TOXICOLOGICAL AND PHYSICAL CHARACTERIZATION OF DIESEL PARTICLE FILTER REGENERATION EMISSIONS USING A LUNG CELL MODEL

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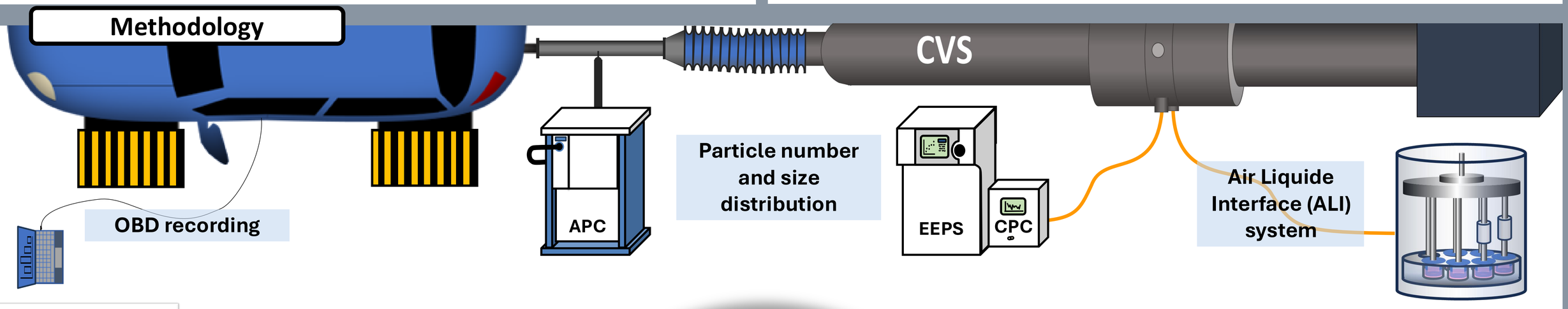
Introductions

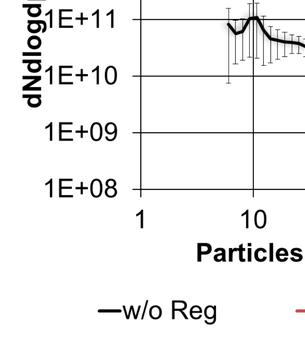
Diesel particulate filters (DPFs) are essential for reducing soot emissions from diesel engines. To keep the filter functional, a regeneration process is required to remove accumulated particles. Although DPF regeneration occurs infrequently and lasts only a short time, it substantially increases particle emissions from Euro 6d diesel vehicles.

Scope

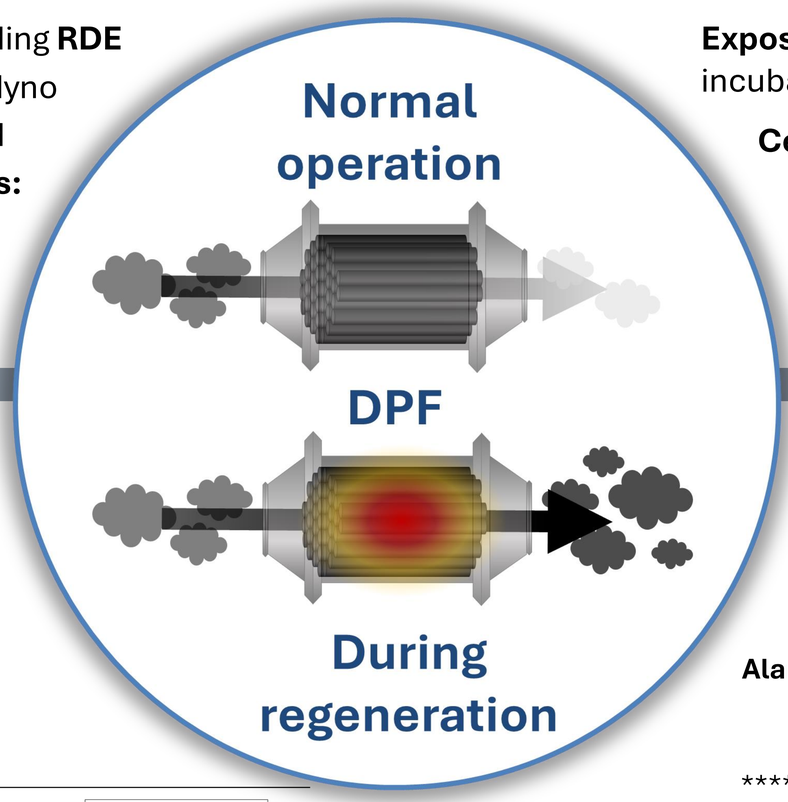
- ✓ Assess DPF Regeneration Frequency and Duration
- ✓ Investigate Impact on Particulate Number (PN) Emissions
- ✓ Analyze Particle Size Distribution and Nanoparticle Levels
- ✓ Evaluate Toxicological Effects of Emissions

Methodology





- ✓ 4 different driving cycles, including **RDE**
- ✓ More than **4500km** in Chassis dyno
- ✓ **12** active regeneration recorded
- ✓ 16 2-h **real time cell exposures:**
  - ➢ 8 w/o regeneration
  - ➢ 8 w/ regeneration



Exposure Duration: 2-hour exposure, followed by overnight incubation in complete medium.

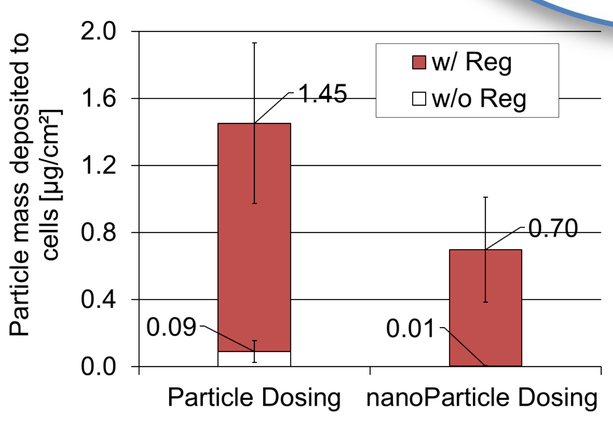
Cellular Model: Utilizing A549 Cells to Assess Toxicity

Cell Viability Assessment: 3-hour incubation with Alamar Blue™ Cell Viability Reagent, with cell number estimation via photometric evaluation.

Results

During regeneration, the **presence of nanoparticles** becomes more pronounced

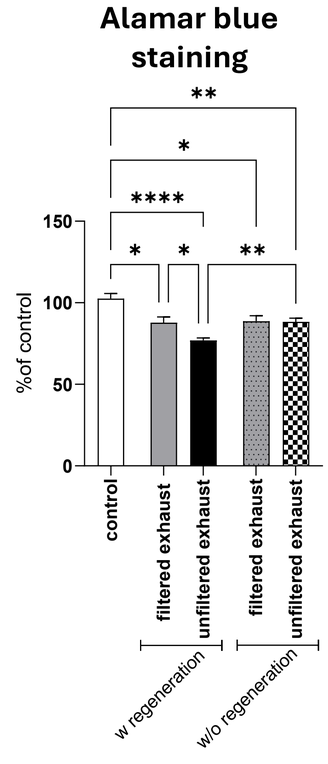
- Their **proportion** in the mixture increases significantly.
- The **number** rise substantially.

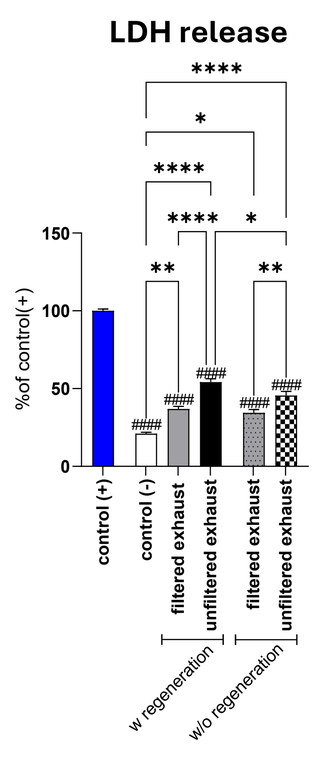


- **Gaseous emission** reduces cell viability
- **Regeneration particles** further reduce viability

Alamar Blue:
*p<0,05
**p<0,01
****p<0,0001
One way ANOVA

LDH:
####p<0,0001 compared to control (+)
*p<0,05
**p<0,01
****p<0,0001
One way ANOVA

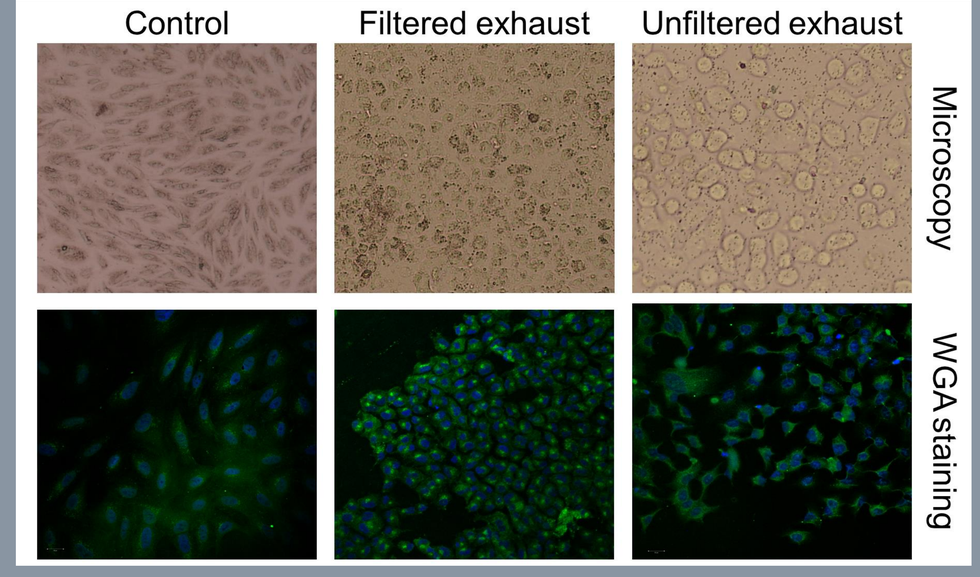




Conclusions

Particle emissions:
The vehicle is a low emitter. However, during DPF regeneration events, can generate significant amounts of solid and volatile particle, up to three orders of magnitude higher.

Viability Reduction and Emissions:
Reduced cell viability is observed only due to gaseous emissions, not particles, during normal DPF operation. However, particles generated during regeneration also reduce cell viability, indicating a potential threat to human health.



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nPETS Nanoparticle Emissions From The Transport Sector

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