



## Medical applications for carbon dioxide today

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As the most prevalent greenhouse gas found on earth, carbon dioxide (CO<sub>2</sub>) has many applications from medical uses, to food processing, to beverage carbonation, and to a wide range of industrial uses. Today, there is an interesting twist in agriculture, where cannabis, being a premium crop, has what some claim to have significant medical and health value and is therefore a growing market for the commodity.

CO<sub>2</sub> is increasingly being used for crop growth enhancement inside closed greenhouses; as well as applications in the fields, for growth enhancement. Beyond the application for growth enhancement of cannabis crops, is supercritical extraction of essential oils from cannabis, which is used in rather expensive proprietary agents, again claimed to have pharmacological value. This is an interesting twist in fate; what

was once an illegal crop in some markets, is now legal, under the guise of a medical agent. Such major growth is taking place in California, Canada, Arizona, New Mexico, and Massachusetts, to name a few places. Growers and processors of the products are generally rather obscure, in terms of locating and identifying their presence and output.

Beyond this specific crop, various essential oils are extracted from other crops, via supercritical CO<sub>2</sub>, which are also used for homeopathic treatments. Certain essential oils are thought to have medicinal properties. As for the solvent used in supercritical extraction, CO<sub>2</sub> is a non-toxic, non-residue, natural means of achieving this process, compared to hexane and other hydrocarbons, which can leave a residue in the essential oil product.

As to new claims for cosmetic surgical techniques, there are claims where

CO<sub>2</sub> is used in lieu of Botox and skin fillers. These treatments are often called carboxytherapy, ranging from improving skin texture to opening pores, on to destroying fat cells – all achieved via CO<sub>2</sub> injection by a specialist. The techniques claim to open closed pores, and dilate blood vessels among other things, leading to improvements to saggy skin, and help to regrow hair. This is an interesting take on CO<sub>2</sub> and over time, I guess we will see how much traction this application gains.

As for the specific grade of CO<sub>2</sub> which is noted for medical applications, this would be USP grade (a reference to the US Pharmacopeia), which is expensive to produce and governed by a strict protocol, which are stringent production assay and quality assurance requirements. The product is generally refined at strategic locations, where companies such as Linde US has designated specific US locations to produce this product,

which covers their marketing presence. USP standards are used globally, in over 130 countries, for medical applications.

### Established applications

The earliest of medically defined applications were for use as a respiratory stimulant; and for use in the enlargement of body cavities during certain surgical procedures, particularly in cases such as endoscopy. Another interesting application is to enlarge blood vessels, in a controlled setting.

I have personally had a wart removed via cryogenics, an experience which was not unpleasant, with outstanding results. Further, on a personal level, I took my dog into the veterinary ophthalmologist for the removal of a growth on and under the eye lid, an extremely delicate experience, removed cryogenically as well. Although these two procedures were accomplished by liquid nitrogen, similar specific applications could occur via CO<sub>2</sub>. This is a function of what the medical specialist has available and is willing to use; sometimes liquid nitrogen is more commonly found in such settings, and preferred due to achieving lower freezing temperatures.

Often, dry ice and liquid CO<sub>2</sub> are agents for the removal of unwanted skin growths (moles, warts, blemishes), and complete healing subsequently occurs within a few days to weeks after treatment. CO<sub>2</sub> lasers can be used in applications such as for closing wounds. The destruction of “burning” away abnormal tissue can occur within oral cavities, as a safe method of treatment as well. As was mentioned at the top of the piece, in early USP definitions of medical grade CO<sub>2</sub>, insufflation – or opening body cavities during surgery – it was reserved for those who could respond well to higher CO<sub>2</sub> levels, and absorption. As with cryotherapy, beyond using liquid CO<sub>2</sub> and dry ice, of course liquid nitrogen is very common; and DEMP (diethyl ether and propane) is often sold over the counter in small cans for wart removal – which is the less successful of all cold treatment agents.

Beyond cryotherapy and cryosurgery,

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is cryopreservation in medicine, which includes cryo preservation of gametes, tissues, specific cellular samples, and even embryos. It is said that during tissue transplant procedures, when a reduced body temperature, or a hypothermic state is sought, this can be well achieved via cryogenics.

Other CO<sub>2</sub>-related applications include use blending the USP grade CO<sub>2</sub> with medical grade oxygen, can yield an approximation of a physiological gaseous atmosphere, which can go along very well with artificial organ systems, as well as kidney dialysis equipment, which relates back to the application in body cavities, as insufflation.

As for CO<sub>2</sub> lasers, often they are thought of as an industrial tool, high powered versions are used to cut metal and lower-powered capacity devices are used for metal engraving, for example. However, the CO<sub>2</sub> laser is used in a wide area of medicine, in extremely delicate and vital applications, including neurosurgery, dermatology, plastic surgery ophthalmology and more. The use of lasers in medicine dates over 45 years or so, with the first laser industrial dates back to about 1960 – initially being an industrial tool. As for medical applications, in 1984, laser surgery became approved by the US FDA (Food and Drug Administration) where the high level of precision and reliability made this option approved, and a highly viable addition in medicine.

On a percentage basis, CO<sub>2</sub> in the medical field, as a USP grade, is a relatively small market by volume; however pricy and essential to certain uses in the medical field. When extending CO<sub>2</sub> usage in greenhouse growth enrichment, or in the field for

expensive crops such as cannabis, the market becomes significantly larger. That being said, in regions such as California’s “Golden Triangle” which is in the far north of the state, growth enhancement of this crop is a significant addition to something which touches medicine and homeopathic treatments. Cannabis in various forms is now more than ever being prescribed, and used in various medical practices. Further, there is the potential for growth in CO<sub>2</sub> supercritical extraction of oils from the crop, also used in formulations which are claimed to have medical and therapeutic value. This crop may be the growth engine for CO<sub>2</sub> in this ever-broader field.

In the end, we need to keep mindful of the safety aspects of CO<sub>2</sub> when over 5% concentration in the atmosphere, breathing difficulties occur and the blood pressure rises; then if in excess of 8%, dizziness results. Much more severe results occur when over approximately 12% is in the atmosphere, when unconsciousness occurs. Safety comes first, when working with this product, in all applications. For the gas companies, it critical to work toward fostering as many uses for the product as possible, when marketing USP grade CO<sub>2</sub>. The CO<sub>2</sub> industry is resilient, and the applications which touch on uses surrounding wellbeing, health and medicine, will continue to expand beyond what is found today. 

### ABOUT THE AUTHOR

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