

## Key Takeaways: Biodegradable Plastics

Plastic pollution is everywhere. From the depths of the oceans to the world's highest mountains to Arctic sea ice, tiny plastic fragments have made their way to the farthest reaches of our planet - and into our bodies.

The good news is that people and governments are increasingly seeking solutions to combat plastic pollution. In this report Greenpeace East Asia evaluates one proposed solution - biodegradable plastics.

Biodegradable plastics are plastics that can be broken down by living organisms. However, while the term “biodegradable” implies that the decomposition process occurs in a matter of a few months in nature, the majority of biodegradable plastics<sup>1</sup> only degrade within six months in controlled compost facilities at high temperatures and high humidity levels. According to the study “Degradation of Biodegradable/Degradable Plastics in Municipal Solid-Waste Landfill”<sup>2</sup> biodegradable plastics can remain intact for much longer than six months under typical conditions such as landfill.

While Europe and North America are home to more mature biodegradable plastics markets, China's biodegradable plastic industry has experienced explosive growth in recent years, driven in part by restrictions on single-use plastic use<sup>3</sup>. This report examines the potential and limitations for biodegradable plastics in China.

### 1. Biodegradable Plastics in China

In January 2020 China announced a ban on non-degradable single use plastics in major cities by the end of 2020 and across the country by 2025. Notably, degradable single-use plastics are exempt from the ban<sup>4</sup> and have been promoted as a “green” alternative.

In China 36 companies have planned or constructed new biodegradable plastic projects, with an added capacity of more than 4.4 million tonnes<sup>5</sup>, according to Huaan Research.

If the rush to produce biodegradable plastics continues, China's e-commerce industry is on

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<sup>1</sup> Meereboer, K. W, Manjusri M, and Amar K M. “Review of Recent Advances in the Biodegradability of Polyhydroxyalkanoate (PHA) Bioplastics and Their Composites.” *Green Chem.* 22. 2020. 5519–58. doi:10.1039/D0GC01647K.

<sup>2</sup> Vaverková, M. D. and Adamcová, D. “Degradation of Biodegradable/Degradable Plastics in Municipal Solid-Waste Landfill.” *Polish Journal of Environmental Studies*, vol. 23, no. 4, 2014, pp. 1071–1078.

<sup>3</sup> Plastics Today Staff. “Biodegradable Plastics Market Rising 9.4% Yearly.” *Plastics Today*, 8 April 2020, [www.plasticstoday.com/packaging/biodegradable-plastics-market-rising-94-yearly](http://www.plasticstoday.com/packaging/biodegradable-plastics-market-rising-94-yearly).

<sup>4</sup> National Development and Reform Commission, “Opinions of the National Development and Reform Commission and the Ministry of Ecological Environment on Further Strengthening the Treatment of Plastic Pollution, Fa Gai Huan Zi [2020] No. 80”, 2020, [https://www.ndrc.gov.cn/xxgk/zcfb/tz/202001/t20200119\\_1219275.html](https://www.ndrc.gov.cn/xxgk/zcfb/tz/202001/t20200119_1219275.html).

<sup>5</sup> Liu, W. “Standard Upgrade Series: Biodegradable Plastics Are Emerging to Fill in the Alternative Material Market.” *Huaan Research*, 2020. [pdf.dfcfw.com/pdf/H3\\_AP202006301388397876\\_1.pdf](http://pdf.dfcfw.com/pdf/H3_AP202006301388397876_1.pdf).

track to generate an estimated 5 million tonnes of biodegradable plastic waste per year by 2025<sup>6</sup>, according to calculations by Greenpeace East Asia.

## 2. Limitations of Biodegradable Plastics

**Cost:** The cost of biodegradable plastics<sup>7</sup> is more than double compared to that of conventional plastics<sup>8</sup>, making its price less competitive on the market.

**Reliance on Agriculture Feedstock:** More than two-thirds of biodegradable plastics produced rely on agricultural plant feedstock, according to Greenpeace East Asia calculations. Only a few leading companies<sup>9</sup> reveal their source of feedstock and commit to responsible and sustainable sourcing – in many countries, disclosing the source of feedstock is voluntary.

The use of agricultural products in bio-based plastic production on an industrial scale could potentially create competition with food supply in a region, issues with responsible acquisition of feedstock, and challenges in ensuring the sustainability of bio-based plastics through the entire supply chain.

**Physical properties and chemical additives:** Although most biodegradable plastics are made from plant materials, the manufacturing process usually involves chemicals such as additives and plasticizers.

A recent study analyzing bio-based and/or biodegradable plastic products in the European market found that 80% of tested products contained more than 1,000 chemicals, and 67% of tested products contained hazardous chemicals<sup>10</sup>.

**Biodegradation and waste management facilities:** The breakdown of biodegradable plastics within months typically requires tightly controlled waste management facilities, which do not exist in many countries. Without the support of disposal infrastructure, biodegradable plastics

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<sup>6</sup> The State Post Bureau [projects the growth rate](#) for online delivery at 27.6% per year. Based on 2019 fieldwork, Greenpeace East Asia [estimates that](#) 9.05% of online delivery packaging is plastic. According to the 2017 policy, "[Guiding Opinions on Coordinating the Promotion of Green Packaging in the Express Industry](#)," 50% of plastics used in online delivery must be biodegradable by 2020. The 2020 policy "[Opinions of the National Development and Reform Commission and the Ministry of Ecological Environment on Further Strengthening the Treatment of Plastic Pollution](#)" requires a complete elimination of non-degradable plastics in online delivery by 2025. Our calculation assumes no reduction in overall plastics use and that conventional plastics used in online delivery are replaced by biodegradable plastics.

<sup>7</sup> "Polylactic acid polymers." Alibaba.com, [https://www.alibaba.com/showroom/polylactic+acid.html?fsb=y&IndexArea=product\\_en&CatId=&SearchText=polylactic+acid&isGalleryList=G](https://www.alibaba.com/showroom/polylactic+acid.html?fsb=y&IndexArea=product_en&CatId=&SearchText=polylactic+acid&isGalleryList=G), Accessed 10 Dec. 2020.

<sup>8</sup> "Real time price list." Plasticsicker, [https://plasticsicker.de/preise/pms\\_en.php?kat=Mahlgut&aog=A&show=ok&make=ok](https://plasticsicker.de/preise/pms_en.php?kat=Mahlgut&aog=A&show=ok&make=ok). Accessed 10 Dec. 2020.

<sup>9</sup> "Ingeo Feedstocks & Certifications." *NatureWorks*, 2018, [www.natureworkslc.com/~media/Files/NatureWorks/What-is-Ingeo/Where-Ingeo-Comes-From/NatureWorks\\_Ingeo-feedstock-certification-options\\_pdf.pdf?la=en](http://www.natureworkslc.com/~media/Files/NatureWorks/What-is-Ingeo/Where-Ingeo-Comes-From/NatureWorks_Ingeo-feedstock-certification-options_pdf.pdf?la=en). Accessed 17 Nov. 2020.

<sup>10</sup> Zimmermann, L, et al. "Are Bioplastics and Plant-Based Materials Safer Than Conventional Plastics? In Vitro Toxicity and Chemical Composition." *Environment International*, vol. 145, 2020. doi: 10.1016/j.envint.2020.106066.

cannot not help to solve the plastic pollution crisis.

According to a 2020 study, 83% of biodegradable plastic used for packaging is “industrially compostable”<sup>11</sup>, which requires processing under industrial composting conditions, with a temperature higher than 50°C and 55% moisture<sup>12</sup>. In most countries, industrial composting infrastructure is insufficient to process all biodegradable plastics, or simply does not exist.<sup>13</sup>

In addition, manufacturers often provide limited information regarding how biodegradable plastic products should be disposed of after use. As a result, consumers in most regions are likely not aware how to dispose of biodegradable plastics<sup>14</sup>, and these materials are unlikely to end up at the appropriate facility.

### 3. Usage of Biodegradable Plastics

Packaging is the primary use for biodegradable plastics and accounted for 59% of the biodegradable plastics made in 2019, according to industry association data<sup>15</sup>.

Global demand for food packaging and single-use plastic has increased because of the the COVID-19 pandemic, and companies have sought biodegradable alternatives for food packaging and single-use cutlery<sup>16</sup>. Demand for compostable bags was 72,000 metric tonnes in 2017, and is forecast to increase by 9% by 2022<sup>17</sup>.

Agriculture and horticulture reportedly used 14% of all biodegradable plastics manufactured in 2019<sup>18</sup>. Agricultural mulching film is used to improve crop yield in many countries. Though the soil biodegradability and impacts of biodegradable plastics are not yet fully understood, many countries have applied it on a larger scale.

China has the largest mulching area of any country, using up to 2.5 million tonnes of mulching films per year. With a presumed 10% annual switching rate to biodegradables, China alone would need more than 200,000 tonnes of biodegradable mulching films per year<sup>19</sup>.

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<sup>11</sup> Meereboer, K. W., et al. “Review of Recent Advances in the Biodegradability of Polyhydroxyalkanoate (PHA) Bioplastics and Their Composites.” *Green Chem*, vol. 22, 2020, pp. 5519-5558. doi: 10.1039/D0GC01647K.

<sup>12</sup> European bioplastics, “Fact sheet 2009 - Industrial composting.” 2009, [https://docs.european-bioplastics.org/2016/publications/fs/EUBP\\_fs\\_industrial\\_composting.pdf](https://docs.european-bioplastics.org/2016/publications/fs/EUBP_fs_industrial_composting.pdf).

<sup>13</sup> Kaza, S., et al. *What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050*, World Bank, 2018. [openknowledge.worldbank.org/handle/10986/30317](https://openknowledge.worldbank.org/handle/10986/30317) License: CC BY 3.0 IGO.

<sup>14</sup> Moss, E. and Harris, R. “Can I Recycle This? A Global Mapping and Assessment of Standards, Labels and Claims on Plastic Packaging.” United Nations Environment Programme, 2020,

<sup>15</sup> “Applications for Bioplastics.” *European Bioplastics*, [www.european-bioplastics.org/market/applications-sectors/](http://www.european-bioplastics.org/market/applications-sectors/). Accessed 20 Oct. 2020.

<sup>16</sup> Accesswire. “Pandemic Leads to More Single-Use Plastic; Company on a Mission to Reduce Waste with Smart Food Packaging that Won’t Harm the Environment.” *AP News*, 4 Aug. 2020, [apnews.com/press-release/accesswire/8c87be3a403f334f993df5d9f9956be7](https://apnews.com/press-release/accesswire/8c87be3a403f334f993df5d9f9956be7).

<sup>17</sup> *ibid.*

<sup>18</sup> “Bioplastics Market Data.” *European Bioplastics*, [www.european-bioplastics.org/market/](http://www.european-bioplastics.org/market/). Accessed 20 Aug. 2020.

<sup>19</sup> Liu, W. “Standard Upgrade Series: Biodegradable Plastics Are Emerging to Fill in the Alternative Material Market.” *Huan Research*, 2020. [pdf.dfcfw.com/pdf/H3\\_AP202006301388397876\\_1.pdf](https://pdf.dfcfw.com/pdf/H3_AP202006301388397876_1.pdf).

#### **4. Recommendations**

Greenpeace East Asia is calling the Chinese government to take action on the following:

##### **Single-use plastics and products:**

- Prioritize the plan for plastic usage reduction and the development of reusable and refillable models, expand extended producer responsibility schemes to plastic packaging.

##### **Biodegradable plastics:**

- Clearly define “degradable” and “biodegradable” plastics, regulate product labeling and forbid the use of ambiguous terms that can be confusing and misleading for consumers.
- Develop standards and a comprehensive certification scheme, which should include laboratory testing that reflects the biodegradability claims in real-world situations.
- Evaluate local waste disposal and treatment capacity before the promotion of biodegradable plastics, and ensure transparency of information.