



Chemical properties of aerosol, trajectories and its impact on human's lung cell during the Middle Eastern Dust (MED) storms in Ahvaz, Iran

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Abstract: Air pollution contains a complex mixture of poisonous compounds including particulate matter (PM) which has a wide spectrum of adverse health effects. For many years, the Khuzestan Province in West southern Iran has been exposed to various ambient air pollutants the most important sources of which were known to be dust and industrial pollutants. Ahvaz, Iran ranks as the most polluted city in the world in terms of PM10 concentrations that lead to deleterious effects on its inhabitants. Reports on the effects of PM10 from dust storm on lung cells are limited. The main purpose of this study was to investigate the chemical composition and in vitro toxicological impacts of PM10 suspensions, its water-soluble fraction, and the solvent-extractable organics extracted from Middle Eastern Dust storms on the human lung epithelial cell (A549). Samples of dust storms and normal days ($PM_{10} < 200 \mu g m^{-3}$) were collected from December 2012 until June 2013 in Ahvaz, the capital of Khuzestan Province in Iran. The chemical composition and cytotoxicity were analyzed by ICP- OES, and Lactate Dehydrogenase (LDH) reduction assay, respectively. The results showed that PM10 suspensions, their water-soluble fraction and solvent-extractable organics from both dust storm and normal days caused a decrease in the cell viability and an increase in LDH in the supernatant in a dose-response manner. Although samples of normal days showed higher cytotoxicity than those of dust storm at the highest treated dosage, T-Test showed no significant difference in cytotoxicity between normal days and dust event days (P-value > 0.05). These results led to the conclusions that dust storm PM10 as well as normal day PM10 could lead to cytotoxicity, and the organic compounds (PAHs) and the insoluble particle-core might be the main contributors to cytotoxicity. Our results showed that cytotoxicity and the risk of PM10 to the human lung may be more severe during dust storm than normal days due to inhalation of a higher mass concentration of airborne particles. Further research on PM dangerous fractions and the most responsible components to make cytotoxicity in exposed cells is recommended. The results of this study motivate more aggressive strategies in Ahvaz and similarly polluted desert cities to reduce the health effects of the enormous ambient aerosol concentrations.

Keywords: Middle Eastern dust, Ahvaz, A549, Cytotoxicity, Chemical composition