


## Chapter 10

# The Uses of Cannabinoids in Medicine and Their Spectroscopic Applications

Alev Er

*Istanbul University, Turkey*

Sefa Çelik

 <https://orcid.org/0000-0001-6216-1297>

*Istanbul University, Turkey*

### ABSTRACT

*Cannabis is a genus of flowering plants in the Cannabaceae family and generally has three species, Cannabis sativa, C. indica, and C. ruderalis. Tetrahydrocannabinol (THC) and cannabidiol are well-known cannabinoids found in cannabis. The elucidation and characterization of the structures of cannabinoids used in the treatment of various diseases is one of the most important steps. Vibrational spectroscopy, FTIR, and Raman spectroscopies are spectroscopic techniques that have been important in characterizing the molecular properties and functional groups of cannabinoids. Over the years, this technique, which analyzes samples in a fast, environmentally-friendly, and non-destructive manner has shown great success in drug analysis and has led to great technological developments accordingly. This chapter presents a historical overview of the uses of cannabinoids in medicine, explains the applications of QR codes in the field of medical cannabis, and offers examples of characteristic vibrational wavenumbers of natural and synthetic cannabinoids using FTIR and Raman spectroscopies.*

### INTRODUCTION

Knowledge of the medicinal properties of cannabis dates back to 2700 BC, when Chinese doctors used cannabis to treat malaria, rheumatic pain, and some other diseases, as well as for anesthetic purposes (Amar, 2006). There is a Sumerian text from 2900 BC and an Arabic document from the twelfth century, showing the medicinal use of cannabis (Russo et al., 2008; Lozano 2001). In 1854, the U.S. Dispensary

DOI: 10.4018/978-1-6684-5652-1.ch010

announced that medical cannabis could be used to treat neuralgia, depression, pain, muscle spasms, insomnia, tetanus, chorea, insanity, and other disorders (Szaflarski et al. 2014). Legal regulations have caused cannabis-containing products to become widespread. This has enabled them to be used in medicines (Johnston et al., 2011).

Medical cannabis, the most common of the cannabinoids, has been used as a medicine in the field of health for many years. The most important active ingredient of the cannabis plant, *Cannabis sativa*, is  $\Delta^9$ -tetrahydrocannabinol ( $\Delta^9$ -THC). The flowering tops and leaves of the *C. sativa* plant secrete a resin containing about 60 terpenophenolic compounds. The highest amount of cannabinoids are found in the upper parts of flowering plants and in the leaves, stems and roots, respectively, according to their abundance, and the seed does not contain any cannabinoids (Ameri, 1999).

Cannabinoids are found in cannabis (*cannabis sativa*) and cannabis products (Pertwee, 2004; Elsohly et al., 2005). Cannabidiol (CBD), cannabigerol (CBG), cannabinol and cannabichromene (CBC) are other most important compounds (Williamson et al., 2000). The medicinal benefit of the cannabis plant is considered to be due to its cannabinoid compounds.

There are four most common cannabinoids used for medical treatment: phytocannabinoids (raw cannabis plant), synthetic cannabinoids (dronabinol, nabilone), purified cannabinoids (nabiximols, CBD), and endogenous cannabinoids (Brown et al., 2010). A synthetic cannabinoid dexabinol uses in treatment for brain trauma and cerebral ischaemia. Dexabinol blocks N-methyl D-aspartate receptors and protects against more harm, it has no psychotropic activity (Hampson et al., 1998). Among the purposes of this chapter, i) the use of cannabinoids in medicine from past to present and areas of application ii) the role of the QR code in cannabinoid products and iii) determination of cannabinoids and Fourier Transform Infrared (FTIR) and Raman spectroscopy applications are included in the detection of impurities, if any.

## **BACKGROUND**

### **The Uses of Cannabinoids in Medicine**

Cannabinoids are effective in chemotherapy-induced emesis (CIE) and nabilone has been licensed for this use for several years (Williamson et al., 2000). The structure of cannabinol was determined in the 1930s and synthesized in the 1940s, and it is the first cannabinoid to be isolated (Ghosh et al., 1940; Adams et al., 1940). Then, Cannabidiol and THC were isolated in 1963 and 1964, respectively, and their structural properties were investigated (Mechoulam et al., 1963; Gaoni et al., 1964).

THC can produce psychosis and cannabidiol is thought to have antianxiety antipsychotic effects and both of them have antioxidant activity (Bhattacharyya et al., 2010; Leweke et al., 2012, Hampson et al., 1998). There are studies showing that cannabinoids are effective in the treatment of chronic pain and spasticity and also low-quality studies showing that cannabinoids are effective in chemotherapy-induced nausea and vomiting, HIV-induced weight gain, sleep disorders and in the treatment of Tourette's syndrome. In addition, cannabinoids cause an increase in the risk of short-term adverse effects (Whiting et al., 2015). Studies conducted have shown that cannabinoids are not effective drugs for chronic noncancer pain but effective in areas such as emotional and physical functioning in people with chronic noncancer pain. There are studies supporting the use of nabiximols to reduce pain as adjunctive therapy in MS-induced pain. Cannabidiol has been tested for pediatric samples with rare and serious forms of drug-resistant epilepsy with several high-quality randomized controlled trials. In some of these existing

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