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E-cigarette Aerosol Physical and Chemical Characterisation

Abstract *

Electronic cigarettes have emerged as a widely-used consumer product. The degree of regulatory oversight varies significantly. Product stewardship requires toxicological assessment of bulk e-liquid composition, thermal breakdown products, and avoiding ingredients that are carcinogenic, mutagenic, toxic to reproduction or respiratory sensitizers. Physical characterisation shows sub-micron droplets at concentrations up to $1e9.cm^{-3}$ for cartomizer type e-cigarettes. We measured 150 chemicals from priority toxicant lists for an e-cigarette (Vype ePen: 3.6V, 1.86% nicotine, 48% glycerol, 25%, propylene glycol and 25% water), versus a reference tobacco cigarette. Of the 150 measurands, 104 were not detected and 21 were present due to laboratory background. Of the 25 species detected, 9 were below limits of quantification. The 16 measurable chemicals comprised major e-liquid constituents (nicotine, propylene glycol (PG), and glycerol), recognized impurities in Pharmacopoeia-quality nicotine, and eight thermal decomposition products of PG or glycerol. Approximately 100 measurands were detected in cigarette smoke. Per-puff emissions of toxicants identified for regulation were 92 to >99% lower than cigarette smoke. These data demonstrate that e-cigarettes can offer the potential for substantially reduced dose relative to cigarette toxicants. Further studies are required to establish whether this potential lower consumer exposure will result in tangible public health benefits.

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