SEA circular
solving plastic pollution at source

Nature-based food packaging

Alternatives to plastic for packaging food

This case study demonstrates market-based solutions towards **"less plastic wasted",** exemplary solutions for transformational changes in the way plastic is managed in the value supply chain. Circular Economy approaches, including business incentives for plastic reduction and recycling, are used, leading to increases in plastic re-use and recycling, and to the reduction of single-use plastic packaging.

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Background

Recognizing the **severe health impacts** that dangerous substances and chemicals in food containers and packaging can cause, Dr. Weerachat Kittirattanapaiboon, a medical doctor, made it his personal mission to find an alternative. After years of research and trials, he developed the technology to make containers and packaging products using natural plant fibres found in Thailand. He started the company Biodegradable Packaging for Environment (BPE) and its Gracz brand in 2005.

Technology to make

Containers and packaging products using

natural plant fibres

The problem

Single-use food packaging is taking a huge toll on our environment, clogging and filling landfill and waterways with plastic bags, polystyrene containers, disposable cups, coffee sleeves and pods, and more. The COVID-19 crisis is seeing more of this waste being created amid health and safety concerns, with used face masks, gloves, plastic gowns, and face shields adding to the existing issue of plastic waste from takeaway food.

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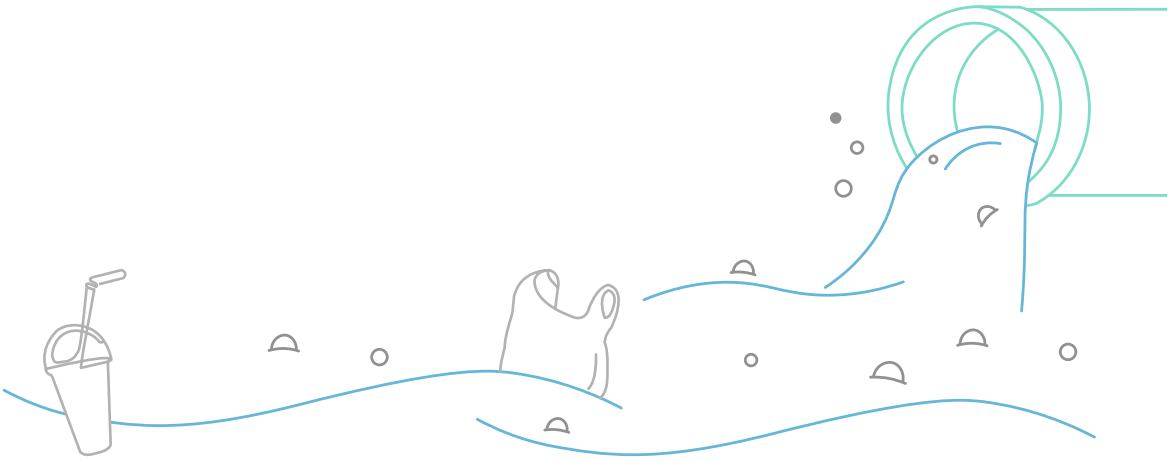


The growing amount of waste finding its way into waterways and oceans is a huge concern that cannot be understated, but nor can the convenience and perceived safety and hygiene of single-use plastic be ignored. Hence, there is a pressing need to explore alternatives to plastic food packaging. For Gracz, this was an opportunity to see whether its own packaging materials, initially envisaged as an option for consumers to be exposed to fewer harmful chemicals in their food containers, could also help achieve less waste for the environment.

Interventions

After five years of research, **bagasse (sugarcane pulp)** was found to be well suited to use in packaging, while also being abundantly available in Thailand from its sugar production processes. Bagasse containers and packaging can hold both **hot and cold food,** and even hot oil. They are **oven and microwave safe, leak proof,** and can **naturally decompose within 45 days**. The quality, functionality, safety, and cost are far superior to other traditional disposable packaging products. Bagasse containers can withstand **hot water and hot oil** at temperatures of 100 degrees Celsius or **cold temperatures** up to minus 20 degrees Celsius, they are microwave safe at 1,000 watts for five minutes, and can even go in the oven at 180 degrees Celsius for 15 minutes (from Test Report from Intertek Testing Services (Thailand) Ltd.).

CHARACTERISTICS	PLASTIC COATED PAPER	PLASTIC	POLYSTYRENE	GRACS
100% Natural plant fibre	✗	✗	✗	✓
Non-toxic and non-carcinogen	✗	✗	✗	✓
Temperature resistance from -20C to 200C	✗	?	✗	✓
Microwave and oven safe	✗	?	✗	✓
100% compostable within 45 dats	✗	✗	✗	✓

The process

Biodegradation is the **dissolution of materials** by bacteria or other biological means. The materials are decomposed and return to compounds commonly found in nature such as water, methane, biomass, and carbon dioxide. Gracz is made from **natural plant fibre** and completely decomposes back into natural elements during the biodegradation process.

Gracz is made from 100 per cent natural plant pulp, is 100 per cent uncoated, and is 100 per cent compostable within 45 days in a typical environment. Since it is made from agricultural waste, the process of **transforming bagasse into food packaging,** then into additional nutrients for the soil once it is composted, is truly a circular approach to resource use.

100%

natural plant pulp

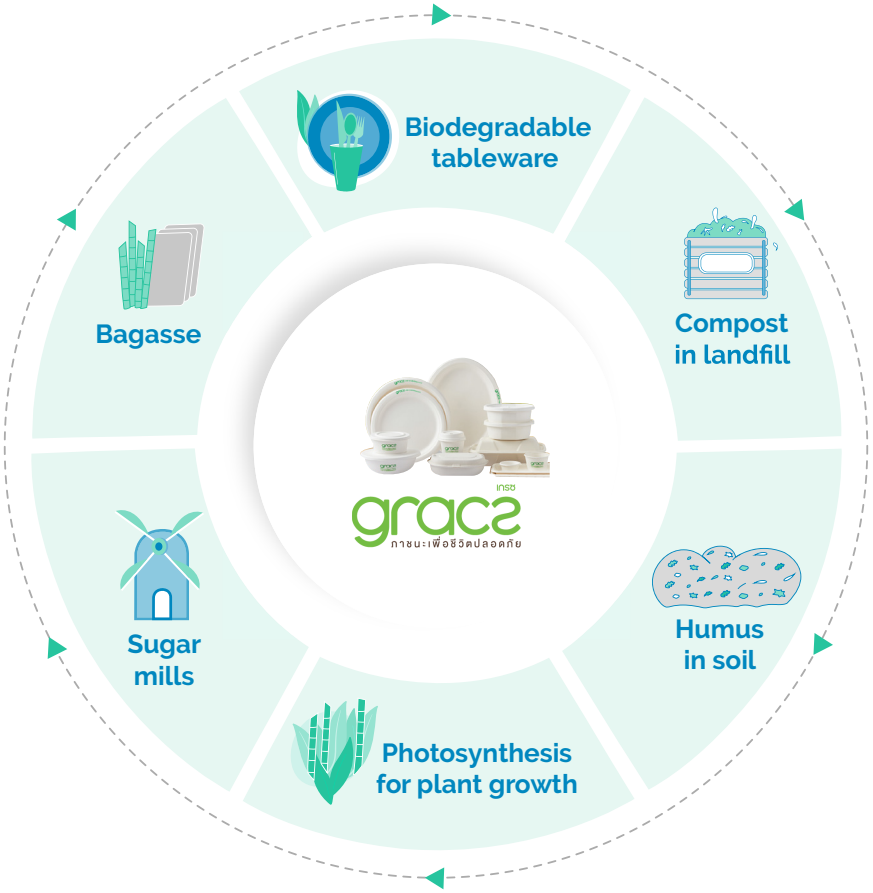
uncoated **compostable**

within **45 days**

in a typical environment

Gracz has since been able to provide **biodegradable alternatives** to polystyrene (the use of which was banned by the Thai Government in 2016) and, in recent years, to single-use packaging (which has increased astronomically with the COVID-19 pandemic). These "traditional" materials do not biodegrade easily and their management and disposal cost the country billions in Thai Baht annually.

As Gracz containers are **leak proof, oven safe and microwavable,** and can be used for hot and cold food, they are excellent for Thai food, which includes soups and incorporates a variety of sauces. The products are available and distributed to a broad range of customers, including institutions, hospitals, restaurants, and street food vendors and hawkers.



Biodegradable results

0 days | 8 days | 14 days | 31 days

Challenges

• Cost

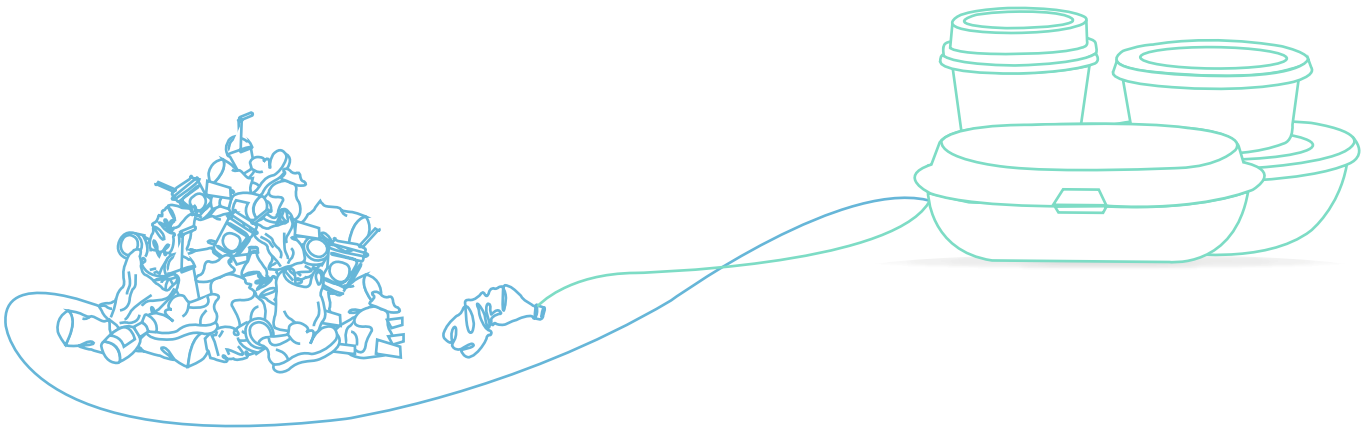
At about average 3 THB/pc, Gracz food packages versus non-microwaveable plastic options cost about 20 per cent more. This cost is comparable to **higher-grade, microwaveable** plastic. Nevertheless, because of better consumer awareness and concern about single-use plastic and the plastic pollution issue, the price is becoming more acceptable. With pricing incentives from the government or higher-demand volumes, a lower price point could be reached to increase take-up among more street vendors and small restaurants or businesses.

• Education

Consumer demand for single-use packaging and plastic alternatives drives market trends. Safety concerns around COVID-19 during the past year meant this demand dropped significantly in favour of more single-use plastic. Through **awareness-raising and education** using channels such as the Ministry of Health, social media influencers, and local television shows, the company is scaling outreach activities to attain pre-COVID-19 levels of consumer use.

• Fake news

Misleading information about the meaning of 'biodegradable' confuses consumers. Support from the government, from scientists, and from material experts to **convey clear and harmonized messaging** to the public about the term can reduce confusion. Terms such as **'degradable'** or **'compostable'** have to clearly indicate how they create micro plastics, and how these respond to conditions including temperature and time. The time period to achieve biodegradation, i.e., **years versus months versus weeks**, should be explicitly conveyed by producers of biodegradable items.



Results - the impacts

• Employment:

The use of bagasse from sugar production processes extends **work opportunities for the agricultural workforce.** Gracz's factories are located in Chinat Province, in close proximity to raw material sources. This allows for the **creation of jobs in the area**, generating incomes for the local communities. Almost 600 people are currently employed in the factory.

• Health impacts:

Chemical additives that give plastics their pliability (i.e., phthalates) or special coatings that allow cardboard to contain liquids (perfluorinated chemicals) or that coat aluminium cans (bisphenol linings) determine if a material can be recycled or not, as well as if it can be extremely dangerous to human health. The use of natural plant fibre and materials makes **containers and packaging products safer** as they are free of substances that can cause cancer. While the direct impacts of plastic use on health cannot be easily quantified, one impact that could be extrapolated would be the raw materials from agricultural waste or the amount of bagasse that would have had to be burned, producing fine particles or PM2.5, which would have contributed to air pollution. Five-hundred million pieces of plastic-alternative packaging produced from almost 10,000 tons of bagasse saved these raw materials from being burned, which would have resulted in particulates being released into the air.

500 million
pieces of plastic-alternative packaging
produced from almost 10,000 tons
of bagasse

• Less plastic wasted:

From 2010, most of **Gracz's products were exported to Europe, the US, and Japan**, with only a residual 10 per cent for the local Thai market – about 50 million pieces. Over the last five years, however, this has increased so that currently about 80 per cent of production is for domestic use (or about 2 billion pieces), with 20 per cent allocated for export. This translates to an equivalent amount of avoided single-use plastic, which otherwise would have had to be collected (taxing formal and informal waste management systems) and / or would have eventually found its way into landfill or waterways.

Moving forward

In addition to coconut fibre, corn and rice husk, and water hyacinth – all of which are plentiful in Thailand – Gracz continues to **develop other raw materials into products,** staying true to the company's objective of **creating value from waste**. The company is currently putting its efforts into developing face masks and hospital equipment such as single-use trays or disposable containers for medicines – items that are adding significantly to the country's waste volume.

There is a clear opportunity to **scale up** the use of virgin agricultural waste and transform this into packaging resources, especially in the region where Gracz is based. As such, Gracz is also looking to **support technology transfer** as part of its vision to increase supply.

"Plastics are very useful and can do very good things. In my opinion, however, it is not ideal for single uses. That plastic has a very long life means that the uses for it should be equally as long lasting."

Dr. Weerachat Kittirattanapaiboon
Gracz CEO

We thank Gracs for sharing details of their exemplary innovations in the SEA Circular project's series on the plastic value chain.

The SEA circular project – Reducing marine litter by addressing the management of the plastic value chain in Southeast Asia is implemented by the UNEP Regional Office for Asia and the Pacific and the Coordinating Body on the Seas of East Asia (COBSEA), with funding support from the Government of Sweden. SEA circular aims to reduce and prevent plastic pollution and its impact by working with governments, businesses, civil society, academia, and international partners. The initiative promotes market-based solutions and enabling policies to transform plastic value-chain management, strengthens the science base for informed decision making, creates outreach and awareness. The project leverages COBSEA's regional mechanism to tackle the transboundary challenge of marine litter in a harmonized manner.

www.sea-circular.org