White Biotechnology Market - Global Industry Size, Share, Trends, Opportunity, and Forecast, Segmented By Product (Biofuels, Biochemicals, Biopolymers), By Application (Bioenergy, Food & feed Additives, Pharmaceutical Ingredients, Personal Care & Household Products, Others), By Region and Competition, 2019-2029F

Market Report | 2024-07-21 | 185 pages | TechSci Research

AVAILABLE LICENSES:

- Single User License $4900.00
- Multi-User License $5900.00
- Custom Research License $8900.00

Report description:

Global White Biotechnology Market was valued at USD 200.48 Billion in 2023 and is anticipated to project steady growth in the forecast period with a CAGR of 8.77% through 2029. White biotechnology, also known as industrial biotechnology or biotech, is revolutionizing diverse industries by leveraging biological processes to develop sustainable products, processes, and energy sources. Unlike traditional biotechnology focused on healthcare and pharmaceuticals, white biotechnology targets industrial applications, offering environmentally friendly alternatives to conventional chemical processes. This burgeoning market is poised for significant growth, driven by increasing environmental awareness, regulatory support, and technological advancements.

The scope of white biotechnology spans across various sectors including agriculture, food and beverages, biofuels, chemicals, textiles, and waste management. In agriculture, biopesticides and biostimulants derived from natural sources enhance crop yields while reducing environmental impact. In food production, enzymes and microbial cultures improve processing efficiency and product quality. Biofuels derived from renewable biomass sources offer sustainable alternatives to fossil fuels, contributing to energy security and carbon reduction goals.

A key driver of the white biotechnology market is its emphasis on sustainability. The use of renewable feedstocks, such as agricultural residues and algae, minimizes reliance on finite resources and reduces greenhouse gas emissions. Biotechnological processes typically operate under mild conditions, consuming less energy and generating fewer toxic byproducts compared to traditional chemical methods. This eco-friendly approach resonates with consumers, businesses, and governments seeking to achieve sustainability targets and mitigate environmental impact.

Advancements in genetic engineering, fermentation technologies, and metabolic pathway optimization are accelerating the development and commercialization of biotechnological solutions. High-throughput screening techniques and computational

modeling enable the rapid design and optimization of enzymes and microorganisms for specific industrial applications. Integrated biorefineries, equipped with state-of-the-art bioprocessing equipment, facilitate the conversion of biomass into value-added products like biofuels, biochemicals, and biopolymers.

The global white biotechnology market is experiencing robust growth, fueled by increasing investments from governments, venture capitalists, and major corporations. Governments worldwide are incentivizing research and development in biotechnology through grants, tax incentives, and regulatory support. Venture capital firms and private equity investors are funding startups and innovative biotech companies focused on developing scalable bioproduction platforms and sustainable technologies.

Despite its promise, the white biotechnology sector faces challenges such as scalability, cost competitiveness, and regulatory complexities. Scaling up biotechnological processes from laboratory to industrial scale requires significant investment in infrastructure and process optimization. Achieving cost parity with traditional chemical processes remains a hurdle, although ongoing technological advancements and economies of scale are driving down production costs.

Opportunities abound for innovation and market expansion in white biotechnology. Collaboration between industry stakeholders, academia, and research institutions is critical for overcoming technical barriers, advancing bioprocess engineering, and commercializing novel bioproducts. As global demand for sustainable solutions intensifies, the white biotechnology market is poised to play a pivotal role in shaping a greener and more sustainable future for industries worldwide.

Key Market Drivers

Growth in Food Industry

White biotechnology is revolutionizing food processing through the use of enzymes, microbial cultures, and bio-based ingredients. Enzymes derived from natural sources improve the efficiency of food manufacturing processes by accelerating reactions such as starch hydrolysis, protein modification, and lipid breakdown. These biocatalysts enable manufacturers to reduce processing times, optimize resource utilization, and achieve higher yields without compromising product quality.

Biotechnological innovations contribute to product quality enhancement in the food industry. For instance, microbial cultures are employed in dairy fermentation to produce yogurt, cheese, and probiotic beverages with desired flavors, textures, and nutritional profiles. Bio-based ingredients like natural colors, flavors, and preservatives derived from biotechnological processes cater to consumer preferences for clean-label products while ensuring safety and sustainability.

The emphasis on sustainability is a significant driver of white biotechnology adoption in the food sector. Biotechnological processes utilize renewable feedstocks, such as agricultural residues and microbial biomass, to produce bio-based ingredients and additives. These sustainable alternatives reduce dependence on finite resources, minimize waste generation, and lower carbon footprints compared to traditional chemical-based ingredients and processes.

White biotechnology plays a pivotal role in biofortification efforts aimed at enhancing the nutritional value of food products. Through genetic engineering and metabolic engineering, researchers develop crops enriched with essential vitamins, minerals, and antioxidants to address global malnutrition challenges. Functional foods fortified with bioactive compounds, probiotics, and prebiotics offer health benefits beyond basic nutrition, catering to the growing demand for wellness-oriented products.

The growth of the global food industry fuels the expansion of the white biotechnology market. As food manufacturers seek sustainable solutions to meet consumer demand for healthier, safer, and environmentally responsible products, investments in biotechnological research and development escalate. Governments and regulatory bodies support these initiatives through funding programs, incentives for innovation, and policies promoting sustainable agricultural practices.

In 2024, CFTRI has successfully commercialized technologies for shelf-stable muffins and bread using natural ingredients that act as antimicrobial and antioxidant preservatives. These advancements have been transferred to two prominent companies in the global market. Muffins, also known as cupcakes, typically have high water content and a short shelf life, but with this technology, they can now be stored for 8-10 days without the need for traditional preservatives. Similarly, bread, which typically lasts 2-3 days, benefits from natural preservatives such as antimicrobials, antioxidants, chelating agents, calcium propionate, or sorbic acid. These ingredients help maintain the products' color, taste, and nutrient content over an extended period.

The shift towards natural preservatives is gaining traction due to their non-toxic nature and minimal adverse effects. This trend reflects a growing preference for healthier food preservation methods. CFTRI's shelf-stable muffins and bread, utilizing natural preservatives, effectively prevent spoilage and ensure that the bread maintains a desirable volume, soft texture, and remains free from mold. Consequently, muffins remain microbiologically safe for up to three weeks, while the bread remains mold-free for five

days.

Growth in Pharmaceutical Industry

The pharmaceutical sector's increasing focus on sustainability, efficiency, and cost-effectiveness is driving the adoption of biotechnological processes and biobased products across the value chain. Biotechnology offers pharmaceutical companies opportunities to improve production methods, reduce environmental impact, and enhance the quality and safety of medicines. Biotechnological innovations have revolutionized bioprocessing techniques used in drug development and manufacturing. Enzymes and microorganisms are employed to produce complex pharmaceutical compounds through sustainable and efficient processes. This approach not only reduces dependency on traditional chemical synthesis but also enhances yield, purity, and consistency of pharmaceutical products.

The use of biobased ingredients and APIs derived from renewable sources is gaining traction in pharmaceutical formulations. Biobased raw materials, such as plant-derived sugars and biomass, are used to produce essential pharmaceutical components, including antibiotics, vaccines, and biologics. This shift towards biobased ingredients supports the industry's goal of reducing reliance on fossil fuels and minimizing carbon footprint.

Increasing regulatory pressures and consumer demand for sustainable products are compelling pharmaceutical companies to adopt biobased technologies. Governments worldwide are implementing stringent environmental regulations and sustainability targets, prompting pharmaceutical manufacturers to explore greener alternatives in their production processes. Biotechnological solutions offer inherent advantages, such as lower energy consumption, reduced waste generation, and improved safety profiles, aligning with regulatory requirements and sustainability goals.

Biotechnological advancements in fermentation, enzymatic catalysis, and bioprocessing enable cost-effective production of pharmaceuticals at scale. Enhanced efficiency in upstream and downstream processes translates to lower production costs and improved profit margins for pharmaceutical companies. Moreover, the scalability of biotechnological platforms facilitates the rapid development and commercialization of new drugs, accelerating time-to-market and enhancing competitiveness in the pharmaceutical industry.

Collaborations between biotechnology firms, pharmaceutical manufacturers, and academic institutions drive innovation in white biotechnology. Joint research efforts focus on developing novel biocatalysts, optimizing production techniques, and exploring new applications for biobased products in drug delivery and formulation. These partnerships foster knowledge exchange, mitigate technological risks, and facilitate market expansion of biobased pharmaceuticals globally.

The convergence of biotechnology and pharmaceuticals is poised to shape the future of drug discovery, production, and personalized medicine. Emerging technologies, such as synthetic biology and genome editing, hold promise for advancing biobased solutions and expanding the repertoire of biopharmaceutical products. Continued investment in R&D, infrastructure development, and regulatory support will be crucial in realizing the full potential of white biotechnology to address healthcare challenges and sustainably meet global pharmaceutical demands.

Key Market Challenges

Biobased Product Performance and Consistency

Biobased products, derived from renewable biomass such as plants, algae, and microbes, offer significant advantages over their petroleum-derived counterparts. They are often biodegradable, produce fewer greenhouse gas emissions during production, and can be tailored to meet specific market needs. However, ensuring consistent performance and quality remains a critical challenge in the global white biotechnology market.

The biological diversity of feedstocks used in biobased product manufacturing introduces variability in composition and quality. Factors such as climate, soil conditions, and genetic variations can impact biomass characteristics, affecting product performance. Biotechnological processes involved in converting biomass into valuable products can be intricate and sensitive to environmental conditions. Variations in fermentation, enzymatic reactions, and downstream processing can influence product consistency. End-user expectations for biobased products often mirror those of conventional alternatives in terms of performance, cost-effectiveness, and reliability. Meeting these demands requires rigorous quality control and optimization of production processes.

Employing sophisticated analytical techniques such as spectroscopy, chromatography, and molecular biology enables real-time monitoring of process parameters and product attributes. This proactive approach helps mitigate variability and ensures

batch-to-batch consistency. Continuous advancements in genetic engineering and metabolic pathway optimization allow for the development of robust microorganisms and enzymes tailored for efficient biomass conversion. Fine-tuning these biological systems enhances product yield and quality. Implementing stringent quality control protocols and adhering to international standards (such as ASTM, ISO) ensures that biobased products meet regulatory requirements and customer expectations across diverse applications.

The global white biotechnology market continues to expand, driven by increasing environmental awareness, regulatory support for sustainable practices, and shifting consumer preferences towards eco-friendly products. Innovations in bioprocessing technologies, coupled with strategic partnerships across academia, industry, and government sectors, are poised to overcome current challenges and unlock new opportunities.

Key Market Trends

Bioremediation and Waste Management

Bioremediation involves the use of microorganisms or plants to degrade pollutants and contaminants in soil, water, and air. This natural approach harnesses the metabolic capabilities of living organisms to detoxify hazardous substances, transforming them into less harmful compounds or removing them altogether from the environment. Unlike traditional remediation methods, which often involve costly and invasive procedures, bioremediation offers a cost-effective and environmentally friendly alternative.

The application of bioremediation spans diverse contamination scenarios, including petroleum spills, industrial waste sites, and agricultural runoff. Microorganisms such as bacteria, fungi, and algae play crucial roles in breaking down pollutants like hydrocarbons, heavy metals, pesticides, and solvents. Advances in biotechnology have enabled the genetic modification of these microorganisms to enhance their effectiveness and broaden their applicability in challenging environmental conditions.

In parallel, white biotechnology is revolutionizing waste management practices by converting organic waste into valuable products through biological processes. Organic waste, such as agricultural residues, food waste, and wastewater sludge, can serve as feedstocks for producing biofuels, bioplastics, biochemicals, and biogas. These biobased products offer renewable alternatives to fossil fuel-derived equivalents, reducing greenhouse gas emissions and contributing to circular economy principles.

Biotechnological innovations in waste management include anaerobic digestion, fermentation, and enzymatic treatments that break down complex organic matter into simpler compounds. This transformation not only mitigates waste disposal challenges but also generates secondary economic benefits by producing bioenergy and bioproducts with commercial value.

Several factors are driving the adoption of bioremediation and waste management solutions within the global white biotechnology market. Regulatory pressures aimed at reducing environmental pollution and promoting sustainable practices compel industries to seek cleaner and more efficient remediation and waste treatment technologies. Governments worldwide are implementing policies that incentivize the use of biobased solutions, thereby stimulating market growth and innovation.

Furthermore, increasing public awareness and corporate sustainability initiatives are fostering demand for environmentally responsible practices across industries. Consumers and businesses alike are prioritizing products and technologies that minimize environmental impact and contribute to resource conservation.

Errors in waste sorting can result in improper disposal, disrupting recycling and reuse efforts. Recent advancements in waste management technologies in 2024 have enabled the precise sorting and categorization of waste using sensors, cameras, and algorithms. Leading this charge in environmental conservation and waste minimization is HERA, a prominent multi-utility firm headquartered in Italy. HERA is dedicated to enhancing urban cleanliness through intelligent waste management systems, leveraging advanced technologies to accurately identify and sort incoming waste for potential reuse and recovery.

In pursuit of this goal, HERA has implemented a strategy to capture video footage of incoming waste and automate the waste identification process using artificial intelligence (AI). To expedite and streamline the development of this innovative solution, HERA has forged a strategic partnership with IBM. Together, they are collaborating to develop an AI-powered system that efficiently categorizes and manages waste, thereby promoting sustainable waste management practices and minimizing environmental impact.

Segmental Insights

Product Insights

Based on Product, Biofuels have emerged as the fastest growing segment in the Global White Biotechnology Market in 2023. One of the primary drivers behind the growth of biofuels is their environmental sustainability. Unlike fossil fuels, which contribute to air

pollution and climate change, biofuels are derived from renewable biomass sources such as agricultural residues, algae, and dedicated energy crops. The production and combustion of biofuels typically result in lower net greenhouse gas emissions, making them a key component of strategies to mitigate climate change and achieve carbon neutrality goals.

Biofuels contribute to energy security by reducing dependence on imported fossil fuels and volatile global oil markets. Countries invest in domestic biofuel production to enhance energy independence, stabilize fuel prices, and mitigate geopolitical risks associated with oil supply disruptions. By diversifying energy sources, biofuels strengthen national energy portfolios and promote resilience in the face of fluctuating oil prices and geopolitical tensions.

Advancements in biotechnological processes have significantly enhanced the efficiency and scalability of biofuel production. Bioconversion technologies such as enzymatic hydrolysis and microbial fermentation transform biomass into biofuels like bioethanol, biodiesel, and biojet fuel. Genetic engineering and metabolic engineering enable researchers to optimize microbial strains and enzymatic pathways for higher yields, improved tolerance to environmental conditions, and enhanced production efficiency.

Application Insights

Based on Application, Pharmaceutical Ingredients have emerged as the dominating segment in the Global White Biotechnology Market during the forecast period. Biobased pharmaceutical ingredients offer distinct advantages over traditional chemical-based counterparts, contributing to their widespread adoption and market dominance. One key advantage is sustainability. Biobased ingredients are derived from renewable biomass sources such as plants, algae, and microbial organisms, reducing reliance on finite fossil resources and minimizing environmental impact. This aligns with global sustainability goals and regulatory initiatives aimed at reducing carbon footprint and promoting eco-friendly manufacturing practices in the pharmaceutical industry.

Technological innovations in bioprocessing have revolutionized the production of pharmaceutical ingredients. Enzymes, microorganisms, and biocatalysts are utilized in biorefineries to convert biomass into high-value pharmaceutical compounds through sustainable and efficient processes. Biotechnological platforms offer precise control over chemical reactions, enhancing yield, purity, and consistency of biobased ingredients compared to traditional synthesis methods. This scalability and reliability support large-scale production of APIs (Active Pharmaceutical Ingredients) and biopharmaceuticals, meeting global demand for innovative medicines.

Stringent regulatory standards and consumer demand for safe, sustainable products are driving pharmaceutical manufacturers to adopt biobased ingredients. Regulatory agencies worldwide are increasingly promoting the use of biobased solutions through incentives, subsidies, and favorable approval processes. Biobased pharmaceutical ingredients often exhibit favorable safety profiles, biodegradability, and lower toxicity compared to their chemical counterparts, facilitating regulatory compliance and market acceptance.

Regional Insights

Based on Region, North America have emerged as the dominating region in the Global White Biotechnology Market in 2023. North America boasts world-renowned universities and research institutions that foster innovation in biotechnology. These institutions serve as hubs for groundbreaking research and development (R&D) initiatives, driving the discovery and commercialization of novel biobased products and processes. The region attracts substantial investment in biotechnology startups, providing critical funding for early-stage ventures to develop and scale innovative technologies. Venture capital firms, coupled with government grants and incentives, support entrepreneurial endeavors in white biotechnology.

North America benefits from a well-defined regulatory framework that promotes the development and commercialization of biobased products. Agencies such as the U.S. Environmental Protection Agency (EPA) and Health Canada provide clear guidelines and support initiatives aimed at advancing sustainable practices and reducing environmental impact. Governments in North America implement policies and incentives that incentivize the adoption of biobased technologies. These include tax credits for research activities, grants for renewable energy projects, and procurement preferences for sustainable products, fostering a conducive environment for market growth.

Key Market Players

- Novozymes A/S
- Kaneka Corporation
- AngelYeast Co., Ltd.

Koninklijke DSM N.V.
Akzo Nobel N.V.
BASF SE
Henkel AG & Co. KGaA
Mitsubishi Corporation
DuPont de Nemours, Inc.
Amyris, Inc.

Report Scope:

In this report, the Global White Biotechnology Market has been segmented into the following categories, in addition to the industry trends which have also been detailed below:

White Biotechnology Market, By Product:

o Biofuels
o Biochemicals
o Biopolymers

White Biotechnology Market, By Application:

o Bioenergy
o Food & feed Additives
o Pharmaceutical Ingredients
o Personal Care & Household Products
o Others

White Biotechnology Market, By Region:

o North America
 United States
 Canada
 Mexico
o Europe
 France
 United Kingdom
 Italy
 Germany
 Spain
o Asia Pacific
 China
 India
 Japan
 Australia
 South Korea
o South America
 Brazil
 Argentina
 Colombia
o Middle East & Africa
 South Africa
 Saudi Arabia
 UAE

Competitive Landscape

Company Profiles: Detailed analysis of the major companies present in the Global White Biotechnology Market.

Available Customizations:
Global White Biotechnology Market report with the given market data, Tech Sci Research offers customizations according to a company's specific needs. The following customization options are available for the report:
Company Information
Detailed analysis and profiling of additional market players (up to five).

Table of Contents:

White Biotechnology Market - Global Industry Size, Share, Trends, Opportunity, and Forecast, Segmented By Product (Biofuels, Biochemicals, Biopolymers), By Application (Bioenergy, Food & feed Additives, Pharmaceutical Ingredients, Personal Care & Household Products, Others), By Region and Competition, 2019-2029F

Market Report | 2024-07-21 | 185 pages | TechSci Research

To place an Order with Scotts International:

- Print this form
- Complete the relevant blank fields and sign
- Send as a scanned email to support@scotts-international.com

ORDER FORM:

Select license	License	Price
	Single User License	$4900.00
	Multi-User License	$5900.00
	Custom Research License	$8900.00
	VAT	
	Total	

*Please circle the relevant license option. For any questions please contact support@scotts-international.com or 0048 603 394 346.

** VAT will be added at 23% for Polish based companies, individuals and EU based companies who are unable to provide a valid EU Vat Numbers.

Email*		Phone*	
First Name*		Last Name*	
Job title*			
Company Name*		EU Vat / Tax ID / NIP number*	
Address*		City*	
Zip Code*		Country*	

Date	2025-05-04
Signature	