Developing Reference Materials and Delivery Systems to Establish Ground Truth in Cannabis Breathalyzer Development

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We aim to develop an infrastructure akin to that which exists for alcohol breathalyzers for evaluation, calibration, and quality control of cannabis breathalyzers. Tetrahydrocannabinol (THC) is lipophilic and has low volatility. Limited human subject studies with different devices help to identify cannabis-associated compounds in breath, their concentrations, and sampling challenges in the field. For sampling devices designed to trap less volatile compounds, THC quantification requires multiple exhalations, even with high-sensitivity mass spectrometry analyses. However, ground truth is unknown. We are developing reference materials and delivery systems to deliver breath surrogates with known THC quantities to any sampling device or sensor technology to establish ground truth for the device's performance. Our approach utilizes vapor pressure measurements of cannabinoids and cannabis-associated compounds to understand their behavior during storage and delivery. In 2017, we published the first-ever vapor pressure measurements for THC and cannabidiol (CBD). The measurement uncertainty was high, and the temperature range was limited. Since then, we have developed dynamic vapor microextraction (DVME) and achieved state-of-the-art, low relative standard uncertainties, approximately 2% in the pressure range studied, for the reference compound n-eicosane ($C_{20}H_{42}$). New, low-uncertainty vapor pressure data for the cannabis-associated terpene linalool and the cannabinoids THC, CBD, and cannabinol (CBN) will be presented. Numerical simulation of the effect of aerosol diameter and velocity on capture in an impaction filter device will be presented as a means to identify important parameters to control when delivering breath surrogates containing aerosols. Together, these data are essential to prototyping initial reference materials and delivery systems for establishing ground truth for the performance of any device intended to determine recent cannabis use.