New Food | IN-DEPTH FOCUS

CBD, Cannabis & Hemp

New Food's Bethan Grylls interviews two experts from Victory Hemp to find out the potential behind hemp as a meat analogue

Jörg Konetzki from Mérieux NutriSciences provides an expert overview on the current EU cannabinoid climate

The next meat analogue

In an effort to create the ultimate meat substitute that delivers on taste and texture, Victory Hemp is placing its bets on the hemp seed heart.

THE DEMAND for meat alternatives is growing worldwide but the challenge of mimicking meat without compromises on taste is a difficult hurdle to overcome. However, one Kentucky-based company believes it's cracked it – and the answer lies in the hemp heart.

The US plant-based market

Global meat consumption is rising, especially in the US, which makes up around $270 billion of the $1.4 trillion worldwide meat industry.[1]

Albeit in comparative infancy to the animal-based food market, there is an increasing drive for meat alternatives in the US. "It's gaining momentum, but it's not a household item just yet," Ben Raymond, Director of Research & Development at Victory Hemp told *New Food*.

Its slower uptake could be down to the delicate balancing act between masking earthy flavours of plants without overdosing on fats, oils or salts; and the complex challenge of developing a product that mimics the unique mouthfeel of meat. It may be a strange notion, making plants taste like meat, but as the market is being driven by flexitarians,[1,2] consumers are looking for products which can replace meat without a trade-off.

Despite its smaller size and challenges, Barclays bank believes the opportunity for plant-based protein will be bigger than the projected stats for electric vehicles 10 years ago.[1]

Rising to the challenge

The protein category is already growing in variety and we're seeing more meat analogues emerging. "Soy is leading, but other alternatives such as pea protein have come to market too," Raymond said. "I believe that rather than there being one dominant protein in the future, we'll see the market diversify. And these options will probably be regionalised, depending on the local tastes, changing climates, and so on."

Hemp protein is not currently used in as many applications as soy, but Raymond makes a good case for why it should be. "There's so much infrastructure for soy, so many acres of land dedicated to its production in the US, Brazil and China, and while crops like soy have enjoyed decades of federal funding in the US, hemp has not," he said, commenting on the factors that have held hemp back thus far. The Marihuana Act of 1937 effectively prohibited not just marijuana, but industrial hemp and it's only recently with the Farm Bill that America has welcomed it back to the fields.[3]

Moreover, although the stereotypes associated with hemp and CBD are loosening their shackles, there is still a way to go. "We've found that online adverts often penalise the word 'CBD'," explained Aleah Rouse, Victory Hemp's Marketing Director. "Although we are not producing CBD, we previously used the term in educational pieces on our website, for example to explain the differences between CBD (which comes from the flowers, leaves and stems of the plant) and our products (derived from the seed, which does not contain CBD). What we found was our adverts kept getting banned and we were constantly having to appeal. We've resorted to removing the word 'CBD' and also 'cannabinoid' entirely from our website – we're a different sector, but we just get lumped together."

Rouse explained that it's not just advertising that is negatively impacted – one of their suppliers even struggled to get a loan due to the negative connotations unfairly linked to hemp. "There isn't enough regulation at the moment. It's easier for us being in the hemp foods industry than it is for the CBD industry, but we do suffer sometimes by association."

Hemp also has to undergo further testing. "Even though the THC in hemp exists in trace amounts – usually less than one part per million (ppm) but it can be up to <4ppm in heart protein and <10ppm in oils – we still have to test for that and it's expensive, and something which producers of other alternatives like pea and soy don't have to do."

Despite its late start, hemp is a fast-growing plant and Raymond assures that the yields will eventually double. "And from there, we don't really know what the limits are of the genetics – other crops have had all this benefit of time and funding. We know that we can improve farming practices and enhance soil health by growing hemp...but who knows what other possibilities await!"

He continued: "What we do know is that hemp is a highly nutritious commodity – a good source of complete protein and highly digestible – and it's not a major allergen unlike soy; even pea is starting to be emerge on the radar as a potential allergen. Hemp has a lot going for it."

The hemp heart

Traditional hemp protein is processed using the entire hemp seed, including the shells. These shells contain tannins and chlorophyll, contributing to its green colour and bitter flavour, which have limited its adoption in the market.

Victory Hemp has developed a novel processing method, which is clean label and doesn't use chemical solvents like hexane. This unique process utilises the inner hemp seed heart, instead of the entire seed – the result is V-70™ Hemp Heart Protein. V-70™ has a near white colour and a neutral flavour, allowing it to be used in a wide variety of applications for the first time.

"The products on the market that are using V-70™ look and taste good – and there's a range of nutritional benefits," Raymond noted. Typical applications for V-70™ are nutritional bars, protein beverage blends, bakery products, sports nutrition products, and dairy and meat analogues. »

"What we do know is that hemp is a highly nutritious commodity – a good source of complete protein and highly digestible"

Ben Raymond

Ben is the Director of Research & Development at Victory Hemp. Ben earned a BS in Nutrition and Food Science at the University of Vermont followed by an MS in Food Science at North Carolina State University and an MBA from the University of Louisville. Ben's professional experience includes developing specialty crops, extraction, purification, and stabilising processes and technologies. Ben is a pragmatic problem solver with ample experience in bringing new food ingredients to market from product inception, to bench-top development, pilot plant validation trials and, eventually, industrial-scale processing.

Aleah Rouse

Aleah is Victory Hemp's Director of Marketing. She graduated from the University of Mississippi where she received a BA in Marketing Communications and has managed annual marketing budgets for large B2B companies including Time Warner Cable Business Class. She has experience in a wide range of industries, including agriculture, real estate, technology and consumer packaged goods. Aleah worked with the Texas Department of Agriculture on its Go Texan campaign, as well as campaigns for commodity crops like Texas Watermelon.

Victory Hemp's V-70™Hemp Heart Protein offers some key functional characteristics that make it a particularly great meat analogue ingredient. For example, it's >70 percent protein on an 'as-is' weight basis (ie, weighing the product as it is rather than its dry or wet weight); it holds oil and moisture well, helping to create a firm, juicy bite; and it doesn't require flavour masking ingredients to cover up beany or earthy notes like a lot of other analogues do. "Hemp ticks a lot of boxes – it's a 'hot' product, incredibly nutritious, and it's environmentally and animal friendly. Plus, it tastes good – and that is really important."

The co-product of V-70™ is Victory Hemp's V-ONE™ Hemp Heart Oil which can be used as an ingredient in frozen novelties like plant-based ice cream, spreads, pestos and dips, as well as in cosmetics and personal care applications, and nutritional supplements.

So, if the hemp heart holds the key to creating a meat analogue which doesn't require flavour masking, why isn't everyone using it? "The hearts are usually around 50 percent fat and that makes them very soft. When you process them, it's tricky not to turn them into paste and damage the protein. What we have figured out is how to remove the oil from the hemp heart in a gentle way that is extremely scalable – it took a long time, but we worked it out," Raymond continued.

"Hemp's progress in this alternative protein category depends greatly on scale," confirmed Rouse. "Traditionally the green protein wasn't particularly appealing, and so hemp protein's progress as an ingredient came to a sort of halt. Now, with V-70™, we have developed a colourless and bland end-product and devised a way to scale that, and that will really drive cost down. Hemp protein is one to watch."

Victory Hemp shared that its next steps will involve the continued development of relationships with farmers and suppliers, the installation of new equipment, and the introduction of increased capacity with new facilities in different regions.

"We're focused on scaling right now, but there's other potential too – for example, how can one use other parts of the plant; can we turn the shells into something useful? We think so and we'll have more news to share on that shortly," Raymond concluded.

It seems that hemp may have had a faltered start, but it's well on its way in the race to be the ultimate protein alternative. Whether it overtakes products like soy or pea is yet to be determined, but it's certainly going to earn its place, standing side-by-side as an equal against better-known analogues.

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Cannabinoids in food, feed and Novel Food in the European Union

Jörg Konetzki from Mérieux NutriSciences outlines the current cannabinoid climate, including legality in Europe and some noteworthy aspects of analytics.

CANNABIS SATIVA, or hemp, is gaining increasing significance in food production, with products containing hemp seeds, flowers or oil becoming more readily available. Hemp seeds, hemp expeller and hemp oil are also approved as feed materials.

A legislative big-bang

Since the landmark decision of the European Court of Justice in November 2020 that cannabidiol (CBD) is not considered to be a narcotic drug and EU member states may not prohibit the marketing of CBD legally produced in another member state,[1] »

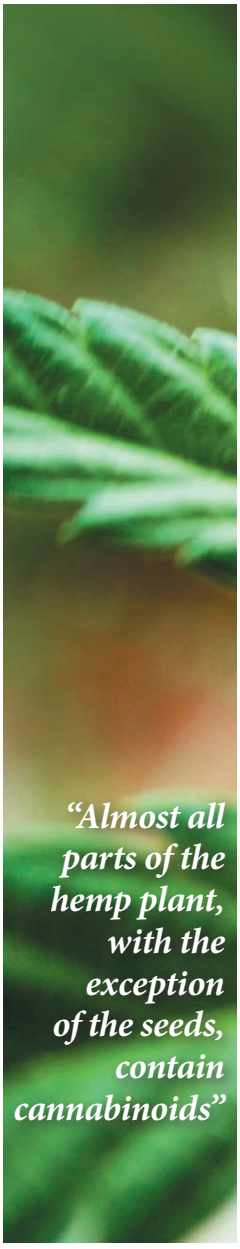
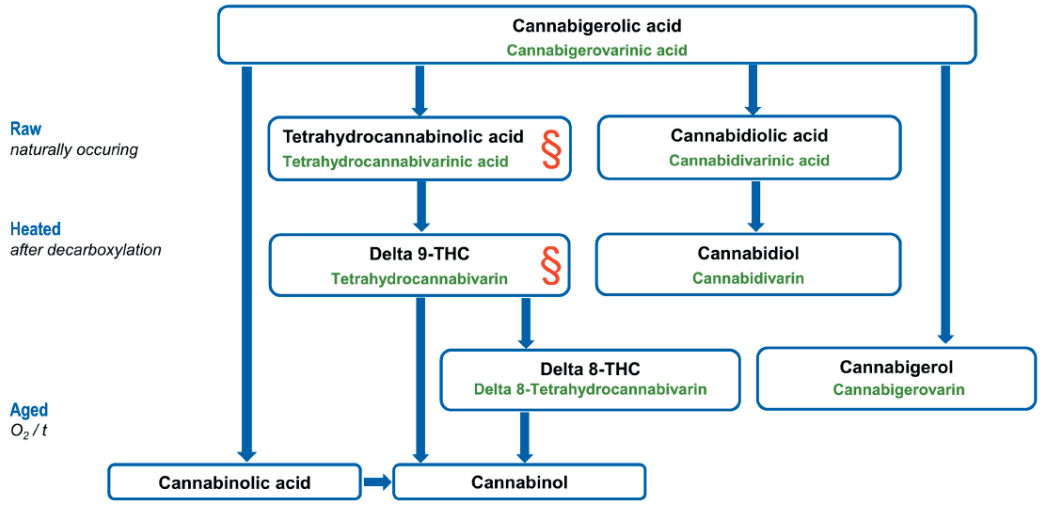


Figure 1



Excerpt from cannabinoid biosynthesis

the European Commission (EC) has resumed the examination of applications for authorisation of CBD products as a Novel Food. But it must be ensured that no delta-9-THC is detectable in CBD products as most food inspection offices will classify CBD products as drugs if delta-9-THC is detectable.

This decision cleared the path for future applications in Novel Food and overturned a ban in France on the marketing of hemp-derived CBD products, which the court said contradicted EU law on the free movement of goods. As such, the enormous market potential for CBD has grown further, driving an increased need for specific and robust analytical methods for the quantification of cannabinoids.

Almost all parts of the hemp plant, with the exception of the seeds, contain cannabinoids (>100 substances known so far) which are produced by glandular hairs. Cannabinoid contents of the seeds primarily result from contamination with other parts of the plant.

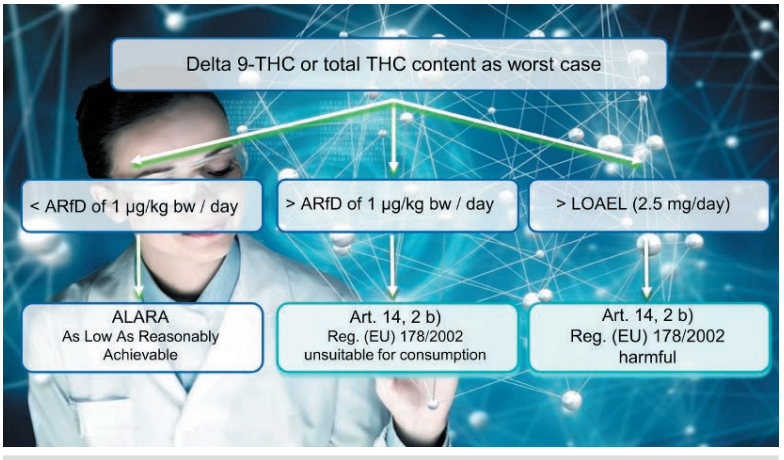
In raw plant material most of the cannabinoids are present as carboxylic acids which can undergo decarboxylation induced by heat in production processes, smoking or even in gas chromatographic analyses (see **Figure 1**). Important acids include tetrahydrocannabinolic acid – the precursor of delta 9-THC (often simply called THC) and delta-8-THC – and cannabidiolic acid – the precursor of CBD. Some cannabinoids are psychoactive (eg, delta-9-THC and delta-8-THC), whereas others are not (eg, delta-9-THC acid, cannabidiolic acid and cannabinol) or they only show slight effects (eg, CBD).

Essential for the analytics of food are the analytes delta-9-THC, the only cannabinoid for which toxicological limits have been established by the EFSA,[2] and delta-9-THC acid for the calculation of potentially formed delta-9-THC as well as for the analytics of CBD products, the analytes cannabidiol and cannabidiolic acid.

Two varieties of hemp are known: drug hemp and fibre hemp, which contains less THC. According to Reg. (EU) No 1307/2013 of the European Parliament, the maximum THC content for state-subsidised fibre hemp is 0.2 percent THC.[3] The CBD content can be used (together with the cannabinol content) for the distinction between drug hemp and fibre hemp.

The monitoring of further cannabinoids is recommended by the EC in the commission recommendation (EU) No. 2016/2115,[4] whereas in case of food of animal origin, only the monitoring of delta-9-THC is recommended. The EC has also asked for the monitoring of even more cannabinoids in hemp-derived foods and foods containing hemp or hemp-derived ingredients, like delta-8-THC (an isomer of delta-9-THC), cannabinol, CBD and delta-9-tetrahydrocannabivarin.

Figure 2



Evaluation of hemp containing food

Analysing CBD

Cannabinoid analytics require certain expertise. Laboratories must apply for approval from national authorities to analyse cannabinoids. The commission recommendation (EU) No. 2016/2115 is an important basis for the selection of a suitable method. A central statement is that cannabinoids shall be determined separately, which makes LC-MS/MS the preferred technique, since GC-MS/MS is not able to distinguish between precursor acid forms and decarboxylated forms. A disadvantage of LC-MS/MS is that the analyst often has to cope with strong matrix effects which require expensive (labelled internal standards) or time-consuming (standard addition) compensation techniques.

Regarding extraction procedures (solvents) and cleanup techniques, there is currently huge variety in the methods used among different laboratories. As such, several state committees are working to develop a harmonised approach.

For the legal evaluation of hemp containing products, the key question is always: 'Is the product food, drug or pharmaceutical?'. Narcotic or psychotropic substances are not accepted as food. "Cannabis and cannabis resin and extracts and tinctures of cannabis" are classified as drugs according to the United Nations Single Convention on Narcotic Drugs of 1961 legislation. Seeds (from fibre hemp) and leaves are excluded from the drug definition. Furthermore, flowering and fruiting tops are not regarded as drugs if the resin has been extracted.

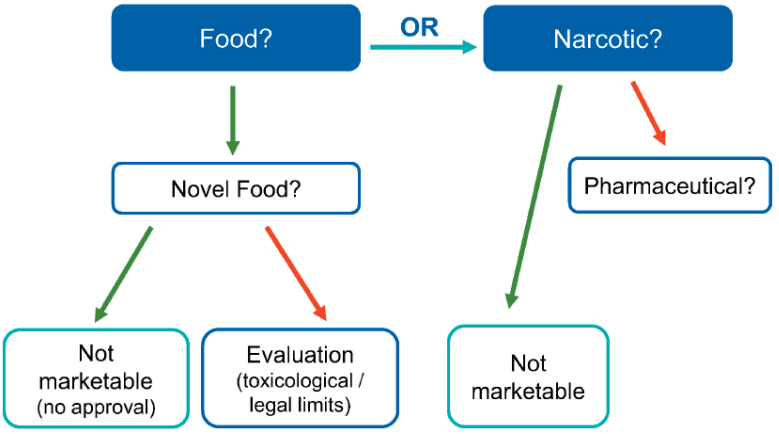
In the European Union (EU), no specific limit for delta-9-THC in food currently exists. The evaluation of THC contents is usually performed by food inspection authorities in consideration of toxicological values published by the European Food Safety Authority (EFSA)[2]:

- Acute Reference Dose (ARfD = estimate of the amount of a substance in food or drinking water that can be consumed over a lifetime without presenting an appreciable risk to health): 1 µg/kg body weight/day
- Lowest Observed Adverse Effect Level (LOAEL = lowest dose at which there was an observed toxic or adverse effect): 2.5 mg/day.

If the content of delta-9-THC (or total THC content, including THC acid in the worst case) is below the ARfD, the content is evaluated according to the ALARA (As Low as Reasonably Achievable) principle. This means that an assessment is carried out if the content could have been technologically avoided or reduced. If the determined content is above the ARfD but below the LOAEL, the product is rated as "unsuitable for consumption" according to art. 14, 2b) of Reg. (EU) No 178/2002,5 and if the determined content is above the LOAEL, the product is rated as "harmful" according to art. 14, 2b) of Reg. (EU) No 178/2002.

Currently, new specific limits for THC in oil from seeds, seeds and food derived from seeds are being discussed.

Figure 3



Product classification (green arrows: yes; red arrows: no)

Conclusion

To conclude the situation of CBD products, three outcomes are currently possible. CBD containing extracts from flowers and leaves are classified as drugs; isolated (pure) or synthetic CBD containing products could be marketed as Novel Food but need approval; and products with highlighted health benefits are classified as pharmaceutical.

Hemp seed, expeller and oil are currently approved as feed materials.[6] Other parts of hemp or the whole plant are not since no feed additives may be placed on the market without an authorisation.[7]

Overall, it can be said that the legal situation in the EU is currently quite complex. There will certainly be some changes in the next few years, but the importance of hemp in food, feed and Novel Food will continue to increase.

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Jörg Konetzki

Jörg is a food chemist and has been working for Institut Kirchhoff Berlin GmbH, part of Mérieux NutriSciences, since 2003. He is a member of the R&D department and is responsible for the implementation and improvement of analytical methods, mainly based on liquid and gas chromatographic techniques coupled with mass spectrometry, with a focus on contaminants. Jörg is a member of a committee for the development of official methods on the basis of the German Food and Feed Act for the analysis of plant toxins.

Cannabis strains and testing criteria

Diana Tran explains the difference between cannabis strains and outlines the common criteria SCIEX looks for when conducting testing.

CANNABIS is a broad umbrella of classification that includes both hemp and marijuana. In the mainstream world, cannabis is grouped into three distinct strains, Indica, Sativa and hybrid. Still, given the scientific definition of the word 'strain,' we hear the term 'chemovars' far more.[1,2]

Chemovar names are loosely based on smell and anecdotal consumer experience rather than on chemical fingerprints. For example, Sunburn Popcorn and OG Popcorn share a buttery popcorn smell, which may have inspired their names, but statistical analysis reveals that their chemical fingerprints are dissimilar.

At present, chemovars are separated based on cannabinoid and terpene profiles. However, in a similar way to that of wine varieties, chemovars can have different characteristics depending on where they are grown – even their effects on consumers can vary based on the plant's origin.

The cannabis plant is a living organism and reacts to differences in growing environments, producing different levels of cannabinoids, terpenes and metabolites depending on the stressors that are present. For example, Gorilla Glue grown in California can differ from Gorilla Glue grown in Colorado because of the nutrients used, indoor vs. outdoor cultivation, or light exposure.

With this in mind, it's clear that chemovar names don't mean much to an analytical scientist since chemovars with similar names can be very different. Alas, there is no easy way to classify cannabis chemovars, which leads to what is known as the entourage effect.

Entourage effect basics

The entourage effect is the synergistic relationship between chemicals that produce a particular feeling. Entourage effect analytical studies can be massively complex and entail a lot of data mining. Statistical analysis, similar to chemical fingerprinting, can help separate different chemovars from one another by focusing primarily on terpenes/cannabinoid interactions and amounts.

Using accurate mass spectrometry and non-targeted analysis, we can tease apart the differences between chemovars. A non-targeted analysis is the least biased approach because it looks at everything in the cannabis plant and can offer insights into the particular variety. It identifies unknowns rather than just looking at cannabinoids and terpenes.

A non-targeted study actually showed that chemovar identification based solely on the cannabinoid profile doesn't work and that there is no exclusive chemical fingerprint between different varieties because there is overlap. A webinar presented by SCIEX Application Scientist, Karl Oetjen, delved deeper into the analysis and how body reactions depend on the location where it is grown. For example, a particular sample of OG Kush smoked in Colorado might be more similar to Tangerine Sunrinse in California than OG Kush in California. For this particular study, more than 3,400 chemical features were identified in the chemovar during non-targeted analysis, which digs into the components that might direct the entourage effect.

How do you test for potency?

Based on individual state regulatory requirements in the US, the potency of commercial cannabis products must be reported. The percentage of THC is printed on cannabis product labels after being certified by a licensed cannabis testing facility. The methodology for obtaining cannabis potency values can vary based on the analytical technique and instrumentation used, which gives testing facilities options for customising or streamlining their workflows.

While marijuana potency testing can vary, hemp analysis must be accurate, otherwise, the crop is considered cannabis and subject to federal confiscation and fines. The US, however, lacks standardised methods to assess products for potency and safety. That's a big problem for the labs tasked with carrying out the testing, and there have been many challenges in the uniformity of potency results across testing sites. Some manufacturers will go to the lab that gives them the highest potency results.

As states in the US struggle to set standards for testing, consumers and retailers are becoming increasingly discerning. Because of the variability and diversity of the matrix composition of samples, analysing cannabis and hemp for pesticides can be daunting. This is especially true for high-throughput cannabis and hemp residue testing. For some tips and tricks, visit https://sciex.li/mt3ffu.

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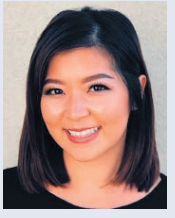

Diana Tran

Diana is a Senior Applications Scientist at SCIEX and specialises in LC-MS/MS method development. For the past four years, she has been actively involved in cannabis testing analysis and has had a hand in almost every cannabis method developed at SCIEX since then. Diana is highly experienced, having working across multiple testing labs in the US, and has made numerous connections in cannabis testing specifically. She also acts as a resource for analytical chemists.

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