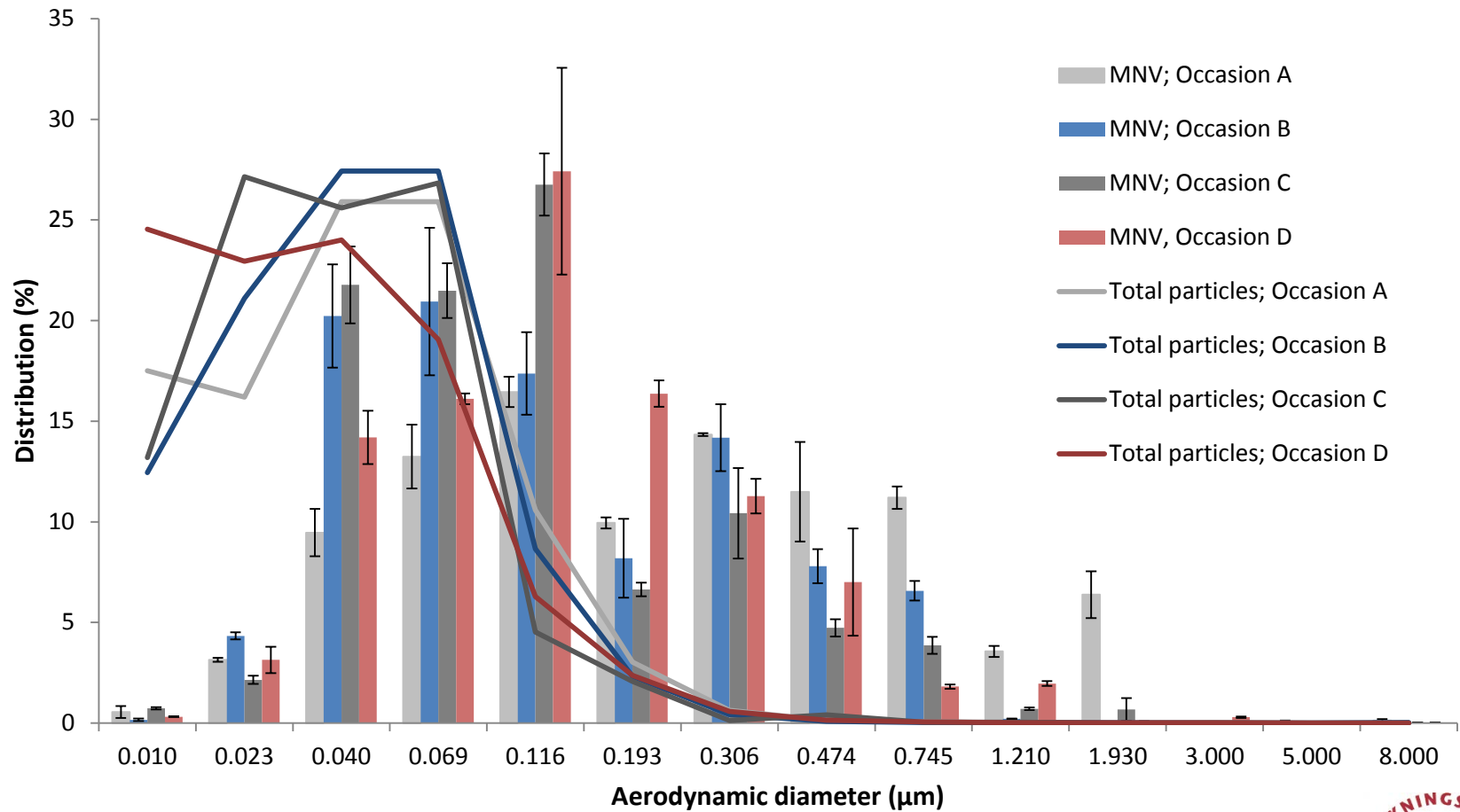


■ Occasion C ■ Occasion D



- MNV recovery significantly higher with GSP than 3P and NIO.
- A higher recovery was also observed for GSP compared with TC, albeit not significantly

Aerodynamic size of MNV



- GMD of total particles and MNV was 33.0 and 126.8 nm, respectively.

Conclusion

- The sampling efficiency of aerosolized MNV was found to be significantly influenced by both sampler and filter type
- **For personal filter-based sampling of airborne NoV we recommend the GSP sampler combined with a nylon filter**
- We have successfully collected NoVs at a WWTP using the GSP sampler with nylon filter



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