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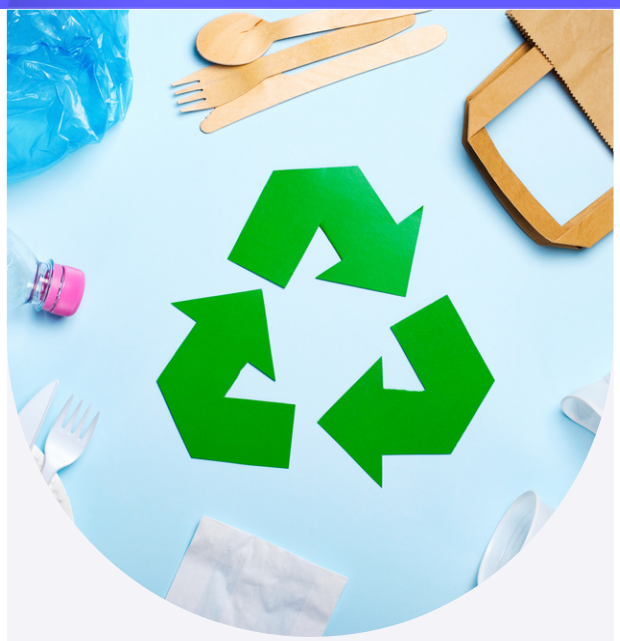

VEC celebrates Earth Day and collaborates with scientists at Entropix to develop Enzymes to accelerate the recycling of plastics

The Earth Day theme for 2024 is Planet vs. Plastics, raising widespread awareness of the health risks of plastics for rapidly reducing single-use plastics across the world. The VEC investigates how investing in technologies can minimise our plastic use for a healthier and more sustainable way of living.

entropix

The World Economic Forum's Global Risks Report 2024 finds that environmental risks make up half of the top 10 risks over the next ten years, with 12 million tonnes of plastic being found in the ocean each year. Currently, humans produce more than 350 million metric tons of plastic waste per year, which is forecast to triple by 2060, reaching one billion metric tons.

Over 50% of our plastic is used once and thrown away with 98% of these single-use plastics coming from fossil fuels. Shockingly, only 9% of plastic to ever be produced globally has been recycled, as plastic production and disposal emits around 3% of global emissions.

The damage this causes is widespread and endless, including the choking of marine wildlife with over 300,000 whales, dolphins and porpoises dying every year from discarded plastic fishing equipment. Plastic can also poison soil and groundwater, which can all have serious health concerns as recent studies have found traces of microplastics in the blood of 80% of people tested.

Small changes and minor investments can lead to considerable impact

Virtual tools for R&D and product development phases can massively reduce businesses needs for plastic materials for developing physical prototypes whilst reaching final designs quickly and efficiently based on virtual changes.

Whilst many manufacturers will focus on reducing their use of plastics, many start to ensure the plastic used is recyclable to ensure the supply chain becomes greener, improve sustainability, and remove one-use plastics within the consumer market.

Ultimately, business leaders strive to eliminate plastics from operations to reduce their environmental footprint, seek alternatives, recycle materials whenever feasible, and even provide incentives for customers to return with their used plastic items. Some companies even reintegrate these materials into their production cycle to bolster their eco-friendly initiatives and cut down material expenses.

Enzymes are proteins that catalyse reactions in living organisms by lowering activation energy. They are essential for digestion, energy production, and DNA replication. Enzymes are proving to be a ground-breaking tool in the quest to reduce plastic usage and enhance recycling processes. These biological catalysts have a remarkable ability to speed up chemical reactions, including the breakdown of plastics, which are notoriously resistant to degradation.

In solid waste processing, enzymes facilitate the breakdown of biodegradable material, such as food scraps, yard waste, and paper products. This process reduces the volume of waste destined for landfills and produces valuable by-products like biogas and compost. One of the most promising applications of enzymes in this context is their ability to break down polyethylene (PE), polypropylene (PP), Nylon, and PET (polyethene terephthalate), a common type of plastic used in bottles and packaging.

PET can be recycled mechanically for re-use in food and drink packaging. However, this process is best suited to clear containers or bottles; it cannot easily handle coloured or multilayer plastics.

Also, the process is energy intensive and involves a gradual accumulation of impurities, reducing the quality and appearance of the recycled material. By using enzymes, PET and other plastics can be recycled back to their original raw materials offering the prospect for infinite re-use of plastics. This new approach will provide additional incentives to collect plastics for recycling and reduce the amount of waste in the environment.

Introducing computer vision for streamlining enzyme testing

The VEC has recently collaborated with Entropix, a biotech company specialising in the development of high-performance enzymes. Entropix enhances natural enzymes through directed evolution, creating high-performance variants tailored to customer needs. Their technology platform accelerates enzyme evolution for applications like breaking down non-recyclable plastic waste and improving diagnostic testing.

The VEC supported Entropix to enhance their processes using AI machine learning, improving screening efficiency by predicting enzyme activity with over 90% accuracy, helping to reduce costs and time spent on testing mutants.

VEC trained an AI system to analyse DNA sequences of active and inactive enzymes. After training, the system was able to recognise patterns in the DNA sequence and predict activity of the enzyme with 99% accuracy based on the sequence alone. VEC also explored machine learning models and considered a regression approach to predict enzyme activity conditions.

In a parallel project, the VEC team investigated using computerised image capture and analysis to automate manual testing processes. They developed methods to count and label bacterial colonies, produce enzyme samples, and address lighting and image quality issues.

"We have had a positive and successful collaboration with the VEC over the last two years. Their skills and expertise in machine learning and image analysis have enhanced our processes in Entropix and helped us to accelerate our enzyme development activities."

Rob Rule, CEO, Entropix Ltd