Trace elements bioaccessibility in fine particles from the urban area of Lille (France)

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Air pollution, significantly reduced in recent decades, continues to exert adverse effects on human health. A recent meta-analysis, combining the results of several epidemiological studies, showed a causal relationship between exposure to normal levels of air pollution and mortality from cardio-respiratory causes (Analitis *et al.*, 2006, Brook *et al.*, 2006). Inhalable atmospheric particles may contain significant concentrations of trace elements (TE) that could be one of the causes of the adverse cardiovascular and respiratory effects (Donaldson *et al.*, 2002).

Among air pollutants, fine particulate matter ($PM_{2.5}$ Particulate matter <2.5µm) is a major health risk factor. Due to their size, $PM_{2.5}$ can penetrate in the deep part of the lung where a fraction of these inhaled particles persists in spite of the pulmonary clearance mechanisms and can exerts toxicological effects (Brauer *et al.*, 2001). Fine particles TE can be partially or completely dissolved upon contact with the lung fluids and the evaluation of this solubility is essential for a better understanding of the particles' toxicology (Costa and Dreher, 1997).

Molecular and cellular mechanisms involved in the pulmonary air pollutants pathogenesis remain highly controversial. Therefore, particle size, shape, chemical composition and potentially toxic bioaccessible content are the main characteristics to consider in the PM-induced biological impacts (Oberdörster *et al.*, 2005). However, these parameters are not taken into consideration in toxicological studies. Bioaccessibility is classically evaluated *in vitro*, in water or in solutions mimicking the physiological fluids (Gamble solution, pH = 7.4 and 37 °C) (Caboche *et al.*, 2011) but in absence of any interaction with human cells. Moreover, toxicological studies are often performed in complex cell culture media with specific nutritive and balanced salt solutions favoring their survival and their growth under particular physiological conditions compatible with the cells culture. In this study, $PM_{2.5}$ TE bioaccessibility was assessed in cell culture media in cells presence or absence.
Fine particles were collected in the traffic influenced urban area of Lille, using high volume cascade impactors (Tish). Bioaccessible fractions and total concentrations of a large set of elements, selected according to their potential toxicity and their property as source markers (Al, As, Ba, Cd, Co, Cr, Cu, Fe, K, La, Mg, Mn, Mo, Ni, Pb, Rb, Sb, Sr, Ti , V and Zn), were analyzed by ICP-AES and ICP-MS. In addition, in order to evaluate the toxicity of the soluble or insoluble TE part of the fine particles, we measured various parameters like cytotoxicity measuring G6PD release, cytochrome P4501A1 activation and inflammation (IL-8, IL-6, TNF-α).

These results indicate that the bioaccessibility may vary depending on the cell culture media employed. Moreover, the interaction between the cells and the culture media participate to the chemical transformation of the pollutants and should be considered in future toxicological studies.

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