



Cannabis Packaging Seeks Novel, Sustainable Options

Legalization of hemp and CDB products is creating demand for effective package designs, SPE conference speakers say

By Robert Grace

Soaring interest in hemp- and cannabis-related products is driving innovation among packaging producers and other suppliers to that sector. Several key factors are core to those efforts, ranging from sustainability and packaging efficacy (especially barrier properties) to cost and supply-chain consistency.

Washington, D.C.-based cannabis market research firm New Frontier Data estimated in April 2019 that 263 million people throughout the world are active cannabis users and valued the global cannabis consumer market at \$344 billion. The group says some 1.2 billion people worldwide have medical conditions for which marijuana has therapeutic benefit. In a report this summer, New Frontier predicts that 73 million Americans are likely to purchase cannabidiol (CBD), one of the chemical compounds extracted from cannabis and hemp plants, by year's end.

This booming market prompted SPE to organize "Plastics in Cannabis Packaging," its first conference on the topic, according to Jeremy Dworshak, a 3M Co. research engineer and SPE Injection Molding Division board member. Dworshak moderated the full-day virtual event on July 28. Nine speakers discussed topics ranging from package design and the use of bioplastics and other sustainable materials to current legal issues related to these controlled substances.

Recent shifts in the legal landscape have helped open the door to the commercial boom for these products. To better understand the complex issues involved, it's vital to

first learn more about the products in question. Here are some highlights from the conference.

The Hemp and Cannabis Back Story

Frederick Stearns, a partner in the Washington, D.C., law firm Keller and Heckman LLP and one of the conference's two keynote speakers, laid out some of the complex history.

A variety of Cannabis sativa L, hemp is unusual in that the entire plant, from stalk to seed, can be used to make fuel and feedstock. Its end uses include fiber (from the plant's stems), protein (from seeds), and oils and smokable portions (from the leaves and flowers). Hemp fibers are used to make items ranging from paper and clothing to rope and building materials.

Hemp and marijuana are both cannabis but their



Frederick Stearns of Keller & Heckman provided legal background to conference attendees.

morphology, chemical makeup, and use are different. The cannabis and hemp plants contain naturally occurring, biologically active chemical compounds, including both CBD and delta-9-tetrahydrocannabinol (THC), which is the psychoactive component known to get people “high.”

For decades, federal law did not differentiate hemp from other cannabis plants, all of which were effectively made illegal in 1937. In 1970, the Controlled Substances Act banned cannabis of any kind and assigned marijuana Schedule I status, the most restrictive of the five possible levels for controlled substances. This move effectively prohibited any legal use of most parts of the hemp plant. Although CBD itself has never been scheduled as a controlled substance, Stearns explained, it was captured in the broad marijuana definition because CBD generally is obtained from parts of the flower and leaves.

In 2014, Congress passed a temporary program that slightly expanded the availability of hemp, prompting many to start openly developing more CBD-based products. Then came a more permanent solution.

The 2018 Farm Bill

The passage of the 2018 Farm Bill significantly altered the legal and commercial landscape for some cannabis, hemp, and CBD products. While it removed hemp-derived products from Schedule I status, the law still did not legalize CBD generally. The Farm Bill defines hemp as the cannabis plant, but with one key difference: Hemp cannot contain more than 0.3 percent of THC. Any cannabis plant that contains more than that level of THC is now considered non-hemp cannabis—or marijuana—under federal law and has no legal protection under the new law.

There remains a patchwork of state laws that are complex and varied, Stearns told attendees, referring them to this website for more details: <https://norml.org/states>. And the U.S. Food and Drug Administration says that CBD cannot be marketed in food or as a dietary supplement. Still, by legalizing CBD under specific circumstances, the U.S. government opened the door to its commercialization in any number of forms—and the market has responded.



Peter Schmitt explained how barrier packaging is vital at three stages in the cannabis supply chain.

Peter Schmitt, managing director of Wilmington, Del.-based Montesino Associates LLC, the conference’s other keynote speaker, commented on the legal status of hemp and CBD at federal and state levels in response to an emailed question after the event. “It is truly a mess,” he says. “Federally, more than 0.3% THC means it is illegal. But the states say: ‘except that it can be sold in dispensaries under these conditions.’ This conflict between federal and state law is truly amazing. The key is that the state issues a license for a dispensary; it is not sold in a retail store.” (For details about state and

federal laws, fees, and possession limits, see: <https://medicalmarijuana.procon.org/legal-medical-marijuana-states-and-dc/>)

This has created a situation where states license dispensaries where CBD materials are sold for medical use, with a physician recommendation, or for recreational use. For example, in California, he explained, “the product must be grown in California and sold in California only through the state-licensed dispensaries.”

Financial transactions are also complicated by this federal-state discord. “Since federal law covers banking, companies dealing in cannabis cannot currently have bank accounts,” Schmitt explained, “though there is pending legislation to change this.” Dispensaries themselves can only deal in cash, so distribution networks have formed, he says, that take cash from dispensaries and use it to pay vendors who provide packaging and other essentials using methods that don’t rely on cash.

In his keynote presentation, Schmitt said the emerging medical marijuana segment dominates the CBD market by end use—the revenue share was 86 percent in 2018. People are using CBD to help treat medical conditions such as inflammation, pain, sleep disorders, epilepsy, schizophrenia, anorexia, and symptoms of multiple sclerosis among others.

Those processing cannabis or CBD typically produce either flowers or buds (which usually are smoked) or use extraction methods to obtain oils from the plant. CBD is often used in edibles, beverages, or lotions, and tends to be packaged in jars or bottles, flexible pouches, blister packs, or similar containers. CBD also is increasingly likely to be vaped.

Packaging Challenges

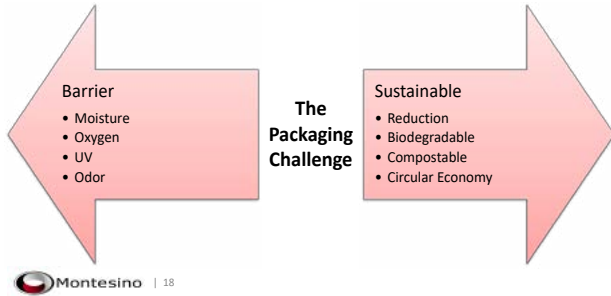
Schmitt noted that cannabis packaging at different stages in the supply chain faces competing demands for barrier protection and sustainability. Those in the industry need to look at three key segments: growing, storage/shipment, and retail.

Although most types of barrier packaging aim to keep moisture and other elements out of the package, he says, cannabis is different in that it also needs barriers to help keep just the right amount of moisture inside the package. For cannabis packaging, the ideal measurement known as water activity (aw) is between 0.55 and 0.62.

Once cultivated, the drying/curing process typically takes two to four weeks. Then, during the distribution and storage stage, the product may be stored in a sealed container for up to six months. Finally, it is packaged for retail. Cannabis flowers and buds need to be kept within a precise water activity range, since being too damp leads to mold and spoilage, and being too dry leads to lost revenue (due to lighter weight) and diluted quality or potency. Those products that are extracted into oil form need protection from moisture, oxygen, and carbon dioxide to avoid turning rancid. Using a desiccant in the package can easily overdry the contents, Schmitt warned.



The Balancing Act



The goals of good barrier properties and sustainability are almost diametrically opposed, but companies are addressing both factors. Courtesy of Montesino Associates

Barrier also comes into play as regards product odor (which is vital to some consumers), while an ultraviolet light barrier protects THC from degradation, and antistatic barriers protect the product’s trichomes and terpenes, which impact quality and potency.

“Cannabis consumers, generally, are more interested and concerned with the brand’s level of activity in the sustainability movement than other types of consumer products,” Schmitt said in his keynote. And yet this preference tends to be almost at direct odds with barrier technology. Barrier layers can reduce a package’s recyclability or compostability. Much work is happening to develop hemp-based materials and compostable or “digestible” materials, and hemp could also be used to package the product itself.

It’s a delicate balancing act. “Barrier is critical in all three of these phases,” Schmitt said, “and there are no silver bullets out there.”

A Truly Versatile Material

Other speakers, such as Chad Ulven, PhD, chief technology officer of North Dakota-based c2renew Inc., a material designer and compounder, has been working for several years to develop hemp biocomposites for cannabis packaging and other applications, and is working to establish a new supply chain for hemp materials in the United States.

Ulven, who is also professor of mechanical engineering at North Dakota State University, noted that hemp has great versatility to be combined with various types of plastics and can be fashioned into a diverse range of end products.

Hemp and flax both have high strength and stiffness and low density. Ulven’s company, c2renew, was spun out of the university in 2012 and began by going after large-volume, low-cost industrial applications in the agricultural sector. But they didn’t get much traction.

“Then we pivoted to focus on lower-volume, forward-facing material applications that ‘scream green’ aesthetically and help to create a message with the material,” he said. Examples include golf tees, air freshener holders, jewelry, guitar picks, toothbrushes, pens—and cannabis packaging, which they developed with Colorado’s Sana Packaging, whose co-founder and chief executive officer Ron Basak-Smith was also on the SPE program. Basak-Smith spoke to the challenges related to labeling different types of cannabis packages, be they compostable, recyclable, or made from recycled content.

Ulven said his firm has learned how difficult it can be to maintain consistency in supply, especially when it comes to the grind of the material. The finer the grind, the less you will see a look of natural fiber in the final product. Some want to see that rougher look, while others want a clean look.



Chad Ulven of c2renew is developing hemp biocomposites and a stable hemp supply chain in the U.S.

“We can tweak it to get the desired end result,” he said, noting that coloring is a challenge, too. One might need to add more colorant to balance out natural hues to get brighter colors, but it can be done. “Do we insist on having suppliers meet certain color specs or relax that and accept the natural variability?” he asked.

Hemp’s Huge Potential

Ron Kander, PhD, founding dean of the Kanbar College of Design, Engineering, and Commerce at Thomas Jefferson University in Philadelphia, spoke about possible hemp applications and stressed the need “to develop a better basic understanding of the hemp plant, not as an agricultural product, but as a raw material.”

Kander said the hemp plant—which can grow 10–15 feet high in just 100 days with little water or fertilizer—has the potential to be one of the most sustainable raw materials used in industry.

“As it sits in the ground as a mature plant, it is carbon negative—it sequesters more carbon than it takes to grow. So, the question as engineers and scientists, is how much

energy is needed to transform that plant as it comes out of the ground into a useful product, without negating that benefit of being carbon negative initially,” he said. “That’s the systems problem we’re trying to solve.”

To support this industry in the United States, Kander argued, there needs to be a holistic approach. Producers must understand the plant and its material properties, he explained, as well as engineer robust processes to transform hemp into easily transportable and usable forms, design desirable products to optimize hemp’s unique properties, and define the markets and supply chains needed, especially processing facilities near the farms, to save on inefficient shipping.

Other conference presenters covered a range of topics:

- » Tom Newmaster, founder and partner in FORCEpkg, a design and branding agency in Lancaster, Pa., offered insights into what cannabis packagers can learn from the experience in this area of other consumer packaged goods makers.
- » Reyna Bryan, founder and CEO of Boulder, Colo.-based RCD Packaging Innovation, talked about her firm’s work with compostable materials, functional biopolymers, and mica-free eco-pigments.
- » Gary Fast, business development manager of St. Louis-based Alpha Packaging, offered an overview of the recyclable polyethylene terephthalate and high-density polyethylene resins currently being used in the cannabis industry, and looked ahead to the development of more sustainable post-consumer


and bio-based resins for this sector.

- » Jordan Hinshaw, director of business development for GreenTek Planet in Long Beach, Calif., discussed how the growing use of bioplastics and biomass in this sector can play a key role in developing U.S.-based resources, jobs, and infrastructure. As he put it: “The fervor behind bioplastics should be that we’re creating an economic independence for ourselves that was spurred by this improbable or unlikely legalization of cannabis.”

Those interested in viewing the recorded presentations from SPE’s Plastics in Cannabis Packaging conference, can do so by registering for the event at bit.ly/SPEcannabispkg. The SPE member rate is \$99, and the non-member rate is \$295.

ABOUT THE AUTHOR

Robert Grace is a writer, editor, and marketing communications professional who has been active in B2B journalism since 1980. He was founding editor of and worked for 25 years at Plastics News, serving as editorial director, associate publisher and conference director. He is now both editor of SPE’s *Journal of Blow Molding* and a regular contributor to various outlets. A long-time member of the Industrial Designers Society of America, he runs his own firm, RC Grace LLC, in Daytona Beach, Fla., and can be contacted at bob@rcgrace.com.





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