Carbon dioxide in medicine: lasers, CBD products

By **Sam A. Rushing** on May 01, 2020

CO2-based medical lasers

From the beginning, the carbon dioxide (CO2) laser was considered highly reliable, and precise in medical applications. The CO2 laser process can be described as follows: a CO2 laser consists of a gas mixture which includes nitrogen, helium, CO2, xenon or water vapor and sometimes hydrogen. The gas mixture acts as a gain medium, and the laser is pumped through an electrical discharge. During the electrical discharge, the nitrogen molecules are excited to their metastable vibration state, and they collide with the CO2 molecules to transfer their energy. The CO2 laser can be operated within a radio frequency range, using AC or DC current. The laser emits an infrared light at standard wavelengths of 9.6 and 10.6 micrometers.

Early general laser developments occurred in 1964 by Bell Labs. Further, CO2 lasers date back over 40 years for applications in medicine, and in 1984 CO2 lasers were approved by the FDA (Food and Drug Administration). CO2 lasers are considered one of today's most powerful continuous lasers. As a function of how the power is being applied in such lasers, the gas discharge medium is either water or air cooled and applications include a number of uses in medicine and dentistry.

As to the applications in medicine, these include dermatology, plastic surgery, ophthalmology, neurological surgery and more. Of perhaps the most noticeable applications, this could be for skin resurfacing, which removes thin layers of skin without surrounding tissue damage from heat. This application is having growing appeal for the aging baby boomers, who seek remedies to enhance their appearance as well as traditional applications in dermatology including the role in removing warts, scars, enlarged oil glands on the nose and the removal of birthmarks.

For laser resurfacing applications, a growing field, a new generation of CO2 lasers are being developed, which use very short pulsed light energy, or ultra-pulsed, or continuous light beams, which are delivered in a scanning pattern. Then, skin incisions resulting from surgical techniques, or wound closures have been treated via a temperature controlled CO2 laser soldering system for soft tissue bonding. This system includes features which make laser soldering suitable for clinical use, sometimes in lieu of staples,

tapes, and tissue adhesives. The temperature-controlled laser system is composed of fiberoptic laser device, infrared fiber optic radiometer, and computerized temperature control program, proprietary grip device, and concentrated human albumin as a soldering agent.

Benefits offered by CO2 lasers, particularly in surgery:

- Less bleeding – As it cuts, the CO2 laser enters lymphatic and small blood vessels, less than 0.5 mm wide, and helps in reducing intra-operative bleeding and prevents post-operative swelling
- Less pain – The penetration depth of the CO2 laser is 0.03 mm which is considered very safe, resulting in sealing of small peripheral nerves, thus alleviating post-operative pain.
- Reduces the risk of infection – There is a sterilizing effect, as it kills bacteria in its path, thus reducing infection

What is really interesting, in such CO2 laser processes, is they sort of resemble some industrial laser applications – where in this specific field, adaptations continue to occur through creativity.

CO2 in CBD products

Supercritical CO2 extraction (sCO2) is a safe, effective, and environmentally friendly extraction process proven to yield a fresh, clean, aromatic oil without the toxicity and other safety hazards inherent in other CBD extraction methods, including hydrocarbon products and alcohols. The supercritical process occurs under approximately 1,70 psi, using the unique supercritical characteristics between a gas and liquid – so this sCO2 maintains a density of a liquid while filling space like a gas.

CBD is the medical abbreviation for cannabidiol, one of the major active components or cannabinoids, found in the cannabis plants. This originates from cannabis sativa plants, such as marijuana and industrial hemp. Unlike THC from marijuana, CBD is not psychoactive.

CBD is everywhere these days – from skin care, to coffee, to pet treats, and you can even buy a CBD-infused beer. Advocates say CBD or cannabidiol, is helpful for anxiety and pain management. However, while there are almost infinite suppliers of, and products containing CBD, the ingredient is not currently approved by the FDA.

Some hope for FDA recognition in 2020, however, such progress is stuck in congress for the time being. However, many physicians write prescriptions for medical use cannabis, and readily recommend the use of CBD infused products, for treatment of anxiety and pain, among other maladies. Many patients have received such recommendations, or alternative treatment options, particularly in light of the opioid crisis in America. Without clear federal guidelines, states have created a regulatory patchwork of often conflicting rules across the country.

As a ‘natural’ agent, CO2 is an excellent solvent for use in supercritical extraction v. the use of hydrocarbons, such as propane, or even long chain hydrocarbons such as hexane, or even ethanol. As to the use of CO2 versus hydrocarbons products, many consumers of such products would much rather have a natural CO2 as an agent used in supercritical extraction versus these other ‘industrial’ agents. Further on the ‘natural’ front, many such buyers of CBD products could well believe in natural treatment methods, covering maladies such as anxiety, for example, versus patent medicines. The trend, however, is growing rapidly, with respect to the addition to an ever-growing list of common daily personal care, food, and beverage products.

I recently put my anxious Italian greyhound on CBD infused treats, about 4 mg of CBD per daily serving, which several veterinarians recommended. We believe he is responding to the product and so many others claim CBD has impressive benefits for their pets, as well as the wellbeing of people who consume or apply CBD on daily basis.

Large food and beverage companies are examining and currently investing in CBD companies, Constellation Brands, the global beer, wine and spirits giant, making an investment in Canopy Growth, a Canadian-based cannabis products company. Molson Coors, another Canadian company, announced a joint venture with a Quebec-based grower Hexo for non-alcoholic beverages. Of course, in Canada, cannabis and CBD are fully legal, unlike a sort of state-by-state patchwork in the US. Expect to see more companies entering the CBD infused markets, to produce a wide range of food, beverage, and health care/personal products. Many of these companies are looking to the FDA and government entities to move in favor of CBD and cannabis.

About the author

Sam A. Rushing is president of Advanced Cryogenics, Ltd., and a chemist by background, offering a full menu of CO2 and cryogenic consulting services.

Tel. 305 852 2597

Email: rushing@terranova.net

www.carbondioxideconsultants.com