

Abstract (1500 characters)

Cannabidiol, or CBD is a compound found in hemp and cannabis plants.¹ Since CBD's legalization in Canada in 2018, it has grown in popularity for its therapeutic uses for health conditions such as epilepsy, schizophrenia, anxiety, and post-traumatic stress disorder.^{1,2} As a result of CBD's positive effects on treating health conditions in humans, CBD products are now commercially available for pets. However, there are currently no authorized veterinary drugs containing cannabis due to lack of testing.³ Consequently, there is a need for the monitoring of the unregulated commercially available pet treats for their CBD content. Currently, the most commonly used quantification methods for analyzing CBD content include high-performance liquid chromatography (HPLC) and gas chromatography (GC) coupled with either mass spectrometry (MS) or flame ionization detection (FID).⁴ These methods, however, are costly and can require extensive sample preparation. Therefore, this study will make use of capillary electrophoresis, a method that offers cost effective sampling, little sample preparation, and rapid analysis times. Establishing this method for the purpose of monitoring CBD content in pet treats will protect consumers and support product regulation in the expanding field of CBD use for therapeutic treatments in pets.

Literature Review (3500 characters):

As of 2018, Cannabis has been legalized in Canada and it has become a popular drug for its main components of Δ^9 -tetrahydrocannabinol (THC) and cannabidiol (CBD).^{2,3} THC is responsible for the psychoactive, "high" effects related to hallucinations and delirium symptoms, while CBD has more use for its therapeutic effects that include anti-inflammatory and antiepileptic properties.⁵ As CBD has been found to be a potential treatment for medical conditions such as epilepsy, chronic pain, anxiety, and inflammation in humans, CBD products have been introduced to the pet industry.⁵ However, due to lack of testing, there are currently no licensed veterinary CBD products; therefore, pet owners must purchase over the counter products that are not regulated.³ Additionally, pets metabolize phytocannabinoids such as THC and CBD differently than humans as THC is toxic to pets.⁶

An area in this field that requires more attention is the regulation of CBD products put into the market for pets. Commercially available CBD products that are not approved by the FDA are often mislabelled for their CBD content. According to Evans, of a sample size of 102 CBD containing products analyzed by the FDA, 18% of CBD products contained less than 80% of the amount of CBD displayed, 37% of products contained more than 120% of the amount displayed, while only 45% of the products were within 20% of the amount of the CBD displayed.⁷ Additionally, the FDA found that 49% of the tested products contained THC.⁷ While this study analyzed CBD products not intended for pets, the lack of licensed veterinary CBD products could mean that labelling inconsistencies are likely apparent in the pet market too. If available CBD products are misrepresenting their CBD content, pets' health could be in danger.

The most common methods for quantifying cannabinoids in various matrices include gas chromatography (GC) and high-performance liquid chromatography (HPLC).⁴ Methods using GC often supplement it with mass spectrometry (MS) or flame ionization detection (FID).⁴ Methods coupling MS with GC often require deuterated standards however, which are expensive and require extensive sample preparation.⁴ Additionally, it is preferred to do two-dimensional gas chromatography for analyzing complex matrices as one-dimensional gas chromatography does not show adequate resolution.⁴ Methods using HPLC have good selectivity as it can be used to differentiate both acidic and neutral cannabinoids while GC can only analyze neutral ones. However, HPLC requires lots of organic solvents to run, needs more sample preparation, and has a very high initial cost for the instrument.⁴ The challenges present with popular methods of CBD quantification call for a more cost-effective, greener, and faster method, such as capillary electrophoresis (CE).

Capillary electrophoresis achieves high separation by carrying the sample through a capillary that provides an electroosmotic flow. Differences in charge and size of the molecules cause them to migrate at different speeds, thereby separating and detecting the analyte.⁸ CE is also an advantageous method for its qualities of low operation costs, relatively short analysis time, and consuming very little analytes and buffers making it more cost-effective and greener than other methods.⁹ This proposed study will fill a gap in the literature by providing a method with appropriate conditions such as buffer composition for the quantification of CBD in pet treats using CE.

Research question/Goal (500 characters):

The research questions I aim to answer with my proposed project are:

1. What are the optimized conditions for running capillary electrophoresis with the intent of CBD quantification in CBD products?
2. Is the labelled CBD content in CBD pet treats accurate, and if not, to what extent is it inaccurate

Methodology (1500 characters):

The CBD extracted from pet treats will be analyzed by capillary electrophoresis (CE). To prepare the samples, pet treats will be sourced from a commercial retailer. The samples will then be homogenized to ensure equal concentration. The CBD will be extracted from the treats and preconcentrated. Internal standards ranging from 5 to 100 ppm will be prepared for sampling.

The samples will then be run on CE. CE achieves high separation by applying an electrostatic force through the buffer that flows through a 15 cm capillary. The structure of the different chemicals, particularly, the mass and charge will cause them to be attracted to either end