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CANNABIS BIOSYNTHESIS:
RESHAPING TRADITIONAL PRODUCTION WITH SCIENCE

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Abstract

Fierce competition to gain market share is revolutionizing the cannabis industry and, as companies invest significant monetary resources to remain competitive in an evolving sector, a new era in cannabis production emerges.

This report aims to explore the potential of cannabis biosynthesis and how it is reshaping traditional production, beginning with a brief description of what this new concept entails and the advantages it has. It also provides an analysis over the implications and opportunities that can be created, with an outlook of the investments and partnerships already made, ultimately reflecting on the impact it might generate.

Keywords

Biosynthesis

Cannabinoids

Production

Costs

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Cannabis Biosynthesis is the newly promising technology that holds the prospect to be remarkably disruptive to the cannabis industry. So far, Canopy Growth and its peers have been investing in expansion strategies, either organically or through acquisitions, increasing their cultivation capacity in Canada and Internationally. Accordingly, during the first year of legalization, total active cultivation area grew to 19 million square feet, representing an annual growth rate around 400%¹. However, if cannabis biosynthesis proves to be a feasible reality, one can wonder what impact that might have on cannabis companies and how it will reshape the actual production process.

Biosynthesis Definition & Advantages Over Traditional Cannabinoids Extraction

Cannabis Biosynthesis is a natural, alternative method of producing cannabinoids (i.e. marijuana's active components), through a process that genetically modifies an organism to produce a pharmaceutically bioactive compound, from simple substance by living organisms such as bacteria, yeast or algae². Hence, the more than 100 cannabinoids like CBD or THC, identified in cannabis plants, can potentially be produced without having to grow the pot plant. Although this method is estimated to only become a commercial reality within 18 to 24 months³ from now, it can be especially important for generating cannabinoids other than THC and CBD, as these minor cannabinoids, are much more difficult to produce from plants, but potentially have unique applications⁴.

According to Rahul Sarugaser of Paradigm Capital, replacing in-the-field crop cultivation by biosynthesis production has several advantages and is the future of cannabis:

“The cannabis plant is a relatively inefficient biological factory. 95 per cent of its volume tends

¹ Cannabis Benchmarks. 2019. “Canada cannabis spot index”. Accessed December 2019. <https://reports.cannabisbenchmarks.com/canada/>

² Alen Brochstein. 2019. “How biosynthesis of cannabinoids could impact the cannabis industry”. Accessed 2019. <https://renewbiopharma.com/how-biosynthesis-of-cannabinoids-could-impact-the-cannabis-industry/>

³ Nick Waddel. 2019. “Biosynthesis is the future of cannabis, not plant cultivation, Paradigm Capital says”. Accessed December 2019. <https://www.cantechletter.com/2019/01/biosynthesis-is-the-future-of-cannabis-not-plant-cultivation-paradigm-capital-says/>

⁴ Canadian Press. 2019. “Canopy Growth's Venture capital arm eyeing biosynthesis investment”. Accessed 2019. <https://www.canadianbusiness.com/business-news/canopy-growth-venture-capital-arm-eyeing-biosynthesis-investment/>

to end up as biomass waste. By volume, the principal cannabinoids, THC and CBD, make up just approximately two to five per cent of the plant, while minor cannabinoids and terpenes — hundreds of them— comprise less than 0.1 per cent.”⁵

Hence, the edge Biosynthesis has over traditional extraction methods relies on the creation of cannabinoids with higher purity, higher quality control and decreased costs, with a much smaller carbon footprint.

Contrarily to synthetic production, which only produces molecules *similar* to naturally occurring cannabinoids⁶, it is foreseen that biosynthesis will generate cannabinoids that conceive the exact same compounds that would be produced from traditional cannabis extraction, and that are not significantly observed in the cannabis plant itself, offering a level of consistency that is not possible to replicate in crops, which are subjected to climate conditions, plagues and other environmental ambiguities.

Biosynthesis is also more environmentally friendly since less energy is required to run a bioreactor than to power the grow lights and ventilation fans of an indoor cannabis-growing operation. Furthermore, less water is needed, and land devastation related to outdoor cannabis cultivation can also be reduced, by eliminating the use of fertilizers and pesticides, also saving money on those resources. Moreover, biosynthesis preserves from the difficult, expensive and time-consuming challenges of planting, growing and harvesting cannabis, for then laboriously extract the cannabinoids⁷.

⁵ Rahul Sarugaser. 2018. “Cannabinoid Biosynthesis: Engineering the Most Disruptive Technology in the Cannabis Industry”.

⁶ Hugo Gray. 2019. “Weed Science – How Biosynthesis will Upend the Cannabis Industry”. Accessed December 2019. <https://thegreenfund.com/weed-science-how-biosynthesis-will-upend-the-cannabis-industry>

⁷ Networknewswire. 2019. “Purified Cannabinoids Open New Opportunities in Pain Management”. Accessed 2019. <https://www.networknewswire.com/pt/purified-cannabinoids-open-new-opportunities-pain-management/>

Implications & Opportunities for the Cannabis Industry

The main allure of biosynthesis technology really relates to the opportunity to reduce costs, mitigating the current tendency of decreasing margins that cannabis companies are dealing with. It is estimated that with biosynthesis production, the expenses related with land, equipment and energy will decrease, allowing to recreate cannabinoids in high quantities, at less than US\$1 per gram⁸.

Accordingly, there are considerable discrepancies between the production levels that traditional plantations can attain and what is possible to produce in laboratories: while in one year of traditional cannabis cultivation might provide 4 to 6 harvests, a single bioreactor can surpass 23 harvests and create nearly 1,000 metric tons of cannabinoids annually in a 1 million square-foot facility designated for biosynthesis production. Whereas if the same 1 million square-foot was intended for a greenhouse, it would yield around 16 metric tons per year⁹.

Biosynthesis can also generate impact on already established segments of the industry. The new cannabis production method can, not only unveil new pharmaceutical opportunities that might further enhance the medical cannabis market, currently estimated to reach US\$57 billion by 2025¹⁰, but also impact the derivatives market, estimated to be C\$2.7 billion annually¹¹. Hence, shall this technology prove to be feasible, and these segments might incorporate biosynthesis cannabinoids instead of the ones originally extracted from the plant, diminishing part of the demand for dried flower products.

Nonetheless, there will always be market for plant-derived pot products, in part due to customer requirements for “naturally sourced” cannabis products, and the relatively low capital investment needed in traditional extraction operations.

⁸ Greg Miller. 2019. “Biosynthesis finds its way into these leading cannabis stocks”. Accessed December 2019. <https://nicinvestors.com/2019/07/05/biosynthesis-finds-its-way-into-these-leading-cannabis-stocks/>

⁹ Maxx Chatsko. 2019. “Will Cannabis Producers Ditch Greenhouses for Bioreactors?”. Accessed December 2019. <https://www.fool.com/investing/2019/03/01/will-cannabis-producers-ditch-greenhouses-for-bior.aspx>

¹⁰ IMARC Group. 2019. “Medical Cannabis Market”. Accessed December 2019. <https://www.imarcgroup.com/medical-cannabis-market>

¹¹ Deloitte. 2019. “Nurturing new growth – Canada gets ready for Cannabis 2.0. Accessed December 2019. <https://www2.deloitte.com/content/dam/Deloitte/ca/Documents/c-and-ip/ca-en-consumer-nurturing-new-growth-en-aoda-may31.pdf>

Outlook of Investments and Partnerships with Biopharma and Biotechnology Companies

Aware of cannabis biosynthesis disruptive power, and concerned with increasing market saturation and compressed margins, some major Canadian Licensed Producers (Canopy's competitors), are positioning themselves to capitalize on the shift, by partnering with Biopharma and Biotechnology companies that are working on refining the process.

Hence, in September 2018, the Boston-based Ginkgo Bioworks, landed a deal worth approximately US\$122 million with Cronos Group, to produce cannabinoids via biosynthesis.

Then, in May 2019, Canadian LP Organigram Holdings invested C\$10 million in Montreal-based Hyasynth Biological, to purchase cannabinoids produced by Hyasynth.

Canopy Growth also expresses accordance with the idea that investments made in biosynthesis can turn to be huge differentiators for investors looking for a cannabis player with an edge.

In an interview in October 2019, Narbe Alexandrian, the chief executive of the venture capital arm of Canopy Growth Corporation, Canopy Rivers, said that he anticipates “the real disruptors will be companies that are focusing on generating cannabinoids other than THC and CBD”¹².

Alexandrian anticipates making an investment in the biosynthesis space within the next year and said that the company has spoken with more than 50 companies across the globe, adding it is “just a matter of executing”. Nonetheless, during 2019 Canopy continued to invest in production capacity expansion, falling behind its peers that started making investments in biosynthesis one year ago, and that already have patents and supply agreements with big biotechnology firms.

¹² The Canadian Press.2019. “canopy growth venture capital arm eyeing biosynthesis investment. Accessed December 2019. <https://www.canadianbusiness.com/business-news/canopy-growth-venture-capital-arm-eyeing-biosynthesis-investment/>

Future Prospects for the Cannabis Market

It will take time for the promise of lab-grown cannabinoids to deliver, but while biosynthesis still has not demonstrated itself as an expandable production method, it can potentially revolutionize the way cannabinoids are produced in the near future, and organizations that competent to succeed in integrate biosynthesis, will likely benefit from a key advantage over their competitors.

Nonetheless, if this new method proves successful, several cannabis production companies, Canopy Growth included, could be left with needless assets, namely the considerable active cultivation area. Although the dried flower will continue to have market, part of the 4.8 million square feet of indoor and greenhouse production capacity that allowed Canopy to harvest 46,927 kilograms of cannabis in 2019, might become unnecessary.

Besides all the advantages presented, companies that are investing in biosynthesis can further leverage their edge in what relates to legalization, since cannabinoid compounds produced through the new method might be more likely to be exempt from the regulatory hurdles governing the cannabis cultivation sector, as they did not originate in the plant itself¹³.

¹³ Hugo Gray. 2019. "Weed Science – How Biosynthesis will Upend the Cannabis Industry". Accessed January 2019. <https://thegreenfund.com/weed-science-how-biosynthesis-will-upend-the-cannabis-industry>