ABSTRACT

Combustion-derived particles leads to adverse health effects such as pulmonary and cardiovascular diseases and premature death. Atmospheric aging of combustion-derived particles induces changes in their chemical composition. However, the impact of these changes on human health remains inconclusive. The purpose of this study was to describe and compare the health effects of freshly emitted combustion particles versus atmospherically aged soot. Consistent combustion particles were produced by combusting a premixed flow of jet fuel and oxygen at an equivalence ratio of 1.8 in a flat flame burner and aged in a potential aerosol mass reactor (PAM). Atmospheric aging of 10 days was mimicked by exposing the combustion particles to OH radical in the presence of 245nm ultraviolet light, humidity, and ozone in the PAM reactor at similar O3/OH and H02/OH ratios to the atmospheric values. Organic gases and ozone exposure was minimized through a series of charcoal denuders. The fresh combustion particles and the aged combustion particles were characterized for chemical composition. The composition of aged particles reveals differences the amount of PAH, oxy-PAH, and aldehydes in both particles. Fresh and aged particles were exposed to A549(alveolar epithelial carcinoma) lung cells line at different doses of 25ng/cm$^2$ 6ng/cm$^2$ and 1.5ng/cm$^2$ and time of 4, 8 and 24 hours. The effect of the exposure was evaluated by biological endpoints such as cytotoxicity, xenobiotic metabolism CYP 1A1 and proinflammatory responses such as TNF-$\alpha$ and IL-8. The results demonstrated that aged combustion particles contained a higher level of oxidized PAH than fresh particles and these oxidized particles likely contributed to higher inflammatory responses and cytotoxicity in aged combustion particles than fresh combustion particles.