Chemical Profiling of Aerosols in Next-Generation Tobacco Products

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Next-generation tobacco products, including electronic cigarettes (E-cigs) and heated tobacco products (HTPs), are increasingly marketed as reduced-risk substitutes for conventional tobacco (CT). Yet, the actual extent to which these products reduce users' exposure to harmful chemicals remains unclear. This work provides a comprehensive comparison of volatile organic compounds (VOCs) detected in both native materials (pre-heating) and the resulting aerosols or smoke (post-heating or combustion) from E-cigs, HTPs, and CT. The three best-selling brands available in Portugal for each product category were analyzed in triplicate. For native characterization, 138 ± 3.84 mg of tobacco or e-liquid were placed in sealed glass vials. Aerosols and smoke were generated following standardized puffing and smoking protocols [1,2] and collected in dedicated flasks. VOCs from both native matrices and generated aerosols/smoke were extracted using headspace solid-phase microextraction (HS-SPME) and dichloromethane solvent extraction, then analyzed by gas chromatography–mass spectrometry. More than 100 compounds were identified across all products. Native HTPs and CT displayed comparable VOC profiles, dominated by ketones, alcohols, terpenoids, and pyridine derivatives, whereas E-cigs exhibited signatures rich in alcohols, esters, pyranones, and lactones. Heating and combustion led to the formation of additional VOCs absent in the native materials. Specifically, HTP aerosols revealed newly formed aldehydes and ketones, while E-cig aerosols contained additional esters. In contrast, CT combustion generated abundant benzenoid compounds and polycyclic aromatic hydrocarbons, which were not detected in HTP or E-cig aerosols. Notably, a considerable proportion of compounds identified in HTP and E-cig aerosols lack hazard classification under the Globally Harmonized System. Overall, the results demonstrate extensive chemical transformations driven by thermal processing and emphasize the urgent need for further toxicological evaluation to inform evidence-based regulation of emerging alternative forms of smoking.

Palavras-chave: electronic cigarettes; heated tobacco products; volatile chemical composition; temperature-induced compound formation

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