



B67 Vaping in the Fourth Generation: A Comparison of Nicotine Dose Capture in Different Forms of Concentrated Substances

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Learning Overview: After attending this presentation, attendees will be able to understand the use of fourth-generation electronic cigarettes (e-cigs) in illicit drug use and the danger this poses.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by further implicating the presence of e-cig use in the realm of controlled substances.

E-cigs were created as an alternative nicotine delivery system. Three generations of traditional e-cigs exist, designed to deliver nicotine through aerosol/vapor by heating an e-liquid solution made up of nicotine, various flavoring agents, propylene glycol, and vegetable glycerin. Two more generations have recently evolved: (1) the fourth generation device, focused on the ability to aerosolize plant material (marijuana), waxes, and dabs (THC based); and the fifth generation “pod mod,” focused on simplicity and ease of use. Novel devices also have more potential to be manipulated for use of other psychoactive substances.

The purpose of this experiment was to determine the efficiency of aerosolizing nicotine in different mediums using a fourth-generation e-cig (the Source Orb 4), which utilizes five different types of atomizers for a more customizable vaping experience.

Two different materials were introduced to each atomizer; a 12mg/mL 50:50 PG:VG nicotine e-liquid and a 12mg/mL nicotine/kava wax mixture. The atomizer was operated at 4.2V, and the generated aerosol was collected in a trap ($n=5$). Nicotine concentrations were determined using a Shimadzu® LC30 Ultra High Pressure Liquid Chromatograph attached to a Shimadzu® LCMS-8050 Triple Quadrupole Liquid Chromatograph Mass Spectrometer (UHPLC-MS/MS). Chromatographic separation was performed on an Agilent® Zorbax® Eclipse XDB-C18, 4.6 x 75mm, 3.5-micron column with 10 μ L injections. Mobile phase A was 0.1% formic acid in water and mobile phase B was 0.1% formic acid in acetonitrile, introduced to the column at a 50% binary gradient and a flow rate of 0.5mL/min. The instrument was run in positive Multiple Reaction Monitoring (MRM) mode. The following transition ions (m/z) with their corresponding collision energies (eV) in parenthesis for nicotine 163>130 (-23), 163>117 (-24), and nicotine-d₄ 167>134 (-25).

The average percent recovery delivered per puff for the five different atomizers ranged between 31%–80% for the nicotine e-liquid and 23%–189% for the nicotine/kava wax. The measured experimental dose ranged from 0.8–7.4 μ g for the nicotine e-liquid and 3.7–53.9 μ g for the nicotine/kava wax.

Depending on the atomizer and type of medium being vaporized, the amount of nicotine aerosolized will vary. The Source Orb 4 was able to weakly aerosolize nicotine in the traditional e-liquid, as compared to the wax. These results further imply the progression of the fourth-generation e-cig in distributing plant and wax material, in a device that has the appearance of a traditional e-cig. As a result, Drugs Other Than Nicotine (DOTNs) with pharmacological and psychoactive properties can be discreetly consumed in public, causing a concern in several aspects of public safety.

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Electronic Cigarettes, Nicotine, LC-MS/MS