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Mineralogical characterization and environmental-health implications of urban PM2.5 from Rome (Italy)

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To evaluate the health effects deriving from the inhalation of air particulate matter a detailed characterization of the airborne particles is required. Many studies focused the attention on the particle dimensional range and in particular on the small size (<PM2.5).
Previous investigations on PM2.5 from city of Rome provided information about the inorganic compound [1,2] , where abundant Fe-sulphate associated to other mineral phases were highlighted.
In the present work a detailed mineralogical investigation on the PM2.5 of 3 different sampling campaign (2011) was carried out. According to the standard procedures [3] , both PTFE and quartz filters were utilized. Combining different analytical techniques (SEM-EDS, X-ray and DTA) sulphates resulted again the most abundant mineral phases. In particular gypsum, melanterite, aphthitalite and glauberite were identified. Subordinate carbonates, clay minerals, oxides and hydroxides were also found.
To investigate the presence of heavy metals and their possible release in biological environment, a suitable amount of material (> 40mg) was collected. A portion of the collected material was analyzed by ion mass spectrometry (ICP-MS, ICP-OES) and the bulk chemical composition evidenced the presence of heavy metals, in particular Cd, Cu, Cr, Fe, Pb and Zn. Consequently, in order to verify the potential mobility of heavy metals, a batch kinetic leaching test was executed, using a physiological solution (mimicking the pulmonary environment, pH 7.4, 37 °C) and various samples were collected from the solution at different times. Among the metals contained in the particulate, a leaching trend was observed principally for Pb, Cd and Cu, with Cd resulting as the most mobile heavy metal, whereas no Fe release was observed so far. Ongoing experiments will define the best experimental condition for the evaluation of metals leaching behaviour.
Preliminary experiments were also carried out in order to evaluate the biological effects of the leached materials on in vitro cellular immunoreactivity. Freshly isolated human polymorphonuclear leucocytes were exposed to different concentrations of filtered (0,2 μm pore dimension) leaching solutions and both the basal and stimulated production of reactive oxygen species were measured by means of the NBT test. The very first results show that the compounds leached from particulate significantly impair cell ability to react to physiological stimuli. Further experiments are in progress in order to define the molecular species involved in the observed effect.

References

[1] Mazziotti Tagliani S., Silvestroni L., Palleschi S., Burragato F., Gianfagna A., Paoletti L. (2009) Innovative chemical and physical characterization of particulate matter related to environmental and health issues. Geoitalia 2009, Rimini, 9-11 settembre.
[2] Mazziotti Tagliani S., Gianfagna A., Piga L. Maras A., Cottignoli V., Inglessis M., Settimo G. (2011) Mineralogical methods for the characterization of 2.5 particulate matter in the urban area of Rome, Italy. Geoitalia 2011, Torino, 19-23 settembre.
[3] 2008/50/CE - Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe. The European Parliament and The Council of The European Union.