

The Influence of Ageing on the Genotoxic Potential of Electronic Nicotine Delivery System Aerosols: An In Vitro Assessment

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BACKGROUND

The safety of electronic nicotine delivery systems (ENDS) remains unknown. Recent evidence suggests hazardous compounds found in ENDS aerosols may increase as the device ages causing inhalation of genotoxic agents. Identifying ENDS usage patterns that may enhance exposure to genotoxic compounds will be essential to protecting public health.

METHODS

In this study, we aimed to characterize the lifecycle and toxicological profiles of aerosols from pod and mod ENDS using primary small airway epithelial cells (SAEC). Aerosols from (1-50) and (101-150) puffs for pods and (1-25), (101-126) and (201-226) puffs for mod devices utilizing tobacco flavored e-liquid were generated using a custom vaping machine. Aerosols were monitored and collected using scanning mobility particle sizer and fluorinated ethylene propylene tube condensation traps, respectively. ENDS aerosols were eluted and prepared for toxicological analysis using cellular viability, oxidative stress and the CometChip assays after 24 hr or 7 days.

RESULTS

Both ENDS devices generated polydispersed size fractions ranging from 10 nm to ~1 micron. Particle concentrations were higher for pod where puffs 1-50 emitted 207 $\mu\text{g}/\text{m}^3$ and puffs 101-150 emitted 153 $\mu\text{g}/\text{m}^3$, while mod ranged from 1, 4 and 7 $\mu\text{g}/\text{m}^3$ for each respective puff fraction. At each puff fraction, duration, and device, significant increases in reactive oxygen species were found in SAEC along with glutathione and cellular viability reduction. Interestingly, at both time points, a two-fold increase in DNA damage due to pod puff fractions 101-150 in comparison to 1-50 puffs was found. Likewise, we observed a three-fold increase in DNA damage caused by puffs 201-226 versus puffs 101-126 for mod aerosols.

CONCLUSION

This work suggests ENDS aerosols become more hazardous as the device ages, which may increase adverse human health effects.

STATEMENT OF RELEVANCE TO CTP REGULATORY AUTHORITIES

Our research may help ENDS manufacturer's develop consumer usage recommendations and warnings regarding potential human health risks associated with certain vaping patterns.

KEYWORDS

Electronic nicotine delivery systems, dosimetry, DNA damage, human health