

Air Pollution: The Journey from Single Particle Characterization to in vitro Fate

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Abstract : It is well-known from public news media that air pollution is a health hazard and is responsible for early deaths. The quantification of the relationship between air quality and health is a probing question not easily answered. It is known that airborne particulate matter (APM) $<2.5\mu\text{m}$ deposits in the tracheal and alveoli zones and our research probes the possibility of quantifying pulmonary injury by linking reactive oxygen species (ROS) in these particles to DNA damage. Currently, APM mass concentration is linked to early deaths and limited studies probe the influence of other properties on human health. To predict the full extent and type of impact, particles need to be characterised for chemical composition and structure. APMs are routinely analysed for their bulk composition, but of late analysis on a micro level probing single particle character, using micro-analytical techniques, are considered. The latter, single particle analysis (SPA), permits one to obtain detailed information on chemical character from nano- to micron-sized particles. This paper aims to provide a snapshot of studies using data obtained from chemical characterisation and its link with in-vitro studies to inform on personal health risks. For this purpose, two studies will be compared, namely, the bioaccessibility of the inhalable fraction of urban road dust versus total suspended solids (TSP) collected in the same urban environment. The significant influence of metals such as Cu and Fe in TSP on DNA damage is illustrated. The speciation of Hg (determined by SPA) in different urban environments proved to dictate its bioaccessibility in artificial lung fluids rather than its concentration.

Keywords : air pollution, human health, in-vitro studies, particulate matter

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