

Short Summary of the EFCA Symposium on Ultrafine Particles – Brussels July 5th -6th, 2022

Sixty-four experts from 14 different countries participated in the 8th symposium on ultrafine particles (UFP) to discuss UFP sources, ambient UFP measurements, urban UFP, UFP toxicity and epidemiology, and integrating actions in 10 sessions. The symposium ended with an interesting panel discussion on the question how to get from UFP monitoring to measures.

The symposium started with a keynote lecture illustrating the role of micro- and nanoplastic particles in air pollution and potential disease pathways associated with it.

A first session presented UFP sources with focus on emissions from the global fleet of ships, from aviation emissions around airports, and from electric vehicles e.g. by braking. Global ship emissions constantly rise especially in the northern hemisphere except in so-called Emission Control Areas. Due to poor regulations, ship emissions are among the world's most polluting combustion sources per ton of fuel consumed. Updated conventions controlling ship emissions should include besides classical pollutants also CO₂, and should support alternative fuels (e.g. LNG, electric). UFP concentrations are higher near airports exceeding the WHO 2021 guidelines with departing older aircraft as major source. Particle emissions from electric cars increase with speed (braking) and acceleration (tires).

The second keynote lecture addressed mainly new European research infrastructures (e.g. ACTRIS) for measurements of UFP especially in urban areas (RI-Urbans) demonstrating the commitment to comprehensive and continuous environmental observations.

In the poster session nine poster showed the carbon content in PM, the composition, and sources of PM_{2.5} near Beirut, air quality changes in Wuhan-China, ions in PM_{2.5} in Croatia, the comminution behavior of carbon fibers, PM emissions in life cycle assessments, UFP from Euro 6 passenger cars and Ferries and the major contributions of fossil fuel combustion and ship emission to high numbers of UFP on a global scale.

The third keynote lecture showed that the spatial extend of hot spots of UFP in Innsbruck, Austria, strongly depend on the weather. At high wind speeds the concentrations drop in short distance from the sources while at lower wind speeds the UFP hot spots are much larger.

The fourth keynote lecture demonstrated the potential uptake of metal containing UFP into different human organs including the brain and thus contributing to cardiovascular and neurodegenerative diseases. Magnetite and associated iron and metal rich redox active UFP may represent a key driver of oxidative stress and inflammation.

Another session focused on method development for UFP characterization and filtration: monitoring physico-chemical properties, harmonized sampling and measurement protocols, source apportionment, and virus removal. Two sessions addressed UFP in urban environments like black carbon reduction during lockdown periods due to less combustion aerosol, harmonized black carbon measurements, seasonal variation of PAH and carbohydrate concentrations, research infrastructures, source apportionment, and transport modelling. This includes studies on long-term exposure to UFP in urban and rural areas and related health effects with disentangling of the possible health effects of UFP in comparison to the regulated air pollutants such as PM₁₀, PM_{2.5}, NO₂ and O₃. Furthermore, it was shown that carbon fibers cause inflammation if deposited on lung cells.

The final session focused on UFP related health effects. Sources of Oxidative Potential (OP) in atmospheric PM in Barcelona is mainly related to local anthropogenic sources such as shipping and traffic. Studies of UFP toxicity by deposition at the air-liquid interface of lung cells facilitate realistic hazard identification but require very careful characterization. The mucus UFP interaction is very relevant for the toxicological effects. Short-term exposure to airport UFP can affect the respiratory and cardiovascular systems but there is yet no significant evidence for long term effects.

The potential transfer of scientific evidence into societal and administrative evidence was topic of the concluding panel discussion.

The Organizing Committee