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Measurements of electronic cigarette-generated particles for the evaluation of lung cancer risk of active and passive users

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Abstract

Electronic cigarettes (ECs) are perceived to be safer than traditional tobacco cigarettes because of the absence of combustion processes. The use of these devices, however, exposes the users ("vapers") and passive "vapers" to possible high concentration of fine and ultrafine particles (UFPs) which can deliver toxic and carcinogenic compounds. In the present work, an experimental campaign was carried out using dedicated instrumentation in order to characterize both the aerosol emitted from ECs and the exposure to second hand EC smoke in a typical indoor microenvironment in terms of particle number and surface area concentrations. Thus, the potential carcinogenic effects due to the inhalation of EC-generated aerosol was evaluated by means of an ad-hoc Excess Lifetime Cancer Risk (ELCR) model able to take into account for the contribution of both sub-micron and super-micron particles, referring to the particles surface area, evaluated on the basis of their solid core only, by heating the aerosol at 300 °C. To this end, literature data of toxic compounds deposited on EC-generated particles (both with and without nicotine) and typical smoking behaviours of male and female Italian vapers were considered. The results showed that the particle number concentrations in EC mainstream aerosol ($2.23 – 2.34\times10^{8}$ part. cm^{-3}, mode at 34 nm) are higher than that in mainstream smoke of traditional cigarettes, while surface area concentrations in mainstream EC aerosol ($2.48 – 3.35\times10^{10}$ nm^2 cm^{-3}, at 300 °C)) are lower than that in traditional mainstream cigarettes smoke. The corresponding ELCR value of mainstream EC aerosol (6.11 –