

## **TBM acquires Bioworks Corporation, a Company that Develops Modifier for Bioplastics, as a Subsidiary** ~ Announcement of Plax, a 100% biomass-based new material ~ (Modified Polylactic Acid Compound)

TBM Co., Ltd. (TBM), a company that develops, manufactures and sells paper and plastic alternative products made from a limestone-based material known as 'LIMEX,' now holds shares of Bioworks Corporation (Bioworks), the company that develops a highly functional modifier, and acquired the company as its subsidiary.

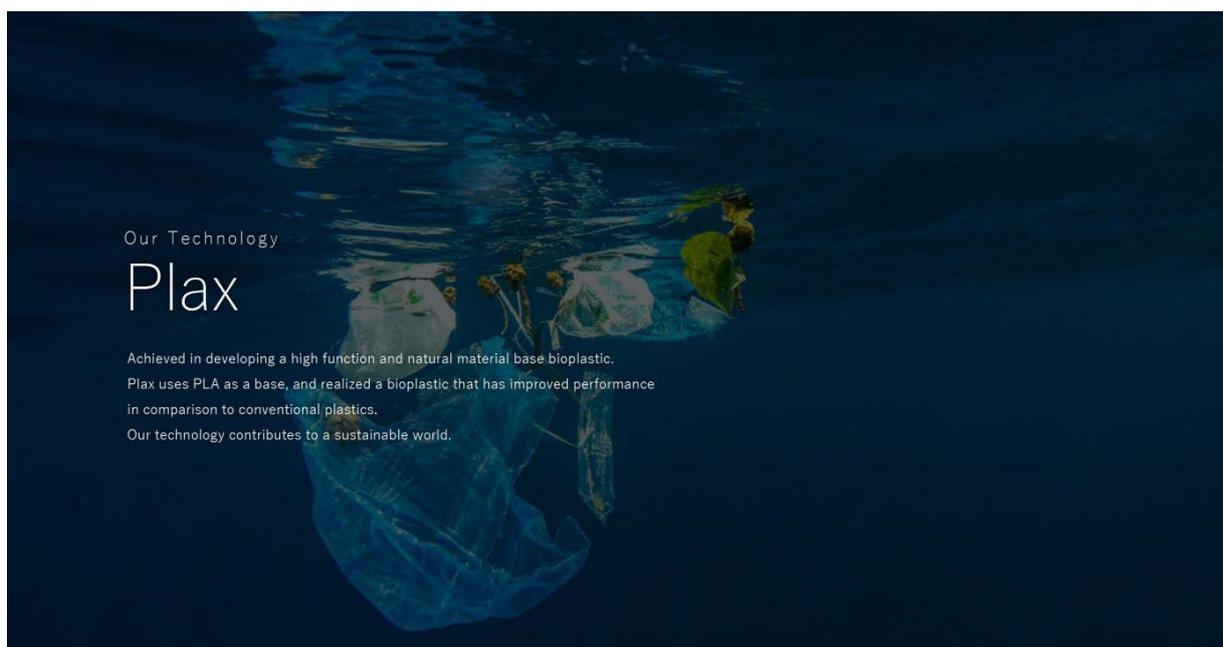
### ■ Background

Companies today are expected to take actions against environmental issues to achieve the Sustainable Development Goals (SDGs). Regulations against plastics have been enforced in recent months overseas and demand for plastic alternative material is expanding.

The Ministry of the Environment has outlined the preliminary draft of a strategy for recycling and reusing plastic products in 2018. One of the targets specified within the plan was the numerical target on increasing the use of biomass-based material in the domestic market from 70,000 tons in 2013, to 2,000,000 tons by 2030.

TBM has anticipated the increase in demand for biomass-based biodegradable resin and being in partnership with 'Brussels SDG Summit 2018', has announced the 'Biodegradable LIMEX'. The Biodegradable LIMEX is composed of limestone being the main raw material, and from biomass-based biodegradable resin.

One of the important subjects of TBM's research and development is to replace the petroleum-based resin with a biomass-based biodegradable resin when producing alternatives to single-use plastics.



## ■ The Purpose for Acquisition

TBM aims to develop a non-petroleum-based biodegradable LIMEX as a product that is harmless and biodegrades even in the natural environment. As a first step to realize this, we have given attention to polylactic acid (PLA) resin, which is 100% biomass-based and biodegradable under compost conditions.

However, PLA resin is difficult to work with, due to characteristics such as hardness, fragility, low heat resistance and difficulty to mold and therefore cannot be used to manufacture limestone-filled products. For this reason, TBM has been working together with Bioworks, a company that has the technology for a modifier that is biomass-based and biodegradable. As a result, we are now closing to launching sheet products and molded products with limestone-filled PLA resin.

Bioworks has registered its modifying method and heat resistance improvement technology for the Japan Patent, the U.S. Patent as well as the European Patent. In addition, it has already been used for market products. In parallel to accelerating the development of the biodegradable LIMEX for market launch, TBM will put the biomass-based biodegradable PLA resin and its products on the market at the earliest opportunity. In order to do so, TBM has decided to conduct equity participation in Bioworks.

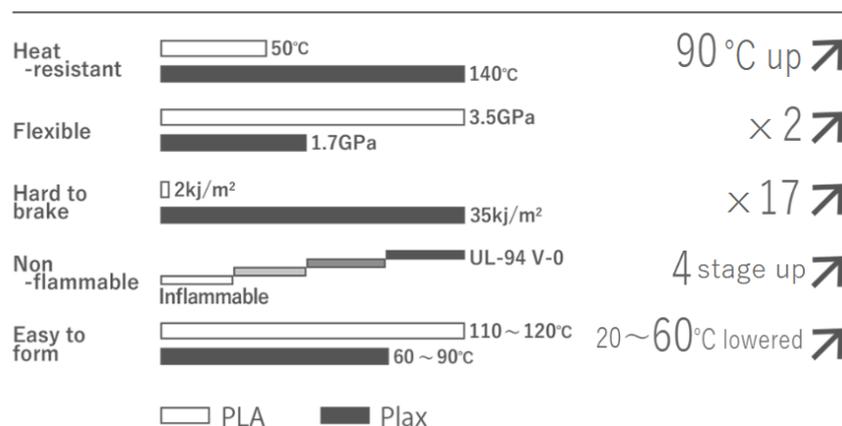
## ■ About Plax (Modified Polylactic Acid Compound)

Bioworks uses a PLA resin as a base which carries two major characters of biodegradability (under compost) and carbon neutrality. There have been challenges with conventional PLA resin on its own regarding moldability and heat resistance and had to be mixed with petroleum-based resin in order to manufacture products. However, Bioworks has successfully developed a 100% biomass-based modifier for the PLA resin and has developed a bioplastic called 'Plax' (Modified PLA Compound) that has improved performance in comparison to conventional petroleum-based plastics. The 100% biomass-based material is highly functional in aspects such as production cost, heat resistance and, flexibility.



In comparison to conventional PLA, Plax has the following characteristics.

### Plax's reforming technology



Through Plax's completely new crystallization promotion mechanism, we have successfully increased the rate of the crystallization speed. For this reason, it is possible to take on the same molding process as the common resin. Furthermore, manufacturing can be done in any factory, as molding under 100-degree Celsius of water is possible. In order for the wide use of Plax, we will supply the compound for applications below.

## ■ Application of Plax

---

- Injection Molding Compound

Application: Automotives, OA devices, Home appliance, Daily necessities, General goods

We will provide molding materials that can serve various needs including heat resistance, shock resistance, flexibility, flame retardant, durability.

- Blow Molding Compound

Application: Automotive (e.g. Aeroparts), Bottles, Mannequins

It is possible to manufacture a heat-resistant bottle without the risk of bursting or losing transparency through the injection blow molding method. Large-scale blow molding is also possible without drawdown.

- Fiber Compound

Application: Natural Fiber Material

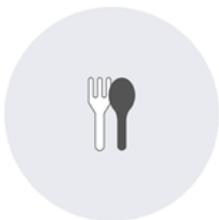
It has the same extent of strength and stretchiness as polyester but only shrinks by 1/10.

It is proven to have the same level of productivity and a consistent thickness of thread in the manufacturing process as nylon resin. Dyeing is also possible with natural dyestuff such as indigo. The fiber is acescent, antibacterial, and gentle to the skin.

- Film And Sheet Compounds

Application: Lunch Box Container, Coffee Cup Lids

High heat resistance (140-degree Celsius) and transparency are achieved for food and beverage container lids at a similar level of those made from PET and OPS. It also has a high low-temperature impact resistance, and therefore can possibly replace PP. Since it is a plant-derived resin, there are no concerns regarding endocrine disruption.



## ■ Towards Creating a Business Synergy

---

Biodegradable LIMEX, which is composed of a mixture of limestone and Plax, can give solutions to the issues of conventional PLA resin such as hardness, fragility, low moldability, and low heat resistance without relying on petroleum-based resins. Biodegradable resin is not commonly used due to its high cost. However, by using a relatively inexpensive PLA resin, and by mixing in inexpensive limestone (Calcium Carbonate) over 50%, biodegradable LIMEX is possible to realize further cost reduction.

TBM and Bioworks will develop packaging and vacuum formed products (cups, food packaging etc.) and will aim to launch them in early 2019. Furthermore, our mid-to-long term aim is not only to launch biodegradable LIMEX that is PLA resin-based and degrades in composting environments but also to develop biodegradable LIMEX that degrades in soil and in oceans as well.

■ Information of Counterparty in the Share Acquisition

TBM acquired shares from OUVC Fund 1 Limited Partnership for Investment and 7 other individual shareholders.

【OUVC Fund 1 Limited Partnership for Investment】

(1) Name	OUVC Fund 1 Limited Partnership for Investment	
(2) Location	2-8 Yamadaoka Suita-shi, Osaka-fu	
(3) Name and Position of the Representative	General Partner Osaka University Venture Capital Co., Ltd CEO Toshiaki Jinbo	
(4) Business	Investment to a Venture Company	
(5) The scale of Fund (Capital Commitment)	12.5 billion yen	
(6) Date of Establishment	31st July 2015	
(7) Total Worth	-	
(8) Net Worth	-	
(9) Limited Liability Partners	National University Corporation Osaka University Sumitomo Mitsui Banking Corporation Mizuho Securities Co., Ltd. Mizuho Bank, Ltd. The Senshu Ikeda Bank, Ltd. Mitsubishi UFJ Capital Co., Ltd. Total 8 Partners	
(10) Relationship of TBM and the Partners	Capital Relations	N/A
	Personal Relations	N/A
	Business Relations	N/A
	Related Partners Relations	N/A

■ Introduction of the new material 'LIMEX'

[What is LIMEX?]

LIMEX is made mainly from limestone. It is an environmentally and economically viable new material that can substitute paper and plastic.

• 2013

TBM was chosen by the Ministry of Economy,

Trade and Industry as one of the Innovation Base Promotion Businesses to be aided by "Subsidy for Advanced Technology Demonstration and Evaluation Facility Development."

• 2014

Patent Approval for the new material technology in Japan.

International patent applications have been approved or await approval in 43 countries.

- 2015

Construction of Shiroishi Plant was completed. (Shiroishi city, Miyagi)

The capacity of Shiroishi Plant is 6,000 tons annually.

- 2016

TBM received The Social Impact Award by Plug and Play Tech Center.

- 2017

TBM was selected as one of the five top companies to participate in the Innovation Showcase of Japan US Innovation Awards program.

[ Paper alternative (LIMEX sheet)]

LIMEX uses almost no water and no trees while 1 ton of paper is made from around 20 trees and 100 tons of water. One

ton of LIMEX Sheet is made from 0.6~0.8 tons of limestone and 0.2~0.4 tons of polyolefin resin.

※Japanese Paper manufacturers plant trees overseas for sustainability.

※If used LIMEX sheet is to be disposed in Japan, it is generally categorized as combustible waste, and cannot be recycled with paper.

[ Plastic alternative (LIMEX pellet)]

• While conventional plastic is made from petroleum-derived resin, LIMEX pellet is made mainly from limestone. LIMEX pellet can reduce the amount of petroleum-derived resin used.

- Limestone costs lower than petroleum-derived resin.
- LIMEX sheet can be up-cycled to LIMEX pellet.

[ Deposits of limestone]

- Limestone is self-sufficient in Japan.
- Limestone is abundant around the world.

#### ■ TBM Co., Ltd.

---

CEO Yamasaki Nobuyoshi

Head Office 2-7-17-6F, Ginza, Chuo-ku, Tokyo, Japan

Founded 2011

Capital 9,194 million yen (Including legal capital surplus)

Business description Development, manufacturing and sale of LIMEX and LIMEX products

URL <https://tb-m.com/en/>

---

#### ■ Bioworks Corporation

---

CEO Yukihiro Imai

Head Office Kyoto HQ & Lab Laboratory Wing 7F, 1-7, Hikoridai, Seika-cho, Souraku-gun, Kyoto 619-0237

Founded 2015

Capital 309.57 million yen (Including legal capital surplus)

Business description Development, Development, manufacture and sales of Plax

URL <https://bioworks.co.jp/en/company/>

---

\*The name of the company, goods and services appeared in this news release are registered trademark or trademark.

\*The contents of this news release are as of the released day. The contents are subject to change without notice.

#### ■ MEDIA CONTACT

---

Takayuki Sasaki, Shun Sasaki, Corporate Communication division, TBM Co., Ltd.

Kenji Fukahori, Administration division, TBM Co., Ltd.

TEL: +81-3-3538-6777

FAX: +81-3-3538-6778

Email:infomail@tb-m.com