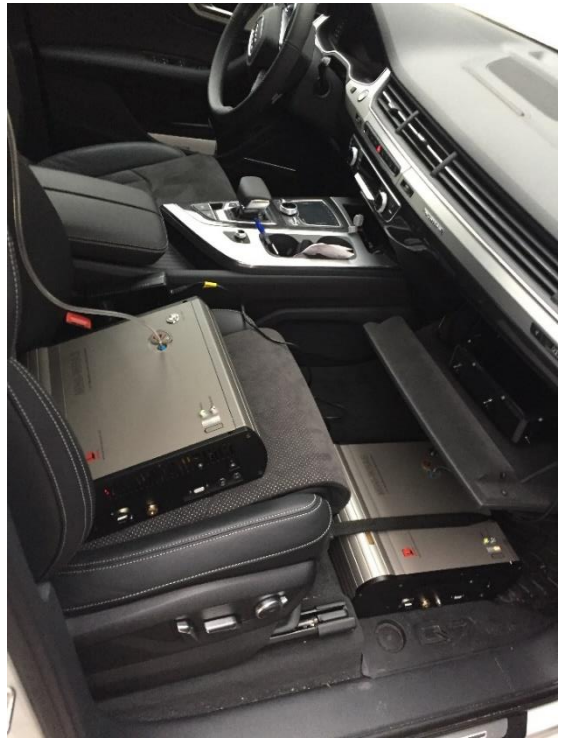
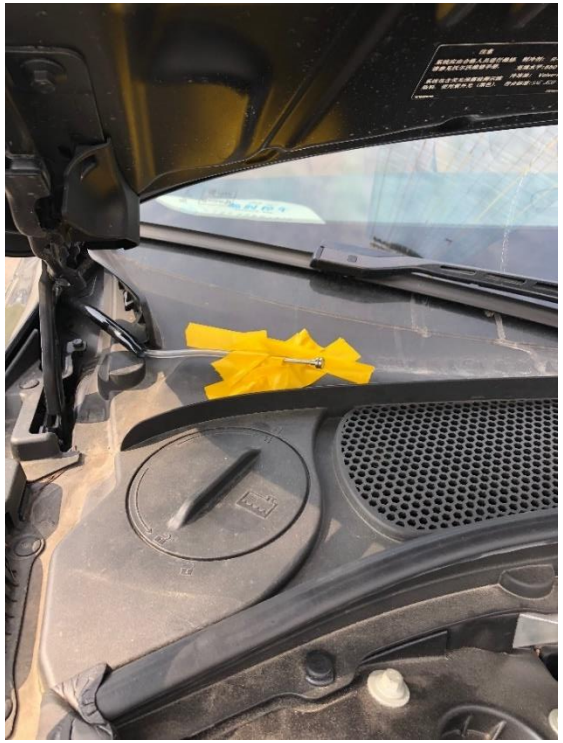
Vehicle filtration performance testing at different locations where the dominant particle size is different

Yingying Cha
Contact: yingying.cha@cabinair.com
CabinAir Sweden AB

Vehicle test set-up





Test in Stockholm

Outdoor sensors

Indoor sensors

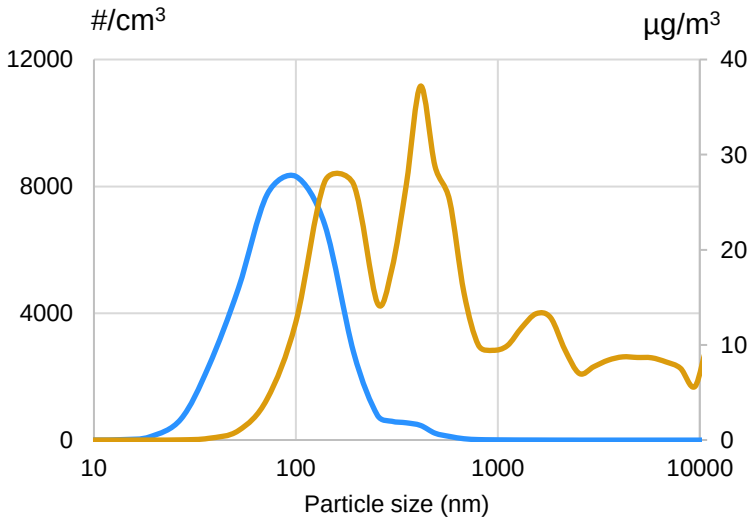
Test in Shenzhen

CabinAir

Vehicle test_ road particle sizes

Count
Mass

Location: Shijiazhuang City, China, on road
Time of test: 2020-01-15
Particle measurement: Grimm MiniWRAS
Average PM2.5: 325 µg/m³

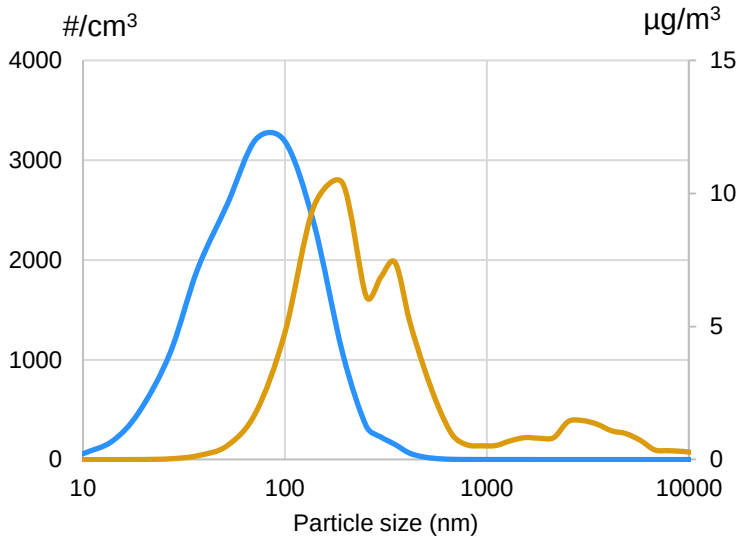


Number (<2.5 µm): **100%**

Mass (<2.5 µm): **75%**

PM1/PM2.5 = **80%**

Location: Shanghai city, China, on road
Time of test: 2018-12-06
Particle measurement: Grimm miniWRAS
Average PM2.5: 73 µg/m³

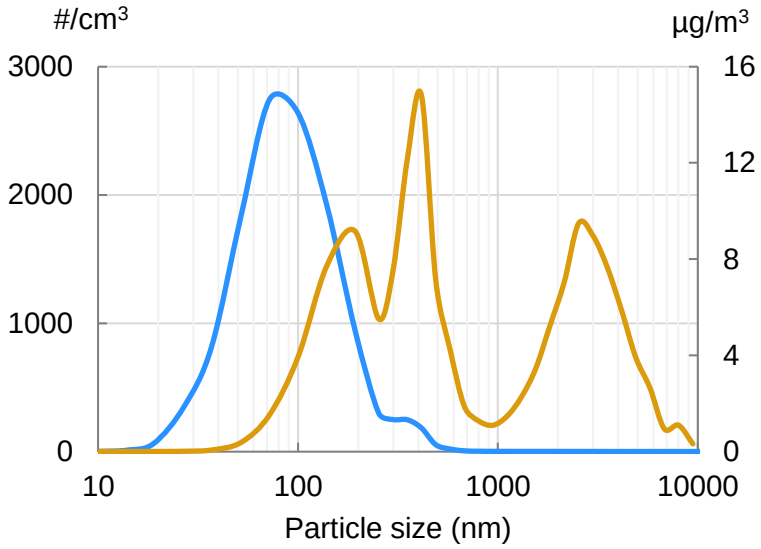


Number (<2.5 µm): **100%**

Mass (<2.5 µm): **90%**

PM1/PM2.5 = **92%**

Location: Xi'an city road, China
Time of test: 2021-03-19
Particle measurement: Grimm miniWRAS
Average PM2.5: 140 µg/m³



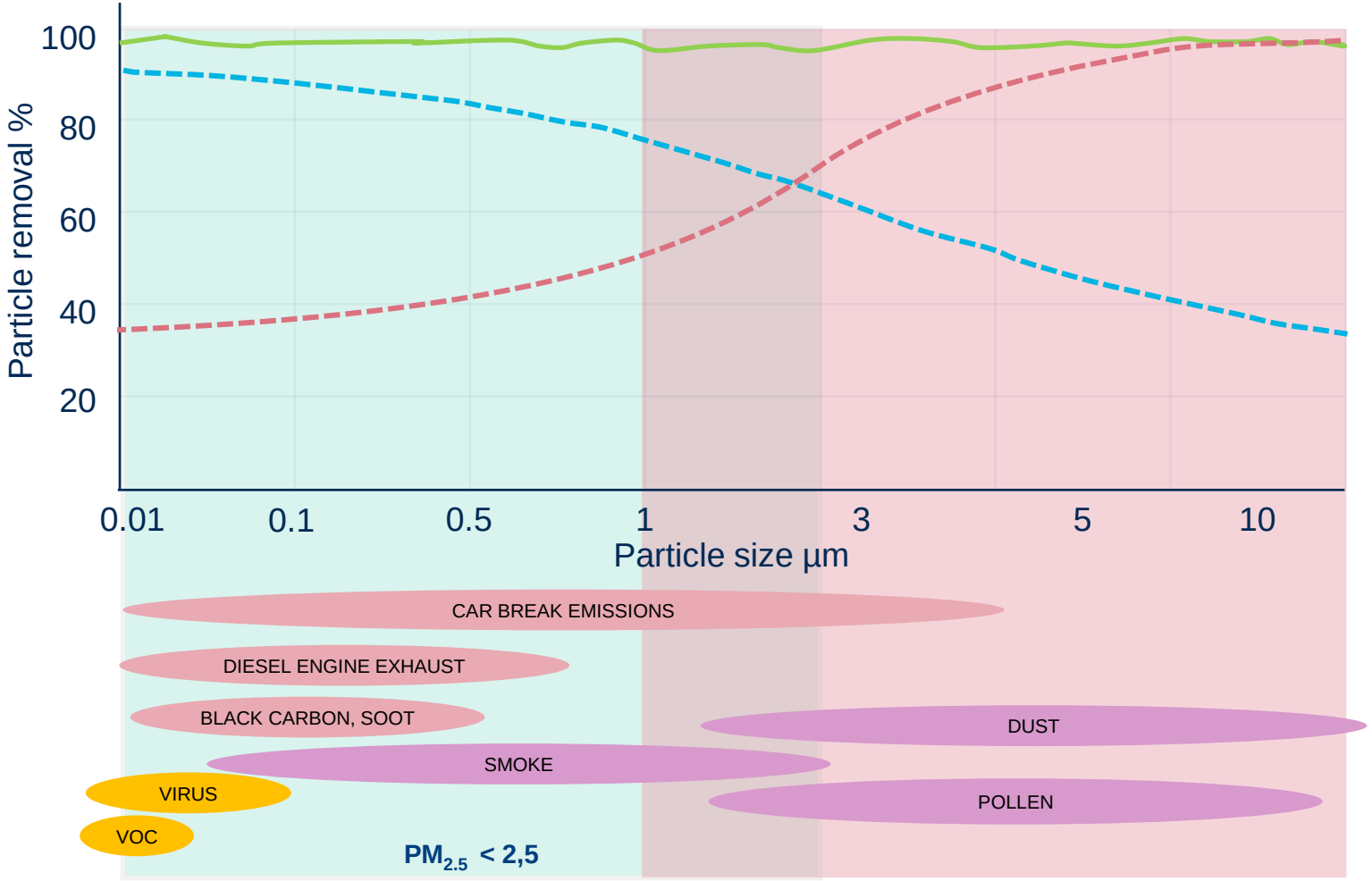
Number (<2.5 µm): **100%**

Mass (<2.5 µm): **70%**

PM1/PM2.5 = **80%**

CabinAir

Filtration mechanism and technology



Combination of particle charging and mechanical filtration or HEPA filtration

Electrostatic filtration

Mechanical filtration alone

The combination of electrostatic and mechanical filtration results in a filtration efficiency superior to either technology alone.

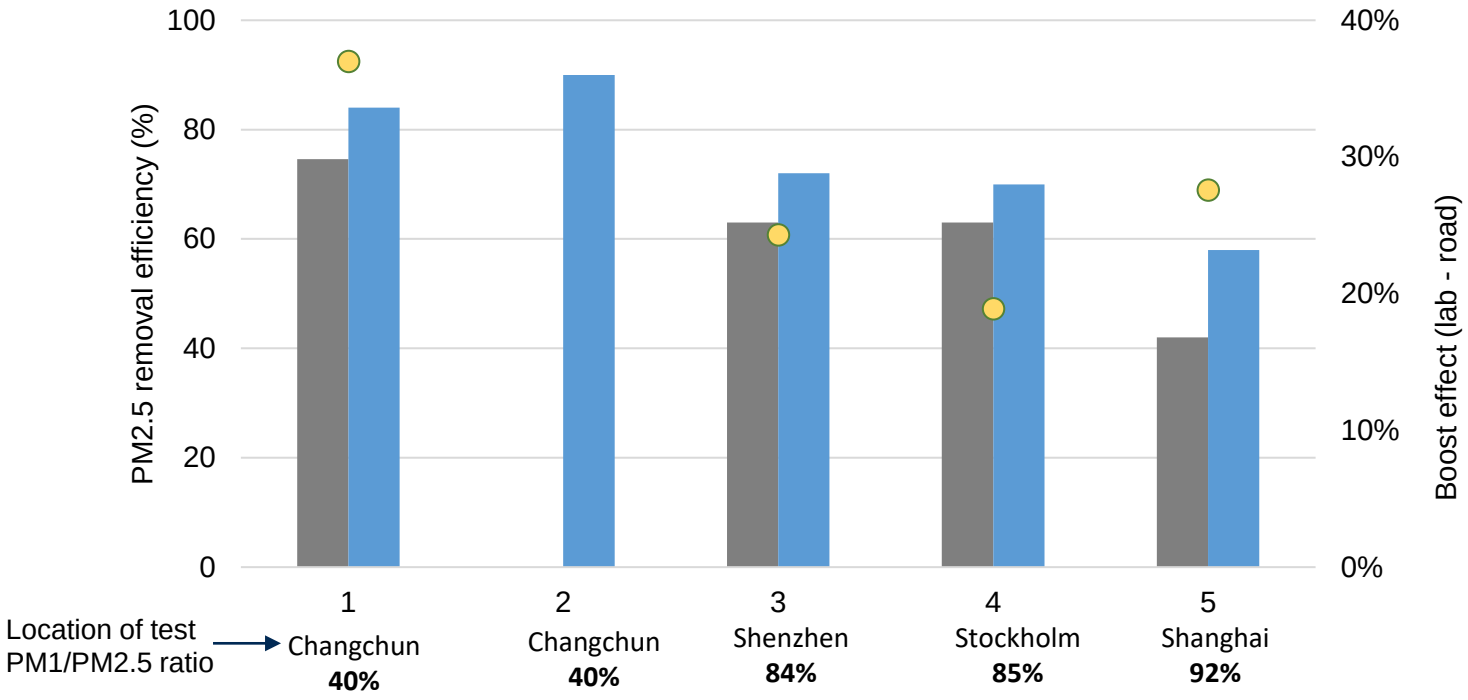
The combination of technologies is especially effective in removing very small particles such as $PM_{1.0}$ and ultrafine particles (< 100 nm), which are the most harmful to health.

CabinAir

Hypothesis

- There should be differences in the filter filtration performance when being exposed to different type of particles (with different sizes)
- For aged filters without electrostatic filtration part, the difference can be bigger

PM2.5 removal efficiency_ new filters



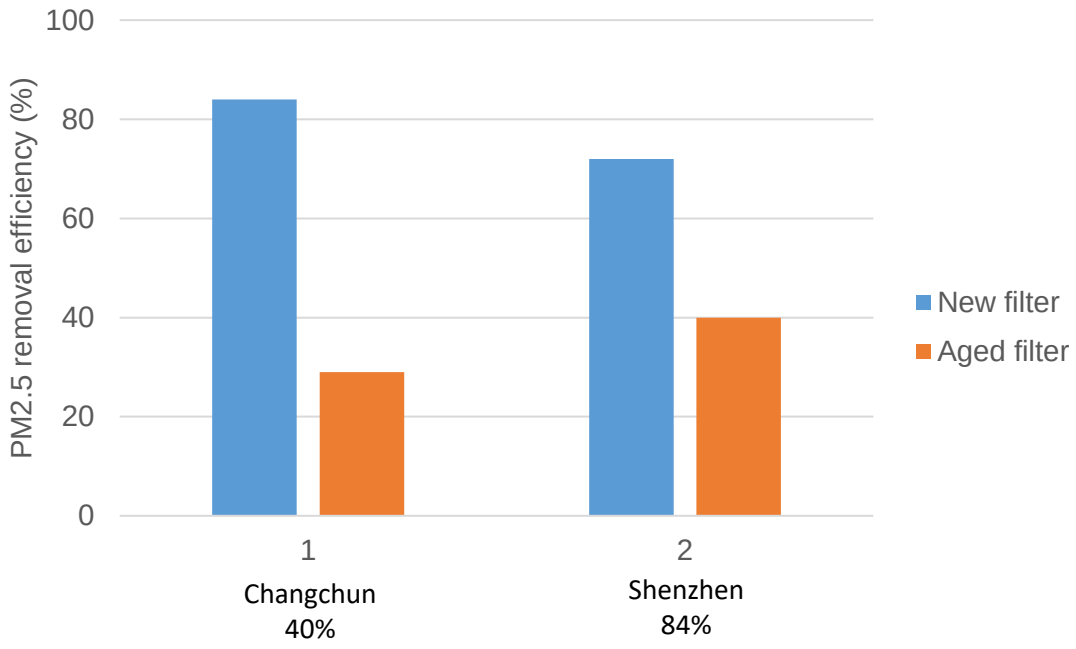
Note: Different model of filters from the same manufacture
Missing tests with the same filter in the same vehicle but tested at different places

Lab test
Airflow: 300m^3/h
Test aerosol: DEHS
Particle measurement: Grimm miniWRAS
Test condition: controlled lab environment

Vehicle test
Airflow: low-medium fan speed, the airflow can be different
Ventilation: outside air intake
Vehicle model: different, the sealing condition can be different
Aerosol: road particles, compositions different
Instrument: efficiency measured with sensors
Test condition: uncontrolled (environment, driving parameters, etc)

CabinAir

PM2.5 removal efficiency_ aged filters



Note:
The aged degree of the filters can be different, even though both filters were about 6-months real-driving aged

The result indicates that when coarse particles dominate, the removal efficiency of small particles can be high for a new filter, but it can still significantly decrease as the filter being aged

More tests are needed to investigate the hypothesis is true or not

CabinAir

Contact:
Yingying Cha
CabinAir Sweden AB
yingying.cha@cabinair.com