

CIRCULAR ECONOMY BUSINESS CASE STUDIES IN SOUTHEAST ASIA



BUYO Bioplastics

- Hanoi, Vietnam
- Plastic industry
- buyoplastic.com
- Analysis period: 2022-2024

From Biowaste to Bioplastics

Business Spotlight

BUYO Bioplastics Co. Ltd. (hereafter BUYO) is a start-up business established in 2022, pioneering the production of biodegradable plastics from biowaste. BUYO’s products are engineered to safely decompose in natural conditions, posing no risk to human health while promoting a circular economy. The company targets a diverse clientele across Europe, North America, and Asia, offering products suitable for flexible and rigid packaging, as well as textile and medical applications.

With its exclusively patented technology producing biodegradable bioplastics from organic waste, BUYO won the National Innovation Technopreneur Contest TECHFEST Vietnam 2023. BUYO was the first company from Southeast Asia selected for the 100+ Accelerator programme to work with the world’s top brands including AB InBev, Unilever, Coca Cola and Colgate Palmolive; the first start-up in Vietnam to join the Select USA Investment Summit in the CleanTech category; and among the top 10 waste management technologies selected by the Singaporean government, *inter alia*.

Keywords

Bioplastics, Biowaste

Innovation

Product/Service design, Manufacturing, End of life management, Resource circularity, Resource substitution



Context and baseline

Plastics are important materials used in all aspects of our daily life and industrial applications. Global plastics production surpassed 400 million metric tonnes annually in 2022. A large share of plastics is used in short-lifespan or even single-use applications, including packaging, which contributed to a rapid increase in plastic waste generation to over 350 million metric tonnes annually in 2019.¹ Moreover, producing fossil-based plastics requires significant quantities of non-renewable raw materials and generates significant amounts of greenhouse gas (GHG) emissions (approximately 5 metric tonnes of CO₂ per metric tonne of virgin plastic production²), including during end-of-life management. The United Nations Secretary General Antonio Guterres in 2023 warned: 'By 2040, 19% of global GHG emissions will come from plastic.'

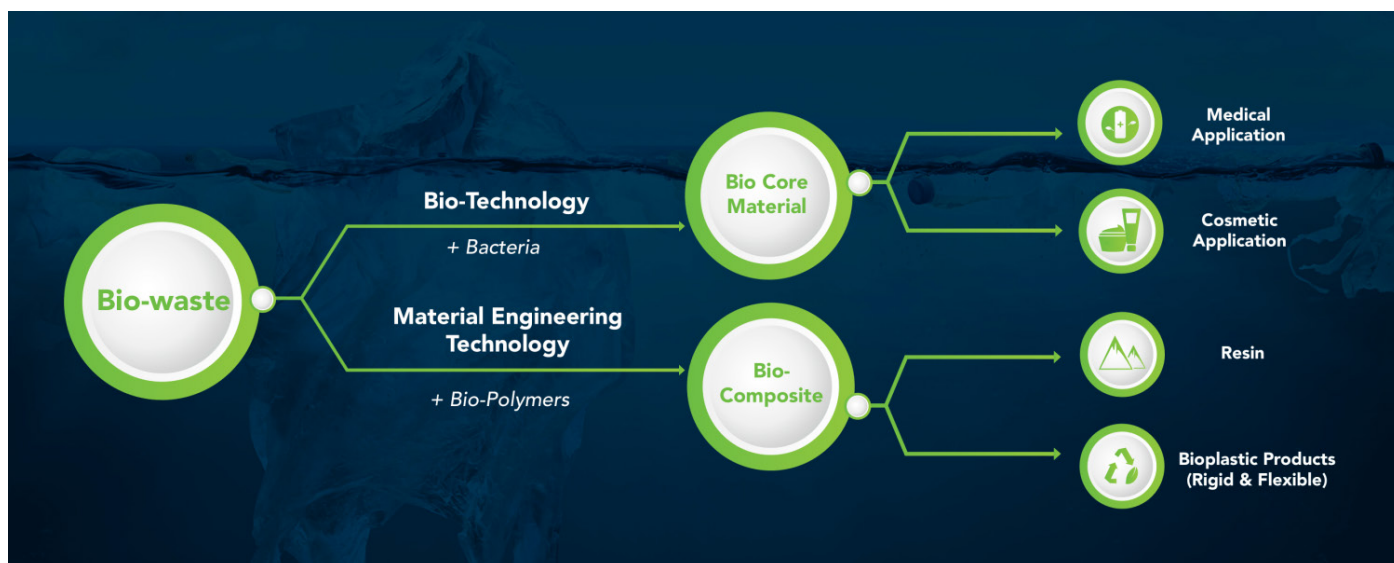
Rapid economic growth, urbanisation, and changing lifestyles in Vietnam have led to a plastic pollution crisis. An estimated 3.1 million metric tonnes of plastic waste is discharged on land in Vietnam annually. It is estimated that at least 10% of this mismanaged waste leaks into waterways, making Vietnam one of the top five plastic polluters of the oceans worldwide. The volume of leakage could more than double by 2030 under the business-as-usual scenario.³ Against the global background and Vietnam's transformation toward sustainability, bioplastics have gained considerable attention owing to their low carbon footprint, sustainable raw materials, and biodegradability.

In alignment with Vietnam's ambitious net-zero emissions target for 2050, local startups are developing and commercialising critical innovations to accelerate the transition to a low-carbon and circular future. These innovative ventures are not only advancing the country's environmental goals but are also generating business opportunities that foster economic sustainability. Founded in 2022, BUYO set out to tackle the global and national plastics pollution crisis. Unlike synthetic plastics that can take up to 500 years to break down, BUYO succeeded in producing bioplastics from agricultural and food and beverage waste that are designed to biodegrade within one year. Employing innovative techniques, the company transforms biowaste into biodegradable plastic.

Innovation

The production of biodegradable plastics by BUYO includes several innovations.

BUYO uses biowaste and other plant-based materials – for example, spent grain from breweries, cassava pulp, other agricultural and/or food waste – to produce bio-based and biodegradable materials, known as second generation bioplastics (an innovation from the first-generation bioplastics that are made from starch-based feedstock). At BUYO, the production processes involve two pathways: material engineering and bio-fermentation to produce biopolymers. BUYO products are made from compounds of different types of biopolymers.



1 https://www.oecd-ilibrary.org/environment/global-plastics-outlook_de747aef-en

2 https://www.energy-transitions.org/wp-content/uploads/2020/08/ETC-sectoral-focus-Plastics_final.pdf

3 <https://www.worldbank.org/en/country/vietnam/publication/towards-a-national-single-use-plastics-roadmap-in-vietnam-strategies-and-options-for-reducing-priority-single-use-plasti>

The bio-based and biodegradable materials that BUYO makes are used for packaging and in the medical and textile sectors. The biopolymers are mixed with other biowaste to produce bio-composites, which is either sold as resin (for later use by plastic packaging and product manufacturers) or transformed into rigid and flexible bioplastic products.

Because of their reliance on carbohydrates (starch), the currently most commonly used first-generation bioplastics compete with starch use for human nutrition, and can potentially compromise food security. On the other hand, second-generation bioplastics, including those from BUYO, use biowaste, which is not suitable for human consumption, as their starting material for bioplastics. These bioplastics biodegrade completely under standard environmental conditions in 3–12 months. The properties of the plastics produced by BUYO plastics are comparable to the synthetic plastics they are replacing in terms of tensile strength, heat and moisture transfer and safety to human health.

Circular Economy impact

Bioplastic production at BUYO contributes to the circular economy principally through the circular recovery and reuse of waste biomass (resource circularity) and using organic waste instead of non-renewable petrochemicals as feedstock for plastic production (resource substitution).

Resource circularity is achieved by recovering biowaste and turning it into bioplastics, which prevents biowaste from being composted, burned or simply dumped into landfill. Not only are waste and pollution minimised, but the greenhouse gas (GHG) and other air and/or water emissions that would otherwise occur from uncontrolled decomposition and/or burning of biowaste are reduced. The BUYO factory started operations in December 2023 with a design capacity of 10 metric tonnes/month; an average scale of 2 metric tonnes/month was attained in the first half of 2024. The material engineering pathway converts 100% of input materials into products; the bio-technology pathway produces organic residues which are composted or sold as animal feed.

The company's innovation also achieves resource substitution as it replaces petrochemicals (as input for plastic production) with organic waste (as input for the production of bioplastics). BUYO utilises discarded biowaste that is abundantly available in Vietnam from the agriculture and agribusiness sectors. This biowaste is unsuitable for human consumption, but some of this biowaste could have value as animal feed. However, compared to first

generation bioplastics that are made with corn or cassava starch, there is no direct competition for food as biowaste is used for bioplastic production.

BUYO bioplastic production is thus creating novel, valuable materials from a previously discarded waste, transforming waste into wealth, showcasing one of the main tenets of the circular economy.

Business and market impact

BUYO derives financial, environmental and social benefits from its production of bioplastics.

The production process has low operating costs, as it uses a low-energy consuming biological conversion, and consumes widely available and thus inexpensive biowaste, which diverts it from landfill or incineration. In late 2023 BUYO invested in equipment and facilities to increase their production to an industrial scale. BUYO has currently applied for two patents on bioplastics. The company is now operating a modern manufacturing facility with a designed capacity of 10 metric tonnes of bioplastics/month. During the first half of 2024, BUYO was in the process of scaling up production, while maintaining high-quality standards and ensuring a positive social, economic and environmental impact.

BUYO is a newcomer in the market, and interest and awareness of its products is still developing. There is, however, a potential for significant growth for the company in the future, given the increasing global market and policy pressures to minimise plastic waste and reduce GHG emissions. Several multinational companies (MNCs) in Europe and North America are looking at bioplastics as part of their plastics management strategies, which will likely increase demand for bioplastic products, including possibly with BUYO materials. Better economic returns from BUYO plastic production can thus be expected, as Ms. Do Hong Hanh, CEO and co-founder of BUYO, has stated: 'This is great timing. Many governments are banning single-use plastics. Alternatives are becoming mandatory. We have a strong team, with top scientists in this area. We have the right timing, the right people, and the right purpose.'

Stakeholders

The main sources of materials for producing bioplastics at BUYO are cassava pulp, brewery spent grains, plant biomass, and other agricultural and food waste. During the product development process and as a startup, BUYO received substantial support and advice from AB InBev (Belgium), the world's largest beer company with a factory in Binh Duong; the Ho Chi Minh City Biotechnology Center; and the

University of Technology, School of Natural Sciences in Ho Chi Minh City. BUYO has also partnered with other companies to supply agricultural byproducts for production of bioplastics.

Implementation

Established as a startup in 2022, BUYO started R&D activities to produce bioplastic from biowaste and agricultural byproducts in the same year. BUYO's team is comprised of globally connected entrepreneurs and leading scientists in the fields of chemical, environmental and material engineering. The company began pilot production in a small workshop in Ho Chi Minh City.

BUYO received encouraging support (information, technical assistance, capacity building, networking, consulting, etc.) from local government and development partners. In 2023, the company succeeded in attracting capital injection from the international venture investment funds group, Antler and Aldebaran Capital.

Despite impressive results from the company's R&D and product development, challenges persist, including:

- the company's limited financial capacity,
- the learning and optimisation curves that bio-based technologies must still undergo to achieve economies of scale and cost competitiveness,
- low awareness of the long-term benefits of bioplastics, thus little behavioural change among customers, and
- strict quality standards requirements set by the customers and other business partners.

To overcome these barriers, several actions have been implemented by BUYO. They include: raising public awareness of the benefits of bioplastics products, enhancing R&D activities, and trust-building communication within companies and among stakeholders and customers to persuade them to accept circular economy solutions.

Takeaways

- Biowaste is a promising source for production of bio-based and biodegradable bioplastic for a sustainable future.
- Establishing a market demand for bioplastics remains as the key challenge for guaranteeing impact and business success.
- Innovation, creativity and a long-term commitment by the company's top leaders to 'go green' is a key for an effective circular economy transition.



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