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Plant-Based Meat Substitutes and Their IP Protection

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A study finds that Meat accounts for nearly 60% of all greenhouse gases from food production. Awareness of good health and a healthy lifestyle is diverting meat eaters towards Plant-based meat substitutes. Plant-based meat substitutes are derived from complex structuring techniques that require evolution over time through Research & Development. The concept of Plant-Based meat substitutes is not new as we can trace its idea generation in various countries through various mediums. The future of these substitutes is bright as the rapidly changing climate, excessive greenhouse gas emissions, the expected increase in world hunger, and environmental protection are the major concerns. Companies producing Plant-based meat substitutes are working according to consumer demands and market conditions. Innovation and invention give them a competitive edge over others and provide the creator, owner, or inventor with Intellectual Property Rights. The commercialization of IP Rights gives twofold benefits to the right holder and the end consumer as well. The present Article focuses on the importance of IP Protection for the success of Companies making Plant-based meat substitutes and the advancement of Plant-based meat products. Some of the steps include Early Patent Applications, Trademark Registration, Branding strategies, and investment in Research & Development.

Keywords: *plant-based meat, research & development, innovation, ipr protection.*

INTRODUCTION

Innovation and Technology advancement has left no field untouched. Food Technology & Bio-Technology are developing in a way to attain the objective of a sustainable environment while fulfilling the emerging need for substituting animal-based meat with plant-based meat. The

PBM substitutes are designed in a way that replicates animal-based meat products. The PBM is derived from plants through analogs¹ made from plant proteins that give it the same texture, taste, and nutritional value.

As per the “Plant-based Meats: Intellectual Property Landscape”² Report, in 2020 approximately 340 million tons of meat was estimated to be produced worldwide. As Compared to the early 1960s, there is an increase of 500%. The process of making PBM and the end product involves the extrusion of the proteins formulated by various compositions. The creation of plant-based meat is novel for the vegan community which wants the same taste and texture as animal-based meat even without harming any animal. The advancement of Research & Development in the Companies producing PBM requires protection for further innovation and improvement in the PBM industry. This can be attained by IP protection of various rights including Patents, Trademarks, Designs, and Trade Secrets.

HISTORY AND THE NEED TO INTRODUCE THESE SUBSTITUTES

The concept of PBM is not new as it has its roots deep in the past. “Tofu”³ was the first substitute for meat which is derived from soy protein. It originated in China in 206 BC during Hyan Dynasty. Wheat gluten or seitan in China, yuba in Japan, and tempeh in Indonesia have their markings as a great source of PBM substitutes in many countries for centuries. Archives show the early days of PBM or fake meat started in the Battle Greek Medical Surgical Sanitarium in the United States. John Harvey Kellogg became its Director in 1876 and served patients vegetarian food believing that meat lowers physical strength and harbors bacteria. He conducted experiments on meat substitutes to provide adequate protein to the population. The

¹ Mudasir Ahmed et al., ‘Plant-based meat alternatives: Compositional analysis, current development, and challenges’ (2022) 2(2) Applied Food Research <<https://doi.org/10.1016/j.afres.2022.100154>> accessed 02 March 2023

² ‘Plant-based Meats: Intellectual Property Landscape Report’ (*Root Analysis*, April 2022) <<https://www.rootsanalysis.com/reports/plant-based-meats-intellectual-property-landscape.html>> accessed 02 March 2023

³ Nea Pantry, ‘The Fascinating History of Meat Alternatives-and Why They’re Not ‘Unnatural’’ (*Peaceful Dumpling*, 2 December 2020) <<https://www.peacefuldumpling.com/history-of-meat-alternatives>> accessed 02 March 2023

first canned meat substitute product to be commercialized was “Nuttose”⁴ produced by the famous John Harvey Kellogg (founder of Kellogg’s) in 1896 using wheat and nut products after many experiments the same is also termed a “substitute for flesh food”.

PBM substitutes are taking a front seat as the current meat consumption leads to increasing climate change, global public health issues, and disruption of the sustainable environment. These substitutes have been covered a long way through Research, Development, and Innovation from old cultural habits of veganism to the future generation's inclination towards adopting PBM substitutes for meat. Quorn launched the first PBM substitutes in 1985 in the UK. Beyond Meat revolutionized the meat sector by introducing PBM substitutes in 2009. In 2011, Impossible Meat launched as a producer of PBM substitutes. Disrupting the market of seafood, Sophie’s Kitchen was founded in 2011 as a company for producing Plant-based seafood⁵ alternatives. The PBM substitutes lower the risk of cardiovascular issues and cholesterol as they are low in saturated fats. The production of PBM substitutes aids in reducing Green House Gas Emissions by 30-90%, reducing reliance on more research-intensive production processes, reducing the use of water by 72-99%, and reducing land usage by 47-99%.⁶ Concerns about health, the environment, food safety, and animal welfare are the reasons behind the increasing demand for PBM substitutes by cutting back on eating meat.⁷

INNOVATION: PROCESS OF MAKING PLANT-BASED MEAT SUBSTITUTES

Plant-based Burgers, Bacon, sausages, nuggets, seafood, and eggs are emerging as great sources of protein and other health benefits without consuming meat. PBM is designed through meat

⁴ Brendan Bachmann, ‘The Battle Creek Diet System: A Pamphlet and Birth of the Fake Meat Industry’ (*Library of Congress Blogs*, 19 Feb 2020) <https://blogs.loc.gov/inside_adams/2020/02/battle-creek-diet-fake-meat/> accessed 02 March 2023

⁵ Katie Jones, ‘Timeline: The Rapid Evolution of Plant-Based Alternatives’ (*Visual Capitalist*, 10 March 2022) <<https://www.visualcapitalist.com/sp/timeline-the-rapid-evolution-of-plant-based-alternatives/>> accessed 03 March 2023

⁶ ‘Plant-Based Meat For A Growing World’ (*The Good Food Institute*) <https://gfi.org/wp-content/uploads/2021/02/GFI-Plant-Based-Meat-Fact-Sheet_Environmental-Comparison.pdf> accessed 05 March 2023

⁷ Justin Mccarthy and Scott Dekoster, ‘Nearly One in Four in U.S. Have Cut Back on Eating Meat’ (*Gallup News*, 27 January 2020) <<https://news.gallup.com/poll/282779/nearly-one-four-cut-back-eating-meat.aspx>> accessed 03 March 2023

analogs extracted from plant protein, and molecular reactions. The functional properties of any substitute are dependent on the kind of protein like amino acid sequencing, and chemical structure. The quality of PBM should have the same consistency, taste, texture, color, etc., to be preferred over meat. This can be attained by the perfect selection of ingredients, and the process of making it. PBM substitutes have approximately 50 - 80% water content, non-textured based protein 4–20%, vegetable textured based proteins 10 - 25%, flavor enhancement additives 3–10%, fats 0–15%, binding agents 0–15% and coloring agents 0–5%.⁸

Protein from soy, protein from oil seeds, protein from legumes, and Wheat Gluten are some of the based proteins. The right and high amount of water not only reduces cost but also provides the required juiciness. Ingredients that are high in proteins have the water-binding capacity and formation of protein network formation as the main function, whereas starches and flour with low protein levels, work as fillers. Impossible Burger's magic ingredient is Heme, a molecule that helps in carrying oxygen in blood throughout the body and gives meat its distinctive flavor. Legume Hemoglobin (harvested from the roots of soy plants) releases Heme and when heated it gives PBM the distinct red color of meat. These methods are sustainable in nature. Another way of giving PBM substitute a meaty aroma and savory Flavour is Maillard Reaction.⁹ This Reaction is very complex to understand. Scientists are still exploring it. It is based on many small, simultaneous chemical reactions that occur when proteins and sugars in and on your food are transformed by heat, producing new flavors, aromas, and colors.

High moisture extrusion¹⁰ is the most used technique that provides a meat-like taste in any bite, and another most used and common technique is shear-cell processing which is more energy-efficient and has a smaller carbon footprint. There are various strategies¹¹ to replicate the texture

⁸ Mudasir Ahmed (n 1)

⁹ Eric Schulze, "An Introduction to the Maillard Reaction: The Science of Browning, Aroma and Flavor" (*serious eats*, 25 September 2019) <<https://www.seriousseats.com/what-is-maillard-reaction-cooking-science>> accessed 05 March 2023

¹⁰ Tara McHugh, 'How Plant-Based Meat and Seafood Are Processed' (*IFT*, October 2019) <<https://www.ift.org/news-and-publications/food-technology-magazine/issues/2019/october/columns/processing-how-plant-based-meat-and-seafood-are-processed>> accessed 05 March 2023

¹¹ Birgit L. Dekkers et al., 'Structuring Processes for meat analogs' (2018) 81 Trends in Food Science & Technology <<https://doi.org/10.1016/j.tifs.2018.08.011>> accessed on 05 March 2023

of meat, which depends upon the type of meat product that is to be replicated. It is done by the development of structured products through meat analogs and in processed meat products, it can be replaced by using PBM extenders. Structuring techniques to produce fibrous products that mimic whole meats can be either a bottom-up or a top-down strategy. In the bottom-up strategy, individual structural elements are created that are subsequently gathered into larger products. The top-down strategy mimics the structure on larger length scales only.

IP PROTECTION TO ENHANCE THE RESEARCH & DEVELOPMENT

According to a new report by Bloomberg¹² Intelligence the plant-based foods market reach up to 7.7% of the global protein market by 2030, with a value of over \$162 billion, up from \$29.4 billion in 2020. The evolution of fake meat from a limited source of veganism to the next generation of PBM through technological advancement is a pathway for global acceptance of PBM over meat. It requires extensive & continuous Research & Development and innovation. Increasing demand for healthy food, balanced diet, sustainability, and protein intake is revolutionizing Food Technology.

PBM-producing companies are investing huge amounts in Research & Development to improve its efficacy and to give the exact sensorial attributes to the consumers when they have PBM substitutes over meat. PBM companies invested \$1.9 billion in 2021, making it an investment of \$6.4 billion in this industry since 1980.¹³ Some of the top rankers in the Plant-based product market are Beyond Meat, Impossible Foods, Danone, Gardein, Hain Celestial, Amy's Kitchen Inc., and Nestle with their strong investment, innovation strategies, and IP Protection.

IP Protection in the PBM industry can be attained by patenting its inventions that add novelty to the prior art, especially utility patents as it protects the product as well as the process of making it, registering its brand names and trademarks that represent its products, registering

¹² 'Plant-Based Foods Poised for Explosive Growth' (*Bloomberg Intelligence Report*, 11 August 2021) <<https://www.bloomberg.com/company/press/plant-based-foods-market-to-hit-162-billion-in-next-decade-projects-bloomberg-intelligence/>> accessed 04 March 2023

¹³ '2021 State of the Industry Report on Plant-Based meat, seafood, eggs and dairy' (*Good Food Institute*) <<https://gfi.org/wp-content/uploads/2022/04/2021-Plant-Based-State-of-the-Industry-Report-1.pdf>> accessed 05 March 2023

the designs of equipment used in the patent application and shapes of the machines, etc. Beyond Meat uses beet juice to replicate the bleeding effect of a real burger., coconut oil and cocoa butter to give it the real texture of meat. When Beyond Meat went public with an IPO of \$25 per share, it gave new heights to the PBM industry. Impossible Foods use genetically engineered strains of yeast to produce soy leghemoglobin, the main ingredient that makes it “bleeding” and gives it a unique meaty flavor.

R&D plays a crucial role in the advancement of the production of PBM. Gardein patented the twin-screw extrusion technology in the early 2000s. Startups Redefine Meat and NovaMeat are working on 3D Food Printing¹⁴ Technology to create structured PBM products with complex shapes and textures and it can recreate the defined areas of fat and muscle in bacon. In India, innovation and skills are encouraged through Startup India Program. Startups with Intellectual Property Rights like Patents and Trademark are provided with an 80% rebate in filing Patents vis-a-vis other companies, which brings down the cost from Rs. 8,000 to Rs. 1,600 and assists them in putting the low cost at the early stage. Similarly, a 50% rebate is provided in the filing of Trademarks, decreasing the cost from Rs 10,000 to Rs 5,000.

In a legal battle between Impossible Foods¹⁵ and Motif Foodworks, Impossible Foods won a patent infringement case against Motif Foodworks. Impossible Foods uses “hemoproteins” to replicate the sensory attributes of meat in the PBM substitutes. It alleged that Motif products that use HEMAMI (a heme-containing protein called “bovine myoglobin”) infringe its asserted patents in this case.

¹⁴ Yaxin Wen et al., ‘Development of plant-based meat analogs using 3D printing: Status and opportunities’ (2023) 132 Trends in Food Science & Technology <<https://doi.org/10.1016/j.tifs.2022.12.010>> accessed 05 March 2023

¹⁵ *Impossible foods Inc v Motif Foodworks* [2022] Civil Action No 22-311-WCB

PATENT LANDSCAPE OF THE PLANT-BASED MEAT

Patents are the IP Rights that are granted for an invention if it is novel, capable of industrial application, and inventive. Invention and innovation are essential for the success of the PBM industry. The young generation who are concerned about the effects of the rapid use of meat on the climate, sustainable development, healthy lifestyle, and animal welfare, gives a driving force to companies and researchers to innovate new technology for PBM substitutes that exactly replicate the traditional meat. Patentable factors in PBM substitutes may be the molecular combination to enhance the taste of the product, ingredients that play a crucial role in PBM substitutes, method or process to make the ingredients, a novelty in the prior art to improve the product quality, and attributes, methods to improve shelf life to the products, packaging refinement.

If we go back in time, Patents were granted for many inventions in new development relevant to PBM substitutes or fake meat, or synthetic meat. But, PBM has gained popularity in the past few years. “Protose”¹⁶ a meat substitute after Nuttose, was invented by John Harvey Kellogg using both peanuts and cereal and it was patented, and trademarked in 1899. It was granted Patent No.US670283A for ‘Vegetable Food Compound’ and the description for the first time used the term ‘vegetable substitutes for meat’.

Li Yu-Ying,¹⁷ a Chinese who is known for his beliefs in potential soyfoods, has a great contribution to introducing soyfoods as a meat substitute in the West. In 1908, he established a laboratory for soymilk studies in Paris. In 1913, he was granted US Patent No. 1064841A for ‘Method of manufacturing products from Soya’. He also has patents granted in the UK from 1910-1912 for products made with soybean and the process of making it.

In 1947 – Robert Boyer,¹⁸ a researcher developed a textured edible soy protein with a similar process that is used for making textile fibers, and in 1954, he was granted the patent (US Patent

¹⁶ William Shurtleff & Akiko Aoyagi, ‘History of Meat Alternatives’ (2014) 6 Soyinfocenter <<https://www.soyinfocenter.com/pdf/179/MAL.pdf>> accessed 04 March 2023

¹⁷ William Shurtleff & Akiko Aoyagi, “Yu-Ying- Part 1 - The History of Soy Pioneers Around the World’ (Soyinfocenter, 2004) <https://www.soyinfocenter.com/HSS/li_yu_ying1.php> accessed 04 March 2023

¹⁸ William Shurtleff (n 15) 8

No. 2,682,466A for the process of preparing textured meatless foods from spun vegetable protein. This paved the way for the spinning of soy protein fibers used to create an entirely new form of meat alternatives that can be frozen also. The term “Synthetic Meat” was used first in this patent. Focusing on the current trends, Impossible Foods has 263 patents globally, out of which 103 have been granted and 239 patents are active.

As per a report by Wissen Research,¹⁹ Most of the pending Patents are in the PBM market i.e., 59.07% followed by Granted patents which are 21.68%. The maximum number of filings is in the Year 2021 with 128 filings in the year followed by 2020 with 97 filings of Patents in Plant-based meat. Some of the major Patent families of PBM are Nestle, EPC Natural Products, Impossible Foods, Cargill, and Sweet Green Field International.

DAIZ Inc a Japanese startup²⁰ established in 2017, is using the Ochiai Germination Method with soybeans that use a natural germination process to increase the amino acid composition of soybeans. It becomes possible through this method to change the taste and nutritional value of soybeans so that it closely replicates pork, chicken, fish, and beef, without the damaging environmental consequences of meat production. Based on this, DAIZ has got its plant-based meat ‘MIRACLE MEAT’ registered as a trademark. The Vegan Society’s Vegan Trademark is the only vegan certification with global recognition. The Vegan Trademark is used worldwide for labels that authenticate the standards of products free from animal ingredients and animal testing.

TRADEMARK PROTECTION IN THE VEGAN PRODUCTS MARKET

Trademarks are best known as a source of representation of any goods or services. Enhanced Brand Management Strategies and timely registration of Trademark yields the best results in the success of any Company. Companies that are entering the PBM market or already have attained a reputation in the PBM market, take reasonable steps to maintain their goodwill by providing

¹⁹ ‘Plant Based Meat’ (Wissen Research, 27 July 2022) <<https://www.wissenresearch.com/blogs/plant-based-meat/>> accessed 04 March 2023

²⁰ ‘DAIZ: combining traditional food and cutting-edge technology for plant-based meats and drug discovery’ (WIPO Case Studies) <<https://www.wipo.int/ipadvantage/en/details.jsp?id=12500>> accessed 05 March 2023

as per changing preferences and demands of the customers. A mark that is non-suggestive and non-descriptive is considered qualified for registration as a Trademark. The PBM industry revolves around the idea of “meatless meat”, Brands should always take cautious steps while choosing their Tradename as distinctiveness is the essence.

Impossible Foods, Beyond Meat, Moving Mountains, Simply Balanced, Lightlife, Sweet Earth, Tofurky, Gardein, Field Roast, Raised & Rooted, and The Very Good Butchers are the smartly drafted names for distinguishing their products in a highly competitive market. Beyond Meat filed 108 Trademarks with the United States Patent and Trademark Office (USPTO). The customers can connect the nature and quality of the product through visualization of the Trademarks after continuous use over some time.

Recently, Mcdonald’s²¹ opposed and prevented Children Cancer Aid Limited to register its mark ‘Mcvegan’ in the UK Trademark Registry under sections 3(6), 5(2)(b), 5(3), 5(4)(a) of the Trade Marks Act 1994. Mcdonald claimed that the applicant was using the prefix ‘Mc’ for its products and there was a likelihood of confusion that may arise in the mind of customers when buying Mcvegan from the applicant. Such circumstances and consequences can be avoided by conducting detailed prior Trademark Searches and using a unique and fanciful name.

In 2020, The District Court in the Hague ruled the Trademark Infringement case in favor of Impossible Foods against Nestle for using ‘Incredible Burger’. Nestle was prohibited from marketing ‘Incredible Burger’ in its name throughout Europe and a penalty of 25,000 euros per day was also imposed. Impossible Foods contended that Nestlé has a malafide intention to confuse consumers into buying their product by imitating Impossible Foods’ name, visual identity, and other branding indications and the customers have a right to transparency when it comes to plant-based meat substitutes. Uniquely designed Trademarks, timely registration, and awareness against the infringers can take the PBM companies towards success.

²¹ *By Childrens Cancer Aid Limited v Mcdonald’s International Property Company Ltd App No 3381199*

CONCLUSION

Plant-based meat substitutes are the future, because of the way it is revolutionizing the world with new techniques and products that replicates the exact sensorial attributes of the meat. The Patent Landscape of Plant-based meat is growing with the entry of new ventures in the PBM market. Customer satisfaction is the target goal in the race between meat and PBM. Improvement and Efficacy in taste and nutritional value require novel and inventive steps. Patent protection provides a road map to the desired results.

Challenges and Opportunities go together. Prohibition of fake products in the name of PBM is a big challenge when convincing customers about the benefits of PBM over meat. Regulations, Policies should be made by organizations promoting PBM products. The researchers and new ventures should be encouraged by providing rebates and awards to help reduce the Research & Development cost.