# VAPORIZATION TECHNOLOGY AS A SAFE METHOD OF MEDICAL CANNABIS DELIVERY

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Nowadays medical cannabis is accepted and prescribed in many countries of the world, while other countries consider legalizing the use under doctors' surveillance. The conditions for which medical cannabis is indicated include multiple sclerosis, cancer, nausea, chronic pain, epilepsy, fibromyalgia, amyotrophic lateral sclerosis, rheumatoid arthritis, Chron's disease, HIV-AIDS, and a number of neuropsychiatric conditions. Laboratory studies and the developed vaporizing devices indicate that it is possible and feaseble to extract medically active vapors and compounds from cannabis plant, like delta9-tetrahydrocannabinol (THC), cannabinol (CBN), cannabidiol (CBD), cannabigerol (CBG) for patients' use. The original technique implies heating the material to a temperature below the point of combustion were the bulk of toxic and undesired chemicals are formed (e.g. volatile phenols, aldehydes, carbon monoxide etc.). By heating cannabis to a certain temperature (about 180ºC-200ºC under normal atmospheric pressure) it is possible to vaporize the cannabinoids that reside on the trichomes on the surface of cannabis flowers and leaves, while avoiding combustion which occurs at 230ºC and above. Vaporization is a relatively new technology, first devices being presented in the late 1990s. The feasibility of vaporization of THC for example has been demonstrated in a series of laboratory studies involving different vaporizer designs. An electric vaporizer was shown to release substantial amounts of the THC and some other cannabinoids while producing no measurable amounts of other toxins like benzene, toluene, naphthalene, polycyclic aromatic hydrocarbons from pyrolysis. Of particular concern are the carcinogenic polynuclear or polycyclic aromatic hydrocarbons (PAHs), known byproducts of combustion that indicate to be a major culprit in smoking-related cigarette cancers. While there exists no epidemiological evidence that marijuana smokers face a higher risk of smoking-related cancers, studies have found that they do face a mild to moderate risk for bronchitis and respiratory infections, when other predisposing factors simultaneously occur. This risk is not thought to be due to cannabinoids, but rather to extraneous byproducts of pyrolysis in the smoke. This fact is due to some cannabinoids like CBD have strong antioxidant and anticarcinogenic properties, or CBN with anti inflammatory properties, both matching high anticonvulsivant profile among others. Vaporizers generally fall into two categories based on their primary heating method, namely conduction and convection, as heat transfer. Conduction is the transfer of heat between two objects in direct contact, ex. herb - heated surface, while convection refers to transfer of heat via liquid or air particles instead. The pros of conduction are less complicated designs, cheaper devices and very fast warm up time, while the cons rely on higher risk of combustion and it requires stirring or shaking the herb between draws. The strong aspects of convection are more accurate temperature control, more even heating and lower risk of combustion, on the other hand being often more expensive and having slower warm up interval. There are several commercially available vaporizing devices today, such as pen vaporizers, portable vaporizers and desktop (stationary) vaporizers. It is relevant that pen vaporizers have as primary material concentrated forms of cannabinoinds such as waxes, shatters and oils. Vape pens almost always utilize conduction heating (as opposed to the preferred convection heating method), making it important to ensure that the product does not get overheated or even burned. For that purpose current flows through the screen of the pen causing rapid heating that is transferred to the plant material in contact with the screen, while after that the screen emits infrared rays that transfer heat creating an area of uniform temperature in the trench (the radiation heat transfer). Therefore vaporization is a valuable technology in medicine for health reasons and it could be considered by patients also for aromatherapy with plants like valerian, passion flower, lavender, lemon balm, chamomile, hops or sage.