

Enzymatic Recycling Market Forecasts to 2032 – Global Analysis By Source (Microbial Enzymes, Natural Enzymes and Genetically Engineered Enzymes), Material Type (Polyethylene Terephthalate (PET), Polylactic Acid (PLA), Polyhydroxyalkanoates (PHA) and Other Material Types), Recycling Process Stage, Technology, End User and By Geography

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Abstracts

According to Statistics MRC, the Global Enzymatic Recycling Market is accounted for \$63.6 million in 2025 and is expected to reach \$213.7 million by 2032 growing at a CAGR of 18.9% during the forecast period. Enzymatic recycling is a biotechnological process that uses specialized enzymes to break down complex polymers—such as PET plastics—into their original monomers, enabling high-quality material recovery. Unlike mechanical or chemical recycling, this method operates under milder conditions, reducing energy use and greenhouse gas emissions. It allows for the recycling of mixed, contaminated, or colored plastics without degrading quality. By converting waste into reusable feedstocks, enzymatic recycling supports circular economy goals and minimizes environmental impact. Its precision and scalability make it a promising solution for tackling plastic pollution and enhancing sustainability across packaging, textiles, and industrial waste streams.

Market Dynamics:

Driver:

Rising Plastic Waste Concerns

Rising plastic waste concerns are catalyzing growth in the enzymatic recycling market by intensifying demand for high-efficiency solutions. Governments, industries, and consumers are increasingly prioritizing eco-friendly alternatives to conventional recycling, driving investment in enzyme-based technologies. This shift is accelerating innovation, regulatory support, and commercialization of enzymatic processes that offer closed-loop recycling and reduced carbon footprints. As awareness deepens, enzymatic recycling is emerging as a scalable, high-value response to global plastic pollution, transforming waste into circular economic opportunity.

Restraint:

High Initial Costs

High initial costs pose a significant barrier to the growth of the enzymatic recycling market. The requirement for advanced technology, specialized enzymes, and infrastructure investments discourages new entrants and slows adoption among existing players. Small and medium enterprises often struggle to secure the necessary capital, limiting expansion opportunities. As a result, market penetration remains constrained, innovation pace slows, and overall competitiveness is hindered, restraining the market's potential growth and scalability.

Opportunity:

Technological Advancements

Technological advancements are revolutionizing the enzymatic recycling market by enhancing enzyme efficiency, scalability, and substrate specificity. Breakthroughs in protein engineering and AI-driven enzyme design enable faster, low-energy breakdown of complex polymers like PET and nylon. These innovations reduce processing costs, boost yield, and support closed-loop recycling systems. Adoption in the packaging and textile industries is accelerated by integration with smart sorting and bioreactor automation, which supports the objectives of the circular economy and regulatory requirements for environmentally friendly waste management. The result is a more viable and impactful recycling environment.

Threat:

Slower Processing Times

Slower processing times in the enzymatic recycling market significantly hinder growth by reducing operational efficiency and throughput. Extended reaction durations increase production costs and delay product availability, discouraging adoption among manufacturers seeking rapid, cost-effective solutions. These delays can strain supply chains, limit scalability, and diminish competitiveness against traditional recycling methods. Consequently, slower processing times act as a persistent barrier, slowing market expansion and investor confidence in enzymatic recycling technologies.

Covid-19 Impact

The Covid-19 pandemic disrupted the Enzymatic Recycling market by slowing industrial operations and delaying new technology adoption. Supply chain interruptions limited access to raw materials and enzymes, while reduced manufacturing output lowered demand for recycled products. However, heightened awareness of sustainable practices and circular economy principles gradually renewed interest. As industries recover, the market is poised for growth, driven by increasing investments in environmentally friendly recycling solutions post-pandemic.

The polylactic acid (PLA) segment is expected to be the largest during the forecast period

The polylactic acid (PLA) segment is expected to account for the largest market share during the forecast period, due to demand for low-energy, selective depolymerization technologies. PLA's bio-based origin and compostability make it ideal for enzymatic hydrolysis, enabling efficient recovery of lactic acid under mild conditions. This segment's expansion is accelerating innovation in enzyme engineering and circular bioplastic solutions, reducing reliance on fossil-based polymers. As PLA usage surges across packaging and consumer goods, enzymatic recycling emerges as a scalable, sustainable end-of-life pathway.

The electronics segment is expected to have the highest CAGR during the forecast period

Over the forecast period, the electronics segment is predicted to witness the highest growth rate because of generating vast volumes of e-waste rich in recoverable polymers and metals. Enzymatic processes offer a low-energy, selective method to break down complex materials like multilayer plastics and circuit board resins. As demand for sustainable e-waste solutions rises, electronics manufacturers are investing in bio-based recycling innovations to meet regulatory and ESG goals. This synergy is

accelerating circular economy adoption and unlocking new revenue streams for enzymatic recycling technologies.

Region with largest share:

During the forecast period, the Asia Pacific region is expected to hold the largest market share because it enabling low-energy, high-efficiency plastic recovery. With rising environmental regulations and surging demand for circular solutions, enzymatic processes offer a breakthrough in PET and mixed plastic recycling. Regional innovation hubs in China, Japan, and India are accelerating enzyme engineering, attracting global partnerships and investments. This market not only reduces landfill dependency but also empowers scalable, eco-friendly manufacturing—positioning Asia Pacific as a leader in next-gen waste valorization.

Region with highest CAGR:

Over the forecast period, the North America region is anticipated to exhibit the highest CAGR, owing to stringent regulations on plastic waste and landfill reduction. Innovations in enzyme technology enable efficient recycling of hard-to-process plastics, fostering a circular economy. Rising corporate sustainability initiatives and government incentives further accelerate adoption. Additionally, growing demand for eco-friendly packaging and materials from industries such as packaging, automotive, and electronics reinforces market expansion, positioning enzymatic recycling as a key solution for sustainable waste management and resource recovery in the region.

Key players in the market

Some of the key players profiled in the Enzymatic Recycling Market include Carbios, Novozymes, DuPont (IFF), BASF SE, Evonik Industries AG, Genencor, Protein Evolution, Inc., Eastman Chemical Company, LanzaTech, Microcos, Arzeda, Codexis, Inc., DSM-Firmenich, NatureWorks LLC, Indorama Ventures, Danimer Scientific, Loop Industries, Unilever and Reliance Industries Limited.

Key Developments:

In July 2025, BASF and Equinor have forged a strategic partnership under which Equinor will annually supply up to 23 terawatt-hours (?2 billion m?) of low-carbon natural gas to BASF over ten years, enhancing Europe's energy security and sustainability efforts.

In September 2024, LanzaTech has entered into a master license agreement with Sekisui Chemical to implement a platform converting syngas from municipal and industrial solid waste into ethanol. Sekisui plans to establish multiple facilities across Japan, utilizing LanzaTech's equipment, engineering, and intellectual property. The initial commercial-scale facility aims to produce 10 to 12 kilotons of ethanol annually.

Sources Covered:

Microbial Enzymes

Natural Enzymes

Genetically Engineered Enzymes

Material Types Covered:

Polyethylene Terephthalate (PET)

Polylactic Acid (PLA)

Polyhydroxyalkanoates (PHA)

Polyamides

Other Material Types

Recycling Process Stages Covered:

Collection & Sorting

Pre-treatment

Enzymatic Breakdown

Monomer Recovery & Repolymerization

Technologies Covered:

Hydrolysis-based Recycling

Enzyme Engineering & Optimization

Depolymerization-based Recycling

Bio-catalytic Recycling

End Users Covered:

Packaging

Textiles & Apparel

Automotive

Electronics

Consumer Goods

Other End Users

Regions Covered:

North America

 US

 Canada

 Mexico

Europe

 Germany

UK

Italy

France

Spain

Rest of Europe

Asia Pacific

Japan

China

India

Australia

New Zealand

South Korea

Rest of Asia Pacific

South America

Argentina

Brazil

Chile

Rest of South America

Middle East & Africa

Saudi Arabia

UAE

Qatar

South Africa

Rest of Middle East & Africa

What our report offers:

- Market share assessments for the regional and country-level segments
- Strategic recommendations for the new entrants
- Covers Market data for the years 2024, 2025, 2026, 2028, and 2032
- Market Trends (Drivers, Constraints, Opportunities, Threats, Challenges, Investment Opportunities, and recommendations)
- Strategic recommendations in key business segments based on the market estimations
- Competitive landscaping mapping the key common trends
- Company profiling with detailed strategies, financials, and recent developments
- Supply chain trends mapping the latest technological advancements

Free Customization Offerings:

All the customers of this report will be entitled to receive one of the following free customization options:

Company Profiling

Comprehensive profiling of additional market players (up to 3)

SWOT Analysis of key players (up to 3)

Regional Segmentation

Market estimations, Forecasts and CAGR of any prominent country as per the client's interest (Note: Depends on feasibility check)

Competitive Benchmarking

Benchmarking of key players based on product portfolio, geographical presence, and strategic alliances

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Note: Tables for North America, Europe, APAC, South America, and Middle East & Africa Regions are also represented in the same manner as above.

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