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March 29, 2017 (https://cannabisindustryjournal.com/feature_article/understanding-dissolved-oxygen-in-cannabis-cultivation/)

Understanding Dissolved Oxygen in Cannabis Cultivation

By Aaron G. Biros

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Utilizing dissolved oxygen properly can help promote healthier root systems, improving overall plant growth and production.

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Upcoming Events & Webinars

 November 16, 2021 – 12:00 pm – 4:00 pm
Infused Products Virtual Conference
(<https://a17960.actonsoftware.com/acton/fs/blocks/showLandingPage/a/17960/p/p-010f/t/page/fm/0>)

Registration is now open! This complimentary virtual conference consists of 4 back-to-back webinars, all on the same day. In a number of states across the country, edibles, topicals, beverages and other infused products are taking up a larger percentage of the market share. They come in all shapes and sizes- from granola bars to lotions, lubricant and scented candles; manufacturers are infusing a wide variety of products with cannabis, creating a market that meets a larger consumer demographic. Different states have different rules when it comes to product safety. Some states require ServSafe training and local health inspections, while others have more stringent lab testing rules, require documented GMPs and even a form of certification demonstrating proper food safety protocols. State regulations shouldn't be the reason why infused products manufacturers have robust safety and quality standards, consumer safety is. Getting ahead of regulations with proactive safety and quality planning can improve a business's bottom line tremendously. There are a number of tools and tricks cannabis companies can learn from the food industry to streamline their businesses and gain a bigger chunk of the market share.

 December 1, 2021 – 12:00 pm – 4:00 pm
The Cannabis Packaging Virtual Conference ()
Welcome to the Cannabis Packaging Virtual Conference! This collection of webinars will explore a variety of topics throughout the cannabis product supply chain. We will take a deep dive into the state of the cannabis supply chain following the pandemic and in the midst of global supply chain crisis.

Oxygen plays an integral role in plant photosynthesis, respiration and transpiration. Photosynthesis requires water from the roots making its way up the plant via capillary action, which is where oxygen's job comes in. For both water and nutrient uptake, oxygen levels at the root tips and hairs is a controlling input. A plant converts sugar from photosynthesis to ATP in the respiration process, where oxygen is delivered from the root system to the leaf and plays a direct role in the process.

Charlie Hayes has a degree in biochemistry and spent the past 17 years researching and designing water treatment processes to improve plant health. Hayes is a biochemist and owner of Advanced Treatment Technologies, (<http://www.advancedtreatmenttechnologies.com>) a water treatment solutions provider. In a presentation at the CannaGrow conference (<https://cannagrowexpo.com>), Hayes discussed the various benefits of dissolved oxygen throughout the cultivation process. We sat down with Hayes to learn about the science behind improving cannabis plant production via dissolved oxygen.

In transpiration, water evaporates from a plant's leaves via the stomata and creates a 'transpirational pull,' drawing water, oxygen and nutrients from the soil or other growing medium. That process helps cool the plant down, changes osmotic pressure in cells and enables a flow of water and nutrients up from the root system, according to Hayes.

Roots in an oxygen-rich environment can absorb nutrients more effectively. "The metabolic energy required for nutrient uptake come from root respiration using oxygen," says Hayes. "Using high levels of oxygen can ensure more root mass, more fine root hairs and healthy root tips." A majority of water in the plant is taken up by the fine root hairs and requires a lot of energy, and thus oxygen, to produce new cells.

So what happens if you don't have enough oxygen in your root system? Hayes says that can reduce water and nutrient uptake, reduce root and overall plant growth, induce wilting (even outside of heat stress) in heat stress and reduce the overall photosynthesis and glucose transfer capabilities of the plant. Lower levels of dissolved oxygen also significantly reduce transpiration in the plant. Another effect that oxygen-deprived root systems can have is the production of ethylene, which can cause cells to collapse and make them more susceptible to disease. He says if you are having issues with unhealthy root systems, increasing the oxygen levels around the root system can improve root health. "Oxygen starved root tips can lead to a calcium shortage in the shoot," says Hayes. "That calcium shortage is a common issue with a lack of oxygen, but in an oxygen-deprived environment, anaerobic organisms can attack the root system, which could present bigger problems."

So how much dissolved oxygen do you need in the root system and how do you achieve that desired level? Hayes says the first step is getting a dissolved oxygen meter and probe to measure your baseline. The typical dissolved oxygen probe can detect from 20 up to 50 ppm and up to 500% saturation. That is a critical first step and tool in understanding dissolved oxygen in the root system. Another important tool to have is an oxidation-reduction potential meter (ORP meter), which indicates the level of residual oxidizer left in the water.



(http://www.cannabisindustryjournal.com/wp-content/uploads/2017/03/10379997_10152186774180949_490880218466278984_o-1.jpeg)

Charlie Hayes,
biochemist and owner
of Advanced Treatment
Technologies



(<http://www.cannabisindustryjournal.com/wp-content/uploads/2017/03/ATT-Cannabis-Skid-Facing.jpeg>)

Their treatment system includes check valves that are OSHA and fire code-compliant.

Citing research and experience from his previous work, he says that health and production improvements in cannabis plateau at the 40-45 parts-per-million (ppm) of dissolved oxygen in the root zone. But to achieve those levels, growers need to start with an even higher level of dissolved oxygen in a treatment system to deliver that 40-45 ppm to the roots. "Let's say for example with 3 ppm of oxygen in the root tissue and 6ppm of oxygen in the surrounding soil or growing medium, higher concentrations outside of the tissue would help drive absorption for the root system membrane," says Hayes.

Reaching that 40-45 ppm range can be difficult however and there are a couple methods of delivering dissolved oxygen. The most typical method is aeration of water using bubbling or injecting air into the water. This method has some unexpected ramifications though. Oxygen is only one of many gasses in air

labeling from seed to sale, working to achieve client goals, logistical issues, environmentally sustainable packaging, reducing plastic consumption and much more. Attendees registering for this complimentary series of webinars will get access to veterans of the cannabis packaging market, who are all available for Q&A after each presentation. In addition to getting the opportunity to chat with these subject matter experts on December 1, a recording of the presentations will be made available to all who register. Practical and educational information from experts in the cannabis packaging field, all on the same day and all from the comfort of your home or office. Want real inside knowledge on cannabis packaging? Stay tuned for important updates, new speaker additions and when registration opens!

**December 9, 2021 – 12:00 pm – 4:00 pm
Cannabis Labs Virtual Conference ()**

The Cannabis Labs Virtual Conference continues! For five years now, we have been hosting this complimentary collection of webinar presentations, designed to help attendees better understand some of the more technical aspects of starting and operating a laboratory. We will take a deep dive into various cannabis and hemp testing methods, laboratory accreditation, microbial testing, standards, method development and more. Attendees registering for this complimentary series of webinars will get access to veterans of the cannabis lab testing industry, who are all available for Q&A after each presentation. In addition to getting the opportunity to chat with these subject matter experts on September 14, a recording of the presentations will be made available to all who register. Practical and educational information from experts in the cannabis lab testing industry, all on the same day and all from the comfort of your lab, home or office. Want real inside knowledge on the cannabis testing industry? Stay tuned for important updates on the agenda. Registration coming soon!

**December 15, 2021 – December 17, 2021
NCIA's Cannabis Business Summit
(<https://cannabisbusinesssummit.com>)**


The industry's most influential trade show is coming back to San Francisco! We're thrilled to be gathering in person December 15-17, 2021 at San Francisco's Moscone Center for the 7th Annual Cannabis Business Summit & Expo. At the premier cannabis business event, industry entrepreneurs, experts, and thought leaders will come together to learn, network, and discover new products & services to help their businesses grow. With unique content presented by the best and brightest minds in the industry, unmatched networking opportunities, and 400+ exhibitors, this is an experience you won't want to miss.

and those other gasses can be much more soluble in water. Paying attention to Henry's Law is important here. Henry's Law essentially means that the solubility of gasses is controlled by temperature, pressure and concentration. For example, Hayes says carbon dioxide is up to twenty times more soluble than oxygen. That means the longer you aerate water, the higher concentration of carbon dioxide and lower concentration of oxygen over time.

Another popular method of oxidizing water is chemically. Some growers might use hydrogen peroxide to add dissolved oxygen to a water-based solution, but that can create a certain level of phytotoxicity that could be bad for root health.


Using ozone, Hayes says, is by far the most effective method of getting dissolved oxygen in water, (because it is 12 ½ times more soluble than oxygen). But just using an ozone generator will not effectively deliver dissolved oxygen at the target levels to the root system. In order to use ozone properly, you need a treatment system that can handle a high enough concentration of ozone, mix it properly and hold it in the solution, says Hayes. "Ozone is an inherently unstable molecule, with a half-life of 15 minutes and even down to 3-5 minutes, which is when it converts to dissolved oxygen," says Hayes. Using a patented control vessel, Hayes can use a counter-current, counter-rotational liquid vortex to mix the solution under pressure after leaving a vacuum. Their system can produce two necessary tools for growers: highly ozonized water, which can be sent through the irrigation system to effectively destroy microorganisms and resident biofilms, and water with high levels of dissolved oxygen for use in the root system.

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About The Author



Aaron G. Biros

Editor & Publisher of CannabisIndustryJournal.com
Innovative Publishing LLC (<https://www.cannabisindustryjournal.com/>)

Aaron G. Biros joined Innovative Publishing LLC full-time after graduating Tulane University in May of 2015. Graduating with a B.A. in Environmental Studies, his coursework involved environmental sustainability, conservation policy, design

thinking in collaboration, social innovation & entrepreneurship, food production & health, and environmental & health risk assessments. He has two years of experience working on staff as an associate editor for FoodSafetyTech.com, writing a series of articles focused on the intersection of food safety and environmental sustainability. Aaron is now the editor and publisher of CannabisIndustryJournal.com, a B2B digital

trade publication that seeks to educate the global cannabis industry on everything seed-to-sale in both recreational and medical markets. CannabisIndustryJournal.com covers news, business trends, technology, regulatory compliance and other important areas, aiding in the advancement of a well-informed and safe market.

Comments



Chris Logel (<http://www.strategicwaterresources.com>)

April 4, 2017 at 2:38 pm

(https://cannabisindustryjournal.com/feature_article/understanding-dissolved-oxygen-in-cannabis-cultivation/#comment-217)

Hi Aaron,

Great article!! I am an owner of a company call Strategic Water ReSources in Mystic, CT. We manufacture advanced oxidation equipment for water applications and have seen the same thing.

I would like to speak with you more and see if we could get some press in your journal.

Please contact me so we can set up a time to talk more.

Best regards,

Chris

Chris Logel

Strategic Water ReSources

Global Business Development

chris.logel@watersr.com (<mailto:chris.logel@watersr.com>)

860-287-4388

<http://www.strategicwaterresources.com> (<http://www.strategicwaterresources.com>)

Strategic Water ReSources, Mystic, CT

Reply ↓



John R Terrell

July 10, 2017 at 12:53 pm

(https://cannabisindustryjournal.com/feature_article/understanding-dissolved-oxygen-in-cannabis-cultivation/#comment-288)

So I have a system that just put over 50 PPM into a cannabis grow out in Nano Bubble size. My question will over 50 PPM hurt plants or just over kill ?

Reply ↓



Dennis (<https://highvolumeoxygen.com>)

January 9, 2020 at 4:49 pm

(https://cannabisindustryjournal.com/feature_article/understanding-dissolved-oxygen-in-cannabis-cultivation/#comment-971)

Hi Aaron,

Your readers may want to take a look at oxygen-generating solutions by

<https://highvolumeoxygen.com> (<https://highvolumeoxygen.com>). Very affordable, reliable systems with built-in IoT for real-time stats on oxygen purity, tank pressure, etc.

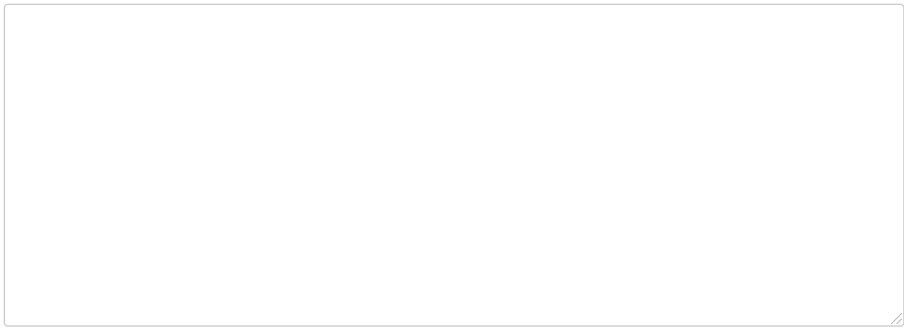
Dennis

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