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

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Funded by

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

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

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.

Results of toxicology

Railway rolling stocks

Kinetics of intracellular ROS formation after exposure to Coriolis µ samples collected for 10 min. 20AB646 - 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, Stéphane Fable, Matheus De Mendonça Andrade, Manon Plumet, Ghislaine Lacroix, Isabelle Col, Jessica Queron

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

Underground railway stations

Railway rolling stocks

Air conditioning on
Air conditioning off

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

Biological particles

Air conditioning on
Air conditioning off

Elements of the cabin: AC = Air conditioning, N = No air conditioning

Experimental setup

Elemental composition dominated by iron and oxygen

Nature of the particles more heterogeneous than in underground railway station

Concentration variability depends on the air conditioning and condition in the coach.

Mass concentration is dominated by iron

Context

- Measured mass concentrations of PM2.5 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).