TOXinTRANSPORT : project about toxicological, chemical, physical characterizations of particles in the cabin air of TRANSPORT in movement

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Context and objectives

Context

- Air pollution by particles: a serious issue for human health
- Difficulty to estimate exposures in microenvironments:
  - complexity of physico-chemical composition of particles
  - spatio-temporal variability of atmospheric pollution
- Lack of knowledge about exposures during travels, their links with travel behavior, and health outcomes
- Atmospheric pollution depends on
  - Emission sources
  - Photochemical processes
  - Meteorological conditions

Scientific and technical locks

- Current toxicological studies consider pollutants as isolated without including “cocktail effects”.
- Need to develop characterization methods taking account both the composition of particles and their toxicity in various environments.
- Samplings have to be made in a medium convenient for both toxicological and chemical analyses.

Objectives

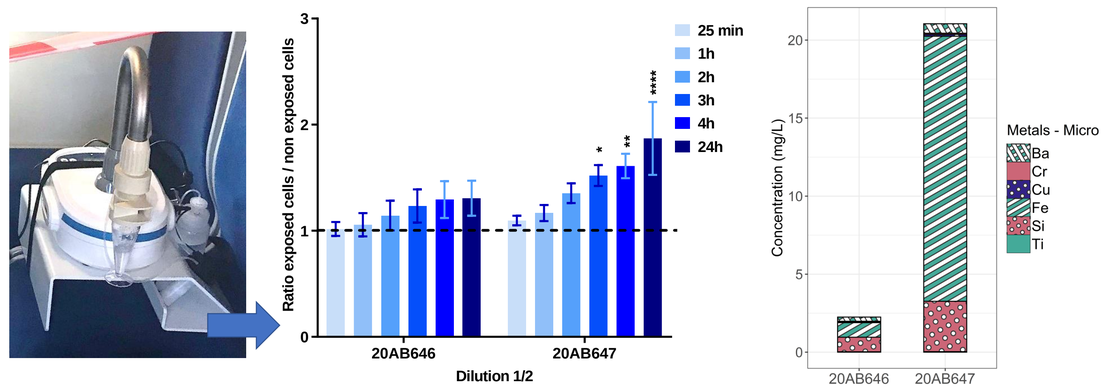
- **Characterize the physico-chemical and toxicological properties of particles in transport environments: underground railway stations and railway rolling stocks**
- **Assess the additional importance of methods characterizing both the toxicity of suspended particles**

Sampling techniques

Results of toxicology

Railway rolling stocks

Elemental composition of the 2 samples



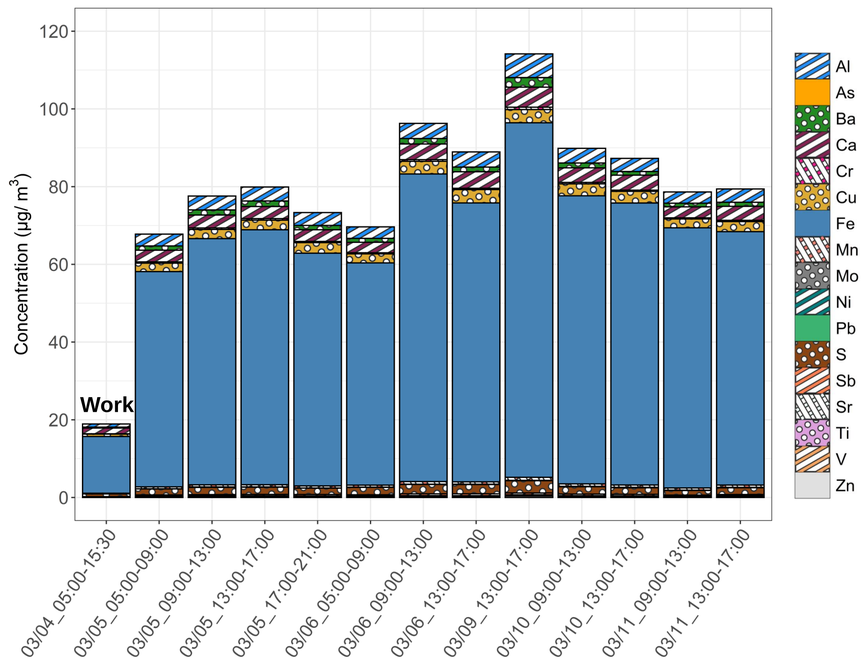
Kinetics of intracellular ROS formation after exposure to Coriolis µ samples collected for 10 min. 20AB646 : Aboveground stations; 20AB647 Underground stations. Tests were performed in triplicate.

For more details, see this poster:
Development of a methodology for the characterization of toxicological risks related to particulate pollution in underground stations, ***Ambre Delater****, Brice Berthelot, Laurent Meunier , Sébastien Fable , Matheus De Mendonça Andrade , Manon Plumail , Ghislaine Lacroix , Isabelle Coll , Jessica Queron*

* TEM : Transmission Electron Microscope

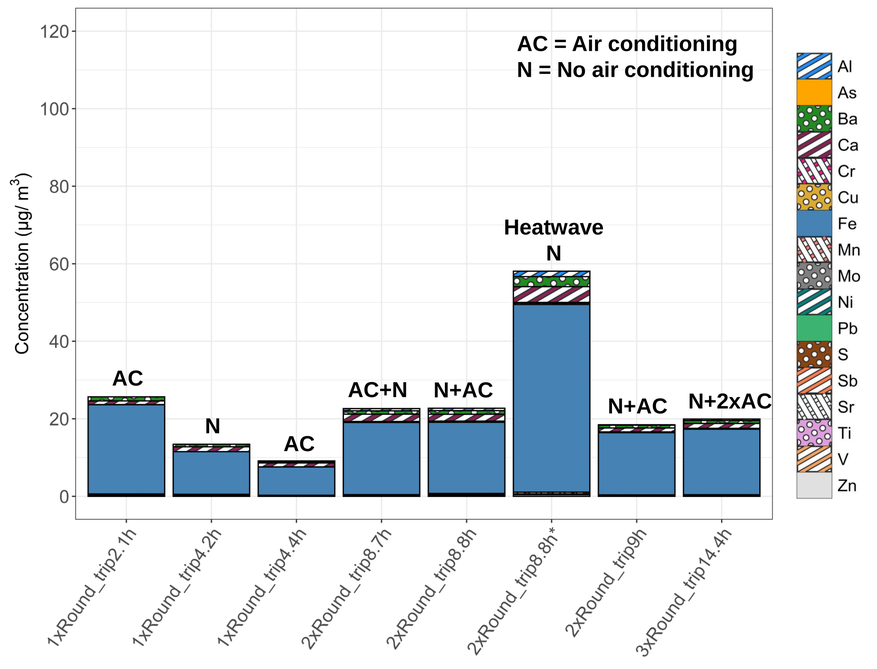
Results of physico-chemical analyses: mass concentrations and TEM* pictures

Underground railway stations

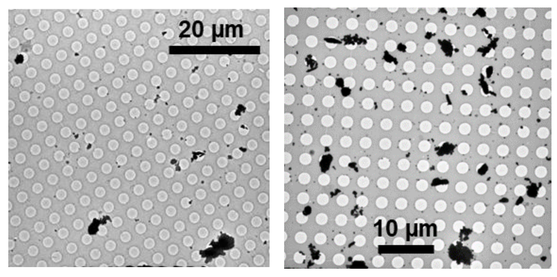


Mass concentrations of different elements as a function of date. Low variability except for the first day (works on railway tracks).
Mass concentration is dominated by iron.

Railway rolling stocks

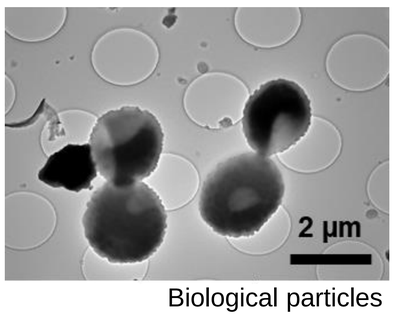


Mass concentrations of different elements as a function of date. Concentration variability depends on the air conditioning and condition in the coach.
Mass concentration is dominated by iron

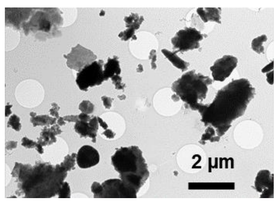


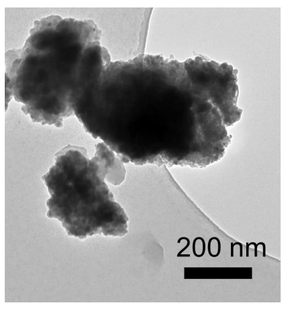
Air conditioning on Air conditioning off

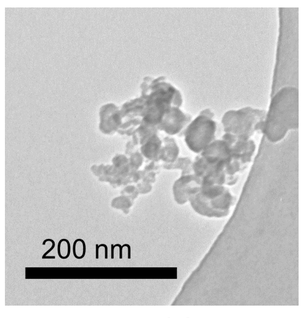
Lot of particles are sampled when the air conditioning is off (these mostly made of iron oxide)



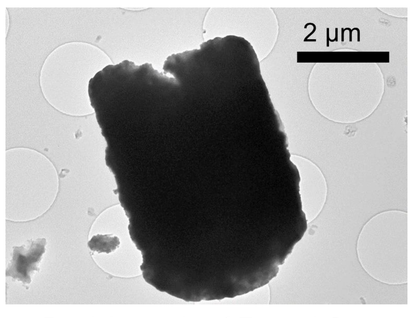
Biological particles

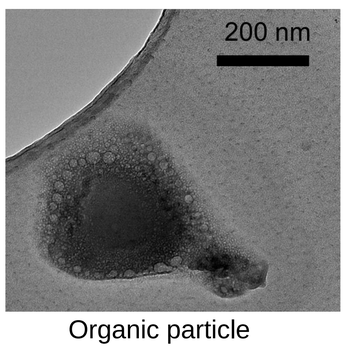


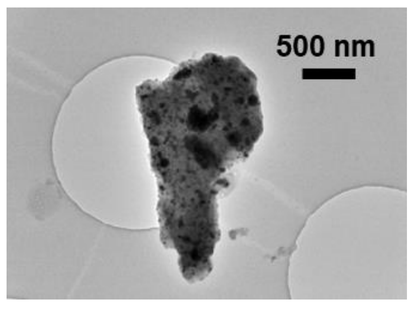




Particle made of Fe and O Soot particle







Particle made of Fe and O Organic particle Particle made of C,O,Fe,Si,Ba,Ca,S, Cl

Particles sampled with an Mini Particle Sampler (**MPS**)
Elemental composition dominated by iron and oxygen
Very few particles made of aluminosilicates, soot, barium sulfate
Size distribution: 50 nm to a few micrometers

Particles sampled with an Mini Particle Sampler (**MPS**)
Elemental composition dominated by iron and oxygen
Size distribution: particle size up to ten micrometers and more
Nature of the particles more heterogeneous than in underground railway station

Conclusion

- ❑ Measured mass concentrations of PM_{10} in this project are consistent with values found in France both for underground station and moving trains
- ❑ Toxicological effects have been linked to the presence of certain physico-chemical parameters and their concentration levels.
- ❑ Inflammation seems to be linked to high concentrations of metals (particularly iron).
- ❑ Oxidizing potential also linked to metal concentration (4 to 10 times higher than average concentrations found in urban ambient air background).