Assessment of the human health risks and toxicity associated to particles (PM10, 2.5 and 1), organic pollutants and metals around cement plants

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Particulate matter (PM) is widely recorded as a source of diseases, being considered by some studies as the most harmful air pollutant. In fact, it is estimated that PM is responsible of 800.000 premature deaths annually. Among PM, the fine fraction (those smaller than 2.5μm of diameter) is identified as the most dangerous. PM is released in the environment as a consequence of different activities, being one of them the concrete production. Although some studies have been carried out relating fine PM emission from cement plants and health effects, we still don't have much info about the behavior this pollutant adopts inside the human body. Moreover, currently many plants are starting to use biomass/waste as fuel, and new efforts have to be made in order to identify if the use of this combustibles involves a greater health risk for the population. In order to clarify the effects of cement manufacturing fine PM over the population, our study will go over different milestones. Three cement plants (Montcada, Alcanar, Els Monjos) have been selected, and an evaluation of the affected area have been performed using atmospheric dispersion modeling (AERMOD). After the sampling of ambient PM, the morphology and the main composition of particles was determined by an Environmental Scanning Electron Microscope. Chemical characterization of the particles (through the analysis of metals, poliaromatic hydrocarbons, dioxins and furanes), and a subsequently ecotoxicity (microtox) and toxicity (lung cell cytotoxicity, genotoxicity, PM-Reactive Oxygen Species, lung macrophages, and endocrine disruptors) tests are performed to evaluate the potential adverse effects on health. Afterwards, the developing of a chronic exposure model will help to evaluate the effects and assess the risk to the population. Our preliminary results show that the 31-50 % of the samples exhibit citotoxicity, while the 18% express a positive response to the genotoxicity test. The microtoxicity seems to be higher in the coarse fraction (particles between 10 and 2.5 μm of diameter) than in the fine one. Further research is needed in order to keep on with the sampling and analysis stage, and to assess the possible health damage over the population. To reach this goal we propose to explore an integrated human respiratory tract (HRT) and physiologically based pharmacokinetic (PBPK) model in order to quantitatively estimate the relationship between exposure to PM and tissue dosimetry, while taking explicitly into account the physiological characteristics of the human biological system.