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Applications of Direct Analysis in Real Time – High-resolution Mass Spectrometry to the Analysis of Cannabis sativa Plant Material and Derived Products

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Abstract: As the Cannabis industry grows and evolves, new testing methods must be developed to analyze the myriad of product types infused with cannabinoids or derived from Cannabis sativa. A large amount of time, resources, and money are put towards the sample preparation steps required prior to interrogating complex Cannabis sample types using traditional chromatographic techniques. Therefore, this study focused on analysis simplification through applying the unique capabilities of direct analysis in real time–high-resolution mass spectrometry (DART-HRMS) to the analysis of C. sativa plant material and derived products. A wide variety of cannabinoid-infused samples were analyzed by DART-HRMS, including edibles, beverages, personal-care products, and plant materials. When interrogated by DART-HRMS in positive-ion mode with no sample pretreatment, protonated [M+H]⁺ peaks consistent with cannabinoids (primarily THC/CBD at m/z 315) were rapidly detected. The work was extended to the development of a method to triage complex Cannabis edibles and plant materials. Research towards the development of quantification protocols using DART-HRMS was also explored. Finally, a DART-HRMS method combined with statistical analysis was developed for rapid differentiation of hemp and marijuana plant material. Preliminary results showed the potential for differentiating these varieties, while advanced statistical processing revealed m/z values diagnostic for distinguishing between hemp and marijuana, the identities of which are currently under investigation. DART-HRMS demonstrated success in the following applications: (1) rapid detection of THC, CBD, and other cannabinoids in complex matrices; (2) differentiation of hemp and marijuana varieties of C. sativa; and (3) potential semi-automated quantification protocols.