

Collection of large amounts of particulate matter from vehicle exhaust using augmented high-volume samplers

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Toxicological aspect of car particle emission is very important, but:

Toxicological assays require collection of a rather large amounts of particulate matter:

~0.01 mg for gravimetry

~1 mg for PAH analysis

~100 mg for RNA microarray

Time-consuming and expensive PM sampling

Atmospheric Hi-Vol samplers (2 x 67.8 m³/h) sampling from a full-flow dilution tunnel but this is still not enough & filter capacity only approx. 10 mg due to small, fractal soot particles.

Goal: Innovation of sampling procedure -> collection of higher amount of PM

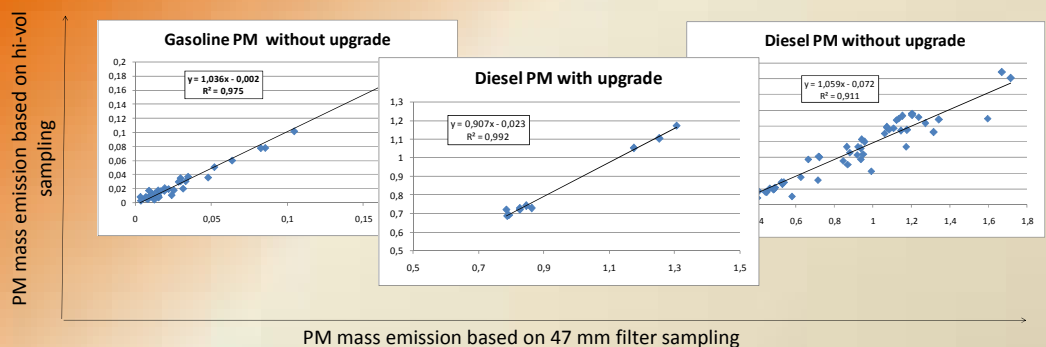
Two high-volume atmospheric samplers have been augmented with an **auxiliary three-stage blower** (17 kPa @ 2*68 m³/h) and with a **high-strength filter holder** (15 kPa pressure drop ~75 kg).



WHTC run:
0.5 mg on 47 mm filter
7,2 mg on 2-3 8x10" without auxiliary blower
20 mg on 1 8x10" with auxiliary blower

Nearly tripled the maximum mass of the particles collected on a 20x25 cm filter

Validation: Comparison of PM mass emissions inferred from gravimetric analysis of 47 mm vs. 8x10" filters.



Iveco Tector Euro 3 diesel engine
1 x cold + 9 x hot WHTC
460 mg from diesel fuel
280 mg from neat biodiesel
285 mg from NExBTL
RNA microarray, DNA adducts and other assays ongoing & to be reported later

Conclusion

Upgrade of high-volume samplers nearly tripled the maximum mass of the particles collected on a 20x25 cm filter, allowing lower dilution rates, longer tests to be run and more particles to be collected in a given time on smaller number of filters, reducing extraction and analysis cost and time and reducing background effects.

Regulation of sample flow at high filter pressure drops still needs to be addressed.

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