Research

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Report #2

Cannabis Extraction and Post-Extraction Technology in North America and Europe



Interview with Edward Klaeger IV, CEO of Fiberlab Inc. The Tech Company That The Cannabis Industry Has Been Waiting For

According to an <u>article</u> by Alan Brochstein, the demand for CBD products is projected to grow very strongly in North America:

"Brightfield Group, a market research firm based in Chicago, expects CBD products to grow from 5% of U.S. cannabis sales today to 12% by 2021, and this doesn't include the pharmaceutical channel... The firm tracks several different distribution channels and suggests that total CBD sales of \$288 million in 2017 grew 65% and predicts the entire category to grow 76% in 2018 to \$505 million. In 2017, it estimates the share of each distribution channel:

Dispensaries and delivery services: 7% Health shops: 6% Smoke shops: 21% Doctor's offices: <1% Online sales: 65%

New Frontier Data predicts that the overall U.S. CBD market will increase more than 422% over the next 5 years to \$1.9 billion."

According to an <u>interview</u> with Edward Klaeger, the supply of separated cannabinoids in bulk quantities is the market's bottleneck:

"The problem with the medical and pharmaceutical markets in the cannabinoid industry: There is no bulk separation of cannabinoids to mass produce a prescription – and that's where Fiberlab comes in."

"The economies of scale is what sets Fiberlab technology apart and then the fact that we can create bulk isolation of cannabinoids."

"We can give you a CBDA stream, or THCA stream, completely pure and clean, which you can then crystallize, or you can keep it as an isolated concentrate, which is ideal for the medical and pharmaceutical market, because then you can micro-dose for compounding, for prescriptions or diagnosis."

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Previous Coverage Report #1: <u>"How Disruptive Technology Can</u> <u>Take The Cannabis Industry To A</u> <u>Higher Level"</u> (November 17, 2017)

"We don't heat any cannabinoids, so our model is based around zero molecular destruction. We maintain the integrity of the whole plant material. We deliver cannabinoids the way nature intended them to be. We use cold-press, coldfiltered extraction – no heat and no pressure in our process." (Edward Klaeger, CEO of Fiberlab Inc., on April 20, 2018)

Exclusive Interview with Edward Klaeger of Fiberlab

The interview was recorded in Zurich, Switzerland, on April 20, 2018, and took place between Stephan Bogner from Rockstone Research and Edward Klaeger IV, CEO of Fiberlab Inc. Please note that below transcript has only been edited slightly for ease of reading.

Rockstone initiated <u>coverage</u> on Fiberlab Inc. in November 2017. It's a very interesting company that we presented to our readership and investors. We think it has a bright future in the US, Canada and even Europe. We are very happy to talk to him directly today here in Zurich.

Mr. Klaeger, great to have you here. Please give us some background information about yourself and how you started to found this company in the US and why your technology is so different from other technologies in this space and what makes this company so special.

Thank you Mr. Bogner very much for the invitation and the opportunity to speak with you today.

My background is in finance. I started with Whale Securities, a New York stock exchange member firm. I worked as a stock broker for a period of years and then I started in the venture capital / private equity markets. That led me to Lugano, Switzerland.

This was 14 years ago, when I first came to Switzerland to work on a project in China with a group in Lugano. And I ended up staying in Switzerland after that. I was living in California at the time, was transiting back and forth from California to Switzerland, and I found it much easier to just to stay in Europe.

I ended up living in Europe for 12 years. I lived in Switzerland, Germany, Ukraine and it was in the Ukraine that I became very active in renewable energy.

We began by trading carbon credits, or emission reduction units, on the London Stock Exchange, and that morphed into renewable energy projects development and finance, where we could actually create the projects and create our carbon credits. And that lead me to the technology that we use for Fiberlab.

The technology for Fiberlab, what sets us apart, is the volume, the throughput, the economies of scale, the enrichment and purification and separation of bulk cannabinoids.

So this technology, which was originally developed in the early 1970s for the use in the oil industry, is still in use today and it maintains a 75% market share in the oil industry.

Our patent inventor and owner, Dr. John Massingill, worked at Dow Chemical for 25 years in the petrochemicals division, which is how he came in contact with the fiber reactor technology. He developed patents for plant-based and bio oils, and that's how it fitted into our renewable energy strategy for bio fuels production.

We spent 2 years developing the technology for bio fuels applications in the US and Europe.

When the price of oil went below 30 dollars a barrel, the bio fuels market was no longer attractive for investment. So we began to look at the technology, the patents, where we could apply those in the current market situation for dynamic growth, and that lead us to the medical

marijuana and the industrial hemp market, which fit with the plant-based bio oil patents.

In March of 2016, we went to Colorado to do a test with the lab unit for the Fiberlab technology.

We took a 30% crude extracted medical marijuana paste and we enriched it to 69%, broke the system down and Dr. Massingill made some calibrations at Texas State University.

We went back 3 weeks later and enriched the cannabinoids to 92%+. So we knew then we had a commercial opportunity and that the product was viable for deployment in the cannabis industry.

We funded a research grant at Texas State University for the development of the enrichment, purification, and separation of cannabinoids from the industrial hemp plant, i.e. less than 0.3% THC, which makes them suitable for interstate commerce in the US.

After about 4 months of R&D at Texas State University, we had perfected our protocols for CBD, CBDA enrichment and separation.

At that point in time, we began to move towards the medical marijuana market, so we had to transition from Texas back to Colorado, where it was legal to operate in this space.



We spent almost 9 months in Colorado, perfecting protocols for the bulk enrichment and separation of marijuanabased cannabinoids and then also for the development of our hemp-based protocols.

In Colorado, we were able to take crude extracted oil from hemp and marijuana, enrich it and purify it to the 90+% range, and then take it one step further into the crystalline isolate market, which is targeted for the medical and pharmaceutical community.

So that is how I came to know the technology and what lead us to the deployment of this technology in the cannabis industry.

That's very interesting, but what is the problem of current technology? I mean, there is different kind of extraction technology out there, but what sets you apart from these technologies?

That's a good question and the answer is actually very simple. It's economies of scale.

Most technology in deployment in this market today is going to be some sort of CO2 or BHO and then some short path distillate unit – it's extremely limited in its throughput and its capacity, it requires a large footprint and extensive staff in an operation.

Our technology, which is industrial in scale, can scale up from 500 gallons a year to a hundred million gallons a year. It's industrial in scale, coming out of the oil industry and then the bio fuels and vegetable oil markets, so obviously you speak about industrial-sized projects.

The largest systems that I have been involved with would be a 1.5 million gallon plant for deployment in the US and then a 12 million gallon refinery for deployment in Germany.

What we did: We took the engineering, which we had developed for the bio fuels market, and we shrank it down. So a system that would fit on maybe an 8 foot lab table is capable of processing up to 20,000 gallons a year of material.





New Frontier Data predicts that the overall U.S. CBD market will increase more than 422% over the next five years to \$1.9 billion. (Source)

The economies of scale is what sets Fiberlab technology apart and then the fact that we can create bulk isolation of cannabinoids.

We can give you a CBDA stream, or THCA stream, completely pure and clean, which you can then crystallize, or you can keep it as an isolated concentrate, which is ideal for the medical and pharmaceutical market, because then you can micro-dose for compounding, for prescriptions or diagnosis.

So you are talking about 90+% purity of this compound?

90+% purity coming out of the oil. When we take it through the crystalline and isolate, we are 99+%.

Wow, that's very pure. And that's what the pharmaceutical industry needs actually to create product?

Right, in the medical and pharmaceutical market you want to be able accurately dose certain cannabinoids for a patient's medical diagnosis or a doctor's prescription. If you have variable cannabinoids, 8 or 9 in your product stream, you are going to have a hard time determining exactly what the ratios are. If you have a 99+% purity, which is pharmaceutical grade, then you can actually micro-dose 2 mg of that, 3 mg of this, you come up with a prescription.

The problem with the medical and pharmaceutical markets in the cannabinoid industry: There is no bulk separation of cannabinoids to mass produce a prescription – and that's where Fiberlab comes in.

That's very interesting. So you are saying that most cannabis producers and processors they don't really have the technology right now to produce large scale and bulk cannabinoids for the industry, isn't it?

That is correct. Technologies are developing, coming on to the market, we see some technologies that represent 5,000 kg a month, but for our technology that's nothing.

Coming back a bit to another separation between Fiberlab and most technologies

in the market: A lot of companies use a short path distillate, in which you superheat the cannabinoids in order to create this golden-yellow high THC distillate.

We don't heat any cannabinoids, so our model is based around zero molecular destruction.

We maintain the integrity of the whole plant material. We deliver cannabinoids the way nature intended them to be.

We use cold-press, cold-filtered extraction – no heat and no pressure in our process. And then the backend is all organic solvent recovery.

Ok that's what is called full spectrum?

Yes, full spectrum extract. That's the new direction of the market, where you actually have the benefit of all of the cannabinoids and not just the Delta-9 [Tetrahydrocannabinol aka THC].

Now we do offer the Delta-9 as a service to clients who want that product, but it's not our core focus.

For example, we procured some trim in California, did a pre-sample analysis and there were 3 cannabinoids in the trim. It came about 13% cannabinoids in the starting material and when we finished our process, we had 90.6% cannabinoids and 8 cannabinoids were present in the analysis. So we were able to enrich those cannabinoids from a non-detectable level to a detectable level.

That's very impressive. So your technology is able to get the full spectrum of the plant but your technology is also capable of extracting just single cannabinoids if the customer wants.

That is correct. What we have perfected so far are CBDA isolation and THCA isolation. We have developed small separations for THCV, CBN, CBG and CBGA.

It's not a matter of *can* we separate the cannabinoids or *can* we separate the cannabinoids in bulk, it's a matter of just



Product Packaging of "Black Magic" (80+% purity of full spectrum cannabinoids)

going through the R&D to isolate each individual cannabinoid and then scaling up.

We focused on the 4 main cannabinoids [CBD, CBDA, THC, THCA]. Those are perfected and optimized, commercialized to market.

Now we are beginning to R&D on the separation of other cannabinoids.

Has your technology already proven commercial viability?

Yes, absolutely. Our product is now

available in Los Angeles through limited distribution. We market it through the Fiberlab brand and this is full spectrum extract, it's the 90+%.

And then we have an 80+% range full spectrum extract, which we call "Black Magic" and the 90+% full spectrum we call "Private Reserve".

So you have 1 system in operation right now?

Currently, we have 1 system in operation in California and that was our pilot plant that we built in Colorado. Yes, already producing, already up and running in our lab in California.

Are you looking for cannabis producers who supply you with feedstock or you already have sourced some producers?

What we have been doing at this stage of our development: We have actually been buying the trim ourselves for production and then doing direct sales. We have aligned ourselves strategically with growers in southern California who can provide us a stable and reliable source of feedstock.

So our model is based around 3 revenue streams:

We have the shared revenue model, where a grower is giving us the trim at no cost, we are doing the processing, – Fiberlab will process and enrich. Backend product comes out, we back out all the cost, do the distribution and share the revenues. This can also be a white label tolling fee but all products are manufactured under the Fiberlab brand.

The other one is the direct sales, which we already discussed, where we buy the trim, process it, package it and sell it directly through Fiberlab.

And then, the last revenue stream that we have is the equipment lease where we have a designated line for a larger grower. They fund the system, we lease it back to them, so we build-own-operate our own technology. We don't sell our equipment. And then they would have a designated line just for their product.

How do you finance your projects right now, do you have investors? I mean it's a privately held company at this stage.

Yes, Fiberlab is a privately held company. We funded our growth and development mainly from investors that I have here in Europe from my renewable energy activities. And then clients and resources that I have available in the US.



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Product Packaging of "Private Reserve" (90+% purity of full spectrum cannabinoids)

Do you have plans to go public in the near future?

We do, yes. I would target public strategy more realistically in 2019 than 2018, so we have a full year of production, audited financial statements showing cash flows, so we get a higher valuation in the public markets.

Yes, that makes sense. What about the rough revenues from one system and how many systems do you plan to put into production over the next couple of years? What are your plans for the US and Canada? We have modeled right now in the US market 10 systems deployed by 2020. That's very conservative – we already have those orders in our books.

We will deploy 4 systems this year: 2 or possibly 3 in California, and then one more in Colorado – we will go back into the Colorado market, where we have established a lot of relationships. And then we will deploy up the west coast, Oregon, and Washington. We also have opportunities in Massachusetts and New York. And these are already identified strategic partnerships we have in these markets. So in the US market we plan to deploy 10 systems by 2020.

Canada is very early stage for us. We are just now engaging in active discussions with large hemp growers and medical marijuana providers. That will entail the establishment of a Canadian entity to take advantage of the licensing and permitting, and any tax advantages that you may have for a Canadian company operating in this space. That's more of a 2019 target than it is a 2018 target.

And then the European market: I am now here in Europe, establishing the European operating entity, which has been done. We expect to deploy at least one system in Europe before the end of the year.

Before the end of this year?

Yes, we would like to get one online in Q4.

Interesting. So that will be probably industrial hemp and then the extraction of CBD?

Yes, we will focus on the CBD market in Europe initially until we have a clear understanding of the licensing and permitting required in distribution and the restrictions of medical marijuana.

I can see on Amazon here in Europe or other retailers on the internet, that you can buy CBD products which are pretty expensive as you can get a small bottle of CBD extract for about 50 euros. I don't know about the purity but it's from industrial hemp, so 1 gram of CBD is selling for more than a dollar or a euro. What are your production costs as these should be below that?

Our production costs per gram are [very competitive!].

If you speak about a dollar per gram, the market is much higher than that.

Let's speak a little bit about that because that's interesting and I always like to use that as a point of reference about the difference between the bio fuels / vegetable oils market and the hemp / cannabis market: Flowers went from 75% of total sales in 2015 to 54% in 2016. Vaporizer cartridges, however, grew from a modest 6% in 2015 to 24% in 2016 – a 400% annual increase.

Product Type Preference



This data comes from Eaze, a marijuana delivery service that operates all over California. Eaze

In bio fuels / vegetable oils you make pennies per gallon – and in this [cannabis] market you make dollars per gram. So it's quite different.

You can build an industrial-sized bio fuels plant, take you maybe 2 to 3 years to build it, and then maybe in 5 years you will have break-even.

In this industry, you can have a plant online in 120 days and you have your money back in 90 days after that. Much quicker payout, much smaller system, more efficient ease of operations.

What's the payback period of 1 system?

We like to be conservative. We model our systems at 20% of designed capacity. Payback period, start to finish including your project build-out, you'd be looking at payback within 9 months.

Wow, that's pretty good. Are you looking for investors right or why are you in Europe? Of course you want to establish the European market, but even for the US business: Are you looking for investors or would investors have a chance to get involved with you if they are interested in your technology? What are the ways to get involved with you?

Currently we are underwriting our Series B. We did the founders round, the angel round, and the Series A. We have funded roughly \$2.5 million, so we have tried to keep it tightly held. And we are now doing our Series B to expand more quickly in the US markets.

As far as the European market goes, I have a lot of shareholders in Europe and a lot of relationships, so I came over here to visit with some of those people.

And then also to establish Fiberlab AG which is now incorporated in Zurich. And I imagine that we will have the registry done next week and the operating accounts will be established 2 to 3 weeks after that.

So I came here for the foundation of Fiberlab Europe, to meet our seed investors and then also with our strategic partners for the supply of the hemp and then the distribution through the markets.

So from an investor's point, it would be still possible to get involved with Fiberlab AG?

Yes, it's still possible. Fiberlab Europe is a separate raise than Fiberlab US. With Fiberlab US, there is still an opportunity, but I don't know how long that opportunity will last. And with the Fiberlab Europe we are doing the founders shares now.

What about if a cannabis producer in the US would approach you? Is

it possible that you work together with those producers to use your technology?

It is possible. So once again we come back to the various revenue streams we have in our business model.

A grower of material would need to have a large supply to have a designated line that justifies having a system.

If they are just a supplier of trim, then they can bring it in our facility, we can process it either on contract for a fee or we can do a revenue sharing model.

Right now we are working with large growers in northern California. We have aligned ourselves strategically with some large growers in the Palm Desert / Palm Springs area. The ones in the desert look more like they will have a designated line as they are large enough to justify having their own system.

And then any shortfall you might have on your production, maybe your supply chain is interrupted, you can just bring in third party trim and process like that so you don't have any downtime with the system.

Where we are with the development of the technology: We have optimized the various components and now we are integrating the system for continuous flow operations. We brought in one of the largest process engineering firms in the world to work with us. I know them from the bio fuels market. And we brought in a highly qualified biomass engineering company that runs a large ethanol refinery in the US and they are mapping out the technology for the finished skid-mounted plug-and-play system that we would deploy.

Would Canada make any sense to you in the near future if a producer approaches you? Would you consider going there earlier?

Yes, we have a great deal of interest in the Canadian market. As I said earlier, we are in active discussions right now.

It's a matter of finding the right partner,

the right opportunity, and understanding the laws.

We are very favorable for Canada because Canada has strong relations with Germany. And they have opened up their markets now for trade in the cannabinoid market. So for us it makes a lot of sense.

Through the Swiss renewable energy company, 85% of its shareholders are Swiss, German or Austrian based. They are very aware of the CBD market, the legalization of medical marijuana in Germany in January of 2017. So the Canadian market is a natural play for us.

How does the European market compare to the North American market for industrial hemp and CBD? It's very early stage here in Europe but do you see any parallels?

Actually, the European market is more developed than the markets in the US and in Canada. What you have in Europe, as our research has indicated, you have medical marijuana legal in 21 countries and hemp legal throughout the EU (with less than 0.3% THC). And 30 million users represent a 36 billion euro market - by comparison, the US has just legalized a total of 8 states and the District of Columbia, with 21 states for medical, you have your retail, and the market in the US is \$7 billion USD.

The Canadian market for us is a new entry point. We don't have a lot of data yet but we do know that this market is gaining a lot of traction and that there is large outdoor hemp operations being put into play.

If you think about the European market, 36 billion euro market, 20% annual growth projected by IBD (Investors Business Daily), and then the US markets with \$7 billion but projected with a 30% annual growth by IBD. So you have a higher growth in US market which will surpass the European market eventually.

Have you filed patent protection also in Europe or is it just covering North American markets?

The technology is patented in South America, Europe, North America, and Asia. We have quite a few patents. There are a total of 4 patents issued and then we just apply those patents to the markets where we want to deploy the technology.

Isn't it that in California you have some regulations coming up about the existing technologies, which are dangerous as these use alcohol and a lot of compression, where it's getting dangerous to process the trim from the cannabis?

That is correct. One of the deficiencies in the current technology is that it is dangerous. It does use highly flammable, highly combustible processes, a lot of pressure and a lot of heat.

Our technology does not use any of those protocols. We are safety rated for use in 7 states. The technology is a sealed, closed loop, self-contained system, all stainless steel, no moving parts.

When you think about the technology deployed on an industrial scale in the oil industry, the bio fuels and vegetable oils industry, you have to speak about a safe, contained, closed loop system, otherwise you are not going to be able to operate in those spaces.

Interesting. Thank you so much for your time to talk to us and presenting your company. I am looking forward to writing a report and staying in contact with you, and updating our readership and listeners about your company.



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International School of Management (D o r t m u n d , Germany), the European Business School (London, UK) and the University of Queensland

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