PM pollution: Oxidative Potential of PM_{10} in the Arve Valley (France) – comparison of two different assays measurement.

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In vitro studies have shown that effects of airborne particles (aerosols) on human health can be mainly attributed to their inflammatory potential due to the oxidative species they carry (Kelly, 2003). Particulate matter (PM) induces the production of reactive oxygen species in the airways and, if these exceed the available antioxidant defenses oxidative stress ensues (Kelly, 2003).

To predict aerosol toxicity, a key parameter to investigate is the oxidative potential of PM. In this respect several, non–invasive screening assays (in vitro) have recently been developed (Cho, 2005. Uzu, 2011, Kelly, 2011. Janssen, 2014).

Arve Valley (Auvergne-Rhône Alpes, France), as other alpine valleys, frequently experiences high PM concentrations. As a consequence this French area frequently exceeds limit and quality values from the European Union air quality directive 2008/50/EC for PM_{10} and $PM_{2.5}$ mass concentration (Golly, 2015). These exceedances are due, in part, to the particular topography, specific weather conditions and anthropogenic activities. To address this issue, a national program has been deployed to reduce the contributions of biomass burning to PM_{10} by changing wood stoves in three townships. Into this framework, the DECOMBIO scientific project aim is, amongst others, to observe if there is modification of PM_{10} chemistry and reduction of PM_{10} mass concentration following replacement of these wood stoves. Three sites, Chamonix, Marnaz and Passy, offer three different areas of the valley where studies were undertaken to establish the contribution of biomass burning over 3 years. Furthermore, an extensive study of the composition of PM_{10} was undertaken. To extend this work, we next investigated the oxidative potential of these PM_{10} samples. This was achieved by using two in vitro assays - the respiratory tract lining fluid (RTLF) model (Mudway, 2005) and the DTT assay (Cho, 2005)

The RTLF exposure model involves following the depletion of three antioxidants commonly found on the surface of the lung - ascorbate, reduced glutathione and uric acid. The DTT assay was developed to simulate the in vivo generation of superoxide radicals. DTT is used as a surrogate of the biological reducing agents (NADH and NADPH) and is, therefore, considered as an antioxidant.

Here, we report, a comparison of the oxidative potential measurements undertaken across one year sampling (one sample every three days on three sites), with the RTLF exposure model, at the king's College (London, UK) and DTT assay, at the LTHE-LGGE (Grenoble, France) on a long series of PM environmental samples (DECOMBIO filters).

Moreover, because bioaccessibility is also a key parameter to investigate, to predict PM toxicity (Caboche, 2010), we also propose an improvement of DTT assay. We settled solutions of extraction mimicking more closely the lung fluid composition, and thereby taking into account the bioaccessibility in the OP assays.

Finally, these oxidative potential measurements will be compared and correlated with extensive chemistry data: EC, OC, ions, PM10, PAH and derivatives, HULIS, biomass tracers, hopanes, metals, sugars and polyols.

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