

Marine Plastics Pollution

SHORT PAPER

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**EU-China Cooperation on Environment
and Green Economy Project**



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Activity 2.3. Short Paper on marine plastics pollution

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Proactive Response to Plastic Waste and Marine Plastic Pollution – Experience and Lessons from the EU

Plastics, as a basic material, are widely used in packaging, construction, agriculture, automobile, consumer products and home supplies. According to statistics, the global plastics production hit 348 million tons in 2016, of which China accounted for 29.4%, and 28 EU member countries, Norway and Switzerland combined accounted for about 18.5%.

Although plastics are important for sustainable development, the mismanagement at the end of the life cycle leads to certain types of plastic, especially those in packaging and other disposable goods, entering the environment as undegradable primary or secondary microplastics and causing great harm to the marine and other ecosystems. It is a concern shared by China, the EU and the rest of the world. Seeing the effective control of plastic pollution as a key to transitioning towards a resource-efficient circular economy, the EU has invested many efforts and accumulated rich experience in this regard, hence establishing a sophisticated system from which China can learn.

1. The problem of plastic waste and marine plastic pollution in China and the response

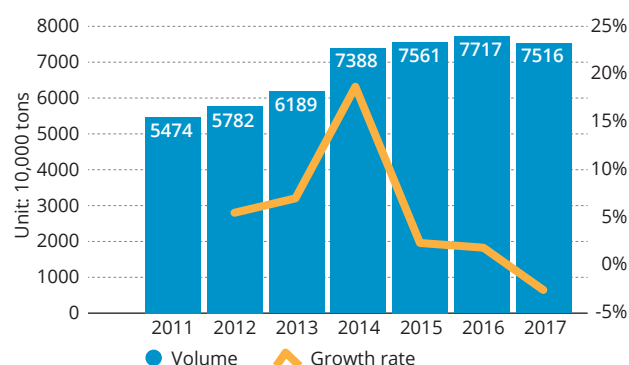
The used plastics may end up in the environment as primary or secondary microplastics. Since plastics are notoriously difficult to break down on natural conditions, the damage they cause to the environment, especially to the marine environment, is long-lasting, which poses a serious threat to the ecosystem and human health.

1.1. The problem of plastic waste and marine plastic pollution in China

China is one of the world's leading producers and consumers of plastics. Statistics show that China's

production in 2017 was around 75 million tons, equivalent to one quarter of the world's total. Plus, China imports around 25 million to 28 million tons a year and consumes 100 million tons a year.

FIGURE 1. CHINA'S PLASTIC PRODUCTION (IN 10,000 TONS) AND GROWTH RATE FROM 2011 TO 2017



According to China Scrap Plastics Association (CSPA), there were 40 million tons of plastic waste in China in 2014, a fair share of which were dumped into the environment rather than being properly reused or recycled, causing lasting damage to the environment.

TABLE 1. THE AMOUNT OF PLASTIC WASTE CONSUMED, DISPOSED AND RECYCLED IN CHINA 2007-2014 (IN 10,000 TONS)

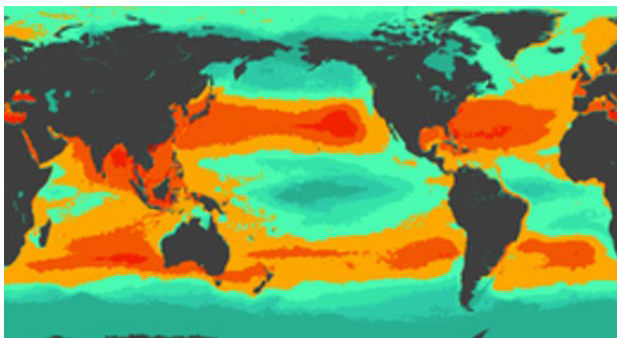
Year	Consumed	Disposed	Recycled
2007	3771	--	800
2008	3500	--	900
2009	4170	--	1000
2010	4693	--	1200
2011	5229	2871	1350
2012	5467	3413	1600
2013	6188	3292	1366
2014	7387	4028	2000

Note: the table is based on China's annual plastic consumption by CSPA

The plastic waste may enter the environment, further run off into the sea or get transported by the winds. In 2015, a research team from the University of Georgia published a paper on the *Science*, estimating that the amount of plastic waste discharged into the ocean in China in 2010 was 1.32-3.53 million tons¹. Professor Li Daoji, director of the Marine Plastics Research Center of East China Normal University, announced his latest research findings in July 2018, saying that in China the amount of plastic waste that made it into the ocean from 2011 to 2016 was between 370,000 and 970,000 tons. According to the *Bulletin of China Marine Environment Status 2017*, plastics contributed the largest share of marine debris, accounting for 87%, 76%, and 74% of the floating trash, beach trash, and seabed trash respectively.

On marine micro-plastics, relevant surveys show that the neighboring seas from north to south in China have been widely polluted, including Qinhuangdao by the Bohai Sea, the area by the Dalian Yellow Sea, East China Sea, and the northern coast of the South China Sea. Microplastics are being discovered in coastal tidal flats, the surface seawater and the seabed sediments. The monitoring results of China's marine departments in 2016 indicated that the average density of microplastics in the surface water in the eastern coastal area was about 0.29 particle /m³. The results in 2017 showed that the average density of microplastics in the surface water monitored was 0.08 particle /m³, with the highest density up to 1.26 particles/m³. The floating microplastics in the sea surface are mostly particles, fibers and fragments mainly made from polystyrene and polypropylene. In 2014, Eriksen and his team used relevant technologies to analyze the distribution of global distribution of microplastics in the sea, which also confirms the conclusion that China's offshore waters have been contaminated by microplastics.

FIGURE 2. GLOBAL DISTRIBUTION OF MICROPLASTICS IN THE SEA (0.33-1MM)



1.2. Existing policy and regulation framework

China is taking actions against plastic waste and marine plastic pollution. In the UN report *Legal Limits on Single-Use Plastics and Microplastics: A Global Review of National Laws and Regulations*, as of July 2018, China was one of 127 countries with the legislation on the management of plastic bags, one of the 27 with a ban on specific plastic products and the production and one of the 30 charging consumers for the use of plastic bags. All in all, China has established a plastic management framework that covers production, import and export, consumption and recycling.

On production, consumption, import, export and use of plastics, *Law of the People's Republic of China on the Prevention and Control of Environmental Pollution by Solid Wastes* stipulates that producers, dealers, importers and users of products shall be liable for the solid waste generated by the products. In 2008, China introduced the "Notice on Restricting the Production, Sale, and Use of Plastic Shopping Bags", putting a national ban on the production, sale and use of plastic shopping bags less than 0.025 mm thick starting from June 1, 2008. In the same year, the *Administrative Measures for the Paid Use of Plastic Bags at Commodity Retailing Places* was introduced to forbid all the supermarkets, shopping malls, markets, among other retailing outlets from providing plastic shopping bags free of charge from June 1, 2008, and consumers must pay for plastic bags. On August 10, 2017, the former Ministry of Environmental Protection, together with other five departments, jointly issued an announcement to move the eight types of household plastic waste from the *Catalogue of Solid Wastes that Can Be Used as Raw Materials under Import Restrictions* to *Catalogue of Solid Wastes Prohibited from Importation*. On April 13, 2018, the industrial plastic waste was moved from *Catalogue of Solid Wastes that Can Be Used as Raw Materials under Import Restrictions* to *Catalogue of Solid Wastes Prohibited from Importation*. **On recycling and reuse,** *Guidelines for the Recovery and Recycling of Plastics Waste 2013* laid out ground rules for the recover (including the recycling) of plastic waste and provided recommendations for the recycling of plastic waste generated from pre- and post-consumer products. The newly implemented action plan on agricultural and rural pollution control explicitly set the requirements for the recycling of mulching film. **On source governance,** at the end of 2018, China initiated waste-free city pilot in a bid to effectively reduce the generation of waste. In addition, laws, regulations,

¹ Estimates of the amount of plastic waste discharged into the ocean in China vary widely

and rules on marine environmental protection also include provisions on strengthening the prevention of plastic waste from getting into the sea, which will generally reduce the plastic waste and marine plastic pollution at source. At the local level, 11 coastal provinces in China developed and implemented provincial-level coastal water pollution prevention and control plan to enhance the regulation over the riverside and seaside discharge outlets and step up prevention and special monitoring of marine debris (microplastics), and experimented with the “bay chief system”.

The management framework for plastics and plastic waste consists of multiple departments. Responsibilities regarding the production, consumption, import and export, recycling and pollution prevention and control are spread over the National Development and Reform Commission, the Ministry of Industry and Information Technology, the Ministry of Ecology and Environment, the Ministry of Commerce, and the State Administration for Market Regulation. As for the control of marine plastic pollution, the Ministry of Ecology and Environment has taken over the baton from the State Oceanic Administration since the institutional reform of the State Council in 2018 in a bid to “integrate the protection of the land and the sea”. At present, the Marine Ecology and Environment Department of the Ministry of Ecology and Environment is responsible for the regulation of the national marine ecosystem, the discharge of land-based pollutions into the sea, and the prevention and control of the marine pollution caused by coastal and marine construction projects, offshore oil and gas exploration, and waste dumping. The department has demarcated a zone for waste dumping. The Marine Ecology and Environment Department has five divisions, among which the Marine Ecological Protection and Environmental Quality Management Division is responsible for formulating marine environmental quality standards, assessment of targets, assessment of marine ecosystem surveys, marine ecological protection and prevention and control of marine debris (microplastics) and persistent organic pollutants, as well as regulation and coordination of the protection of deep-ocean and Arctic marine ecosystems.

1.3. Latest Developments

Recently, China has carried out the following work to tackle the pollution of plastics and marine plastics:

- ¶ Improving relevant laws, regulations and standards-Currently, the Ministry of Ecology and Environment is taking the lead to draft the “Technical Specifications for Application and Verification of

Pollutant Discharge Permits for Waste Processing Industry” to regulate industries including waste dismantling, waste plastics processing and recycling, waste tire processing and recycling, waste mineral oil processing and utilization, and waste battery.

- ¶ Holding corporate culprits accountable-The “Technical Specifications for Comprehensive Utilization of Plastic Waste” promulgated by the Ministry of Industry and Information Technology (hereinafter referred to as the “Specifications”) has come into effect since 2018. The Specifications covers industries such as the PET bottle flakes recycling industry, the crushing, cleaning and sorting of plastic waste, and plastic granules recycling. As industries that require strict environmental protection standards, the Specifications clearly stipulated that the plastic waste shall be “reused and recycled efficiently” and set standards on energy consumption. For example, in the recycling of plastic waste, “dumping, incineration and landfill” are strictly prohibited; in reuse and processing, the energy consumption for processing every ton of plastic waste shall be no more than 500 kWh; while in the PET bottle flakes recycling industry, the crushing, cleaning and sorting of plastic waste, water consumption per ton of plastic waste shall not exceed 1.5 tons.
- ¶ Optimizing the import and export structure-On Apr 13th, 2018, industrial plastic waste was moved from the *Catalog of Solid Waste that Can Be Used as Raw Materials under Import Restrictions* into the *Catalog of Solid Waste Prohibited from Importation*, and the change has been in effect since Dec 31st 2018.
- ¶ Setting up pilot programs on marine microplastics monitoring-China has started pilot projects on monitoring of marine microplastics since 2016 and has arrived at an initial understanding of microplastic pollution in key waters and marine organisms in China. Monitoring results show that compared with other sea areas around the world, China’s marine micro-plastic pollution is generally at a medium-low level, and is of the same order of magnitude as the Midwest Mediterranean and the Japanese Seto Inland Sea.
- ¶ Staying active in international cooperation and exchanges-Under the China-Japan High-level Consultations on Maritime Affairs, the China-Japan Experts Dialogue Platform on Marine Debris Cooperation has been established to carry out research on marine microplastics monitoring

and measuring of environmental impacts. China also participated in the UNEP Cooperation on Marine Litter and Microplastics.

2. EU Experience in managing plastic wastes and marine plastic pollution

2.1. Production, use, recycling and disposal of plastics in the EU

The plastics industry has made great contribution to the EU economy. The industry, recycling included, has hired 1.6 million people, involved 50,000 small and medium enterprises, and generated an annual turnover of 260 billion euros. In 2017, the largest plastics producer in Europe was Germany (24.6%), followed by Italy (14%). France and Spain had the largest demand, totaling 51.2 million tons, and the largest six European countries combined accounted for about 70% of the total. EU's demand for plastics comes from packaging (39.7%), construction (19.8%), motor vehicles (10.1%), electronic appliances (6.2%), houseware (4.1%), agriculture (3.4%), and others (16%).

The life cycle of plastics ranges from less than 1 year to 50 years. Among the disposed plastics, 31.1% are recycled, 27.3% end up in landfills, and 41.6% are used for energy recovery. During 2006-2016, the amount of recycled plastics worldwide increased from 4.7 million to 8.4 million tons (of which 63% take place in the EU). Meanwhile, the amount of plastics ending up in landfills fell from 12.9 million to 7.4 million tons, down 43%, and that for energy recovery increased from 7 million to 11.3 million tons. In 2016, for the first time the recycled plastics outnumbered those sent to landfills. From 2006 to 2016, the amount of recycled plastic packaging increased from 14.9 million to 16.7 million tons. The landfilling rate dropped continuously. 40.8% were recycled, 38.8% used for energy recovery, and 20.4% sent to landfill. In 2016, the recycling rate of plastic packaging in 19 EU member countries combined exceeded 35%, of which Germany and the Czech Republic alone contributed over 50%. Of all sources of waste plastics in the EU in 2015, 59% come from packaging and 8% from electronics and electrical appliances and construction, with automobiles and agriculture each accounting for 5%. To better tackle the plastics waste, the EU has adopted "Plastics 2030", a guiding strategy to deal with plastics waste Europe-wide which is backed by the plastics industry in European. The strategy is set to manage key plastic products and prevent plastics leakage into the environment. Under "Plastics 2030", the plastics industry has made voluntary commitment that focuses on accelerating

resource efficiency and increasing re-use and recycling with the ambitious targets to reach 60% for plastics packaging by 2030 and 100% by 2040.

Marine plastic pollution has become the primary concern at the UN General Assembly. Research estimated that there were about 4.8-1.2 million tons of plastics ending up in the ocean in 2010, mainly originating from China and Southeast Asian countries.

2.2. Laws and Policies Regulating Plastics in the EU

1) The EU Waste Framework Directive

The European Commission has created a set of standards for waste recycling and re-use, requiring member states to develop their own national waste prevention plans based on the standards. The EU adopted the Waste Framework Directive (Directive 2008/98/EC) (WFD) in October 2008, a basic legal framework for waste disposal in Europe that provides for the management of waste within the EU. Its purpose is to reduce the environmental impact of waste and encourage efficient use of resources by reuse, recycling and other measures.

The Amendments to the Waste Framework Directive (EU) 2018/851, published in the Official Journal, also made amendments to the Packaging and Packaging Waste Directive (EU) 2008/852. The revised waste legislation sets new recycling targets and a mandatory extended producer responsibility scheme. Suppliers of articles which contains substances of very high concern (SVHC) are required to inform the European Chemicals Agency (ECHA) which is also developing a new portal for industry to submit information. Member States are required to take actions to stop generating marine litter, to prevent, reduce and clean the waste, as well as to identify the major source of marine litter.

The directive embodies the concept of sustainable waste management and applies priority order when it comes to waste management (i.e. the waste management hierarchy: prevention, preparing for re-use, recycling, recovery and disposal). The directive clarifies the concept and definition of "waste", "by-products", "recycling", "energy recovery" and "waste terminal". It also promotes appropriate waste disposal technologies and sets requirements on recycling and reuse, separate collection of organic waste and extended producer responsibility. The specific targets for reuse and recycling and the timetable are laid out by the directive to secure the implementation.

Plastic Packaging Management Directive and Producer Responsibility Extension (EPR)

Packaging is the main source of single-use plastics. The European Union adopted the Packaging and Packaging Waste Directive (PPWD) in 1994 and revised it in 2018. The objectives of this Directive, on the one hand, are to prevent any impact from packaging and packaging waste on the environment or to reduce such impact, thus providing a high level of environmental protection, and, on the other hand, are to ensure the functioning of the internal market and to avoid obstacles to trade and distortion and restriction of competition within the Union. The Directive, setting specific objectives for member states to achieve though, cannot be directly applicable in EU countries. It must first be transposed into national law.

The Packaging and Packaging Waste Directive (PPWD) is to coordinate different measures by setting a common rule that enables free trade of packaging and packaging of goods EU-wide. It aims to a.) help prevent trade barriers and b.) reduce the environmental impact of packaging. It contains the “essential designed requirements” for packaging design. Packaging that meets these requirements is guaranteed free circulation. It also puts forth objectives that oblige Member States to recycle or recover certain amount of used packaging. The European Council adopted PPWD in the early 1990s to address obstacles to free movement of packaging and packaged goods caused by distortions of competition.

The European Packaging and Packaging Waste Directive regulates packaging materials which are often discarded by consumers to environmental soil after use. Consequently, hazardous substance contained will cause direct pollution to the soil and water. The Directive restricts the presence of four major heavy metals (lead, mercury, cadmium and hexavalent chromium) in packaging and sets concentration limits of no more than 100 ppm on lead (Pb), cadmium (Cd), mercury (Hg), hexavalent chromium (Cr+6). Materials under regulation include packaging cartons, cardboards, wooden frames, film boxes, plastic bags, bubble bags, foam, Polylon, fixtures, sheets, ropes, paints, inks, tapes, glues, cable ties, labels, instructions, etc.

The Directive contains 25 articles, namely objectives, scope, definitions, prevention, recovery and recycling, return, collection and recovery systems and marking and identification systems, standardization, concentration levels of heavy metals, information systems, information for users of packaging, management plans, notification, obligation to report,

freedom to place on the market, adaptation to scientific and technical progress, specific measures, committee procedure and implementation in national law.

This Directive lays down measures aimed at preventing the production of packaging waste and, at reusing packaging, at recycling and other forms of recovering packaging waste and, therefore, at reducing the final disposal of such waste. Other prevention measures including national action plans and introducing extended producer responsibility schemes to reduce the impact of packaging waste on environment.

The attainment of the recycling and recovery targets with specific measures provides foundation to meeting main objectives in the Directive. The Paragraph 1 of Article 6 provides for specific recovery and recycling targets the EU member states must meet. This Directive also obligates Member States to take necessary measures to build return, collection and recovery systems for used packaging and/or packaging waste from the consumer, other final user, or from the waste stream in order to channel it to the most appropriate waste management alternatives; it also stipulates that these systems shall be open to the participation of the economic operators of the sectors concerned and to the participation of the competent public authorities. They shall also apply to imported products under non-discriminatory conditions, including the detailed arrangements and any tariffs imposed for access to the systems, and shall be designed so as to avoid barriers to trade or distortions of competition in conformity with the Treaty. To put differently, the Directives obliges non-EU states to abide by the EU's rules on return, collection and recovery of packaging waste when exporting goods to the EU.

To facilitate collection, reuse and recovery including recycling, packaging shall indicate for the purposes of its identification and classification. Packaging shall bear the appropriate marking either on the packaging itself or on the label. It shall be clearly visible and easily legible. The marking shall be appropriately durable and lasting. To mobilize consumers to attain the objectives of recovery, return and reuse, access to information for users of packaging must be provided.

Under the Directive, the Commission shall, as appropriate, promote the preparation of European standards relating to the essential packaging requirements to prevent any impact of packaging on the environment, in particular, the preparation of

European standards relating to:

- ¶ criteria and methodologies for life-cycle analysis of packaging,
- ¶ the methods for measuring and verifying the presence of heavy metals and other dangerous substances in the packaging and their release into the environment from packaging and packaging waste,
- ¶ criteria for a minimum content of recycled material in packaging for appropriate types of packaging,
- ¶ criteria for recycling methods,
- ¶ criteria for composting methods and produced compost,
- ¶ criteria for the marking of packaging

PPWD adopted in 1990 also establishes Extended Producer Responsibility (EPR) schemes aimed at minimizing the environmental impact of packaging.

In July 2014, the EU released a report in review of targets related to recycling and recovery of other wastes. It encourages a transition towards a circular economy. The transparency and cost-effectiveness of EPR will also be improved. The WFD provides for the minimum requirements for EPR, and the Member States shall implement it through their national packaging waste policies.

Since the introduction of PPWD in 1994, it has been a key driver of the steady increase in packaging recycling. According to the latest official data from the EU in 2012, 64.6% of the used packaging was recycled and 78.5% recovered. However, within the EU, the efficiency of packaging waste management varies greatly from country to country.

For WFD and PPWD, EPR is a policy approach which obliges producers to take some or all financial and operational responsibility for its products and/or packaging during its life-cycle, including the post-consumer phase to meet the recycling and recovery objectives and targets at national or EU level. In almost all Member States, the responsibility for fulfilling recovery and recycling targets have been shifted towards producers who must draft an EPR plan for the used package to ensure compliance. Since PPWD does not specify how Member States should implement EPR, or how the responsibilities and cost of packaging waste collection and

classification should be divided between participants (such as producers, local authorities, private or public waste management companies or consumers) and EPR requirements. Also, the practice is different, and the EPR must meet certain requirements before the producer can obtain the business license.

The EPR schemes can ensure that packaging waste is collected, sorted and recycled under statutory objectives, and that the producer/importer provides funding for the specific materials paid for the packaged EPR schemes on the national market. These fees are charged based on the tonnage (weight) of packaging that the producer places on the market, this incentivizing the optimization of materials. These days European producers pay approximately €3.1 billion per year for EPR solutions. The cost per ton of packaging material placed on the market varies from country to country, partly due to the differences in obligations and responsibilities of each Member State. The fees paid by producers to the EPR schemes typically include all or some of the cost of separate collection/classification of used packaging and consumer awareness campaigns.

In some Member States, the fees paid to the EPR schemes are used to pay private or public waste management companies that collect and classify post-consumer packaging waste (e.g. Spain, Czech Republic). While in other countries, these costs are paid separately to local authorities that collect packaging waste or designate (a contractor to collect on their behalf (such as Austria, Belgium, Sweden). The used packaging collected and sorted will be sold to recyclers or energy recovery operators. Normally, the revenues from the sales of secondary materials will balance out the financial contribution made by producers and importers to EPR schemes.

The EU Marine Strategy Framework Directive

In June 2008, the EU Marine Strategy Framework Directive to establish guidelines and methodological standards for Member States. The Directive was revised in 2017. The EU is proposing a directive to reduce the environmental impact of certain plastic litter, namely the EU Directive on Disposable Plastics and Fishing Gear which lays out different measures to be applied to different plastic articles. For products governed by waste regulations, the recycling and recovery rates should be increased (plastic bottles for example). Where alternatives are readily available, single-use plastic products will be banned from the market (e.g. plastic straws). Where alternatives are still under R&D (such as plastic containers), the aim should be limiting the use of the products.

For products without straight-forward alternatives (e.g. sanitary products, cigarette butts), the focus is on limiting the harm and inform the public.

The EU Development Strategy towards Circular Economy and the EU Plastics Strategy

In December 2015, the European Commission adopted the EU Circular Economy Action Plan. The plan identified the management of plastics as a priority and promised to “prepare a strategy to address the challenges posed by plastics to the entire value chain by taking into account its impact throughout the entire life cycle”. In 2017, the European Commission confirmed that it would focus on the production and use of plastics and was committed to guaranteeing 100% recycling of all plastic packaging.

The EU Plastics Strategy was released in 2018. The EU is best placed to lead the transition to the plastics of the future. By pursuing these aims, the strategy will also help achieve the priority set by this Commission for an Energy Union with a modern, low-carbon, resource and energy-efficient economy and will make a tangible contribution to reaching the 2030 Sustainable Development Goals and the Paris Agreement.

By 2030, all plastics packaging placed on the EU market is either reusable or can be recycled in a cost-effective manner. Changes in production and design enable higher plastics recycling rates for all key applications. By 2030, more than half of plastics waste generated in Europe is recycled. The classification and collection of plastic waste will reach a fairly high level. Recycling of plastics packaging waste achieves levels comparable with those of other packaging materials. EU plastics recycling capacity is significantly extended and modernized. By 2030, sorting and recycling capacity has increased fourfold since 2015, leading to the creation of 200 000 new jobs, spread all across Europe. Using more recycled plastics can reduce dependence on the extraction of fossil fuels for plastics production and curb CO₂ emissions, in line with commitments under the Paris Agreement. Europe confirms its leadership in sorting and recycling equipment and technologies. Exports rise in lockstep with global demand for more sustainable ways of processing end-of-life plastics. Construction and the automotive, furniture and electronics sectors are also important applications for plastics use and are a significant source of plastics waste that could be recycled. For these applications, lack of information regarding the possible presence of chemicals of concern (e.g. flame retardants) creates a significant obstacle to achieving higher recycling rates. As part of its work on the interface between

chemicals, waste and product policies, the Commission is proposing to accelerate work in order to identify possible ways to make chemicals easier to trace in recycled streams. The aim will be to make it simpler to process or remove these substances during recycling, thus ensuring a high level of health and environmental protection.

In addition, the Commission also remains committed to developing, where appropriate, product requirements under the Ecodesign Directive that take account of circular economy aspects, including recyclability. This will make it easier to recycle plastics used in a wide variety of electrical appliances and electronic goods. The Commission has already proposed mandatory product design and marking requirements to make it easier and safer to dismantle, reuse and recycle electronic displays (e.g. flat computer or television screens). It has also developed criteria to improve recyclability of plastics in its Ecolabel and Green Public Procurement criteria (e.g. marking large plastic parts to facilitate sorting, designing plastic packaging for recyclability, and designing items for easy disassembly in furniture and computers).

One of the reasons for the low use of recycled plastics is the misgivings of many product brands and manufacturers, who fear that recycled plastics will not meet their needs for a reliable, high-volume supply of materials with constant quality specifications. Plastics are often recycled by small and predominately regional facilities, and more scale and standardization would support smoother market operation. With this in mind, the Commission is committed to working with the European Committee for Standardization and the industry to develop quality standards for sorted plastic waste and recycled plastics.

A greater integration of recycling activities into the plastics value chain is essential and could be facilitated by plastics producers in the chemical sector. Their experience and technological expertise could help reach higher quality standards (e.g. for food grade applications) and aggregate offer for recycled feedstock.

The Commission ensures that by 2025, ten million tons of recycled plastics find their way into new products on the EU market. It has also developed criteria to improve recyclability of plastics in its Ecolabel and Green Public Procurement criteria.

Reducing fragmentation and disparities in collection and sorting systems could significantly improve the economics of plastics recycling, saving around a

hundred euros per ton collected.³⁴ To encourage more standardized and effective practices across the EU, the Commission will issue new guidance on separate collection and sorting of waste.

Establishing a clear regulatory framework for plastics with biodegradable properties

In response to the high level of plastic leakage into our environment and its harmful effects, solutions have been sought to design biodegradable and compostable plastics. Targeted applications, such as using compostable plastic bags to collect organic waste separately, have shown positive results; and standards exist or are being developed for specific applications.

However, most currently available plastics labelled as biodegradable generally degrade under specific conditions which may not always be easy to find in the natural environment, and can thus still cause harm to ecosystems. Biodegradation in the marine environment is particularly challenging. In addition, plastics that are labelled 'compostable' are not necessarily suitable for home composting. If compostable and conventional plastics are mixed in the recycling process, it may affect the quality of the resulting recyclates. For consumer applications, the existence of a well-functioning separate collection system for organic waste is essential.

It is important to ensure that consumers are provided with clear and correct information, and to make sure that biodegradable plastics are not put forward as a solution to littering. This can be achieved by clarifying which plastics can be labelled 'compostable' or 'biodegradable' and how they should be handled after use. To allow adequate sorting and avoid false environmental claims, the Commission will propose harmonised rules for defining and labelling compostable and biodegradable plastics. It will also develop lifecycle assessment to identify the conditions under which the use of biodegradable or compostable plastics is beneficial, and the criteria for such applications.

Finally, some alternative materials claiming biodegradability properties, such as 'oxo-degradable plastics', have been found to offer no proven environmental advantage over conventional plastics, while their rapid fragmentation into microplastics cause concerns. Therefore, the Commission has started work with the intention to restrict the use of oxo-plastics in the EU.

Achieving the objectives laid out in this strategy will require major investments in both infrastructure

and innovation. Meeting ambitious goals on plastics recycling alone will require an estimated additional investment of between EUR 8.4 and 16.6 billion. Therefore, creating an enabling framework for investment and innovation is central to implementing this strategy.

The EU will continue to support international action, promote best practices worldwide, and use its external funding instruments to support improved waste prevention and management around the world. In particular, the Commission will continue to make use of policy dialogues on environment and industry and dialogues under free trade agreements, and to actively cooperate in Regional Sea Conventions. It will also take an active part in the working group established by the United Nations Environment Assembly in December 2017 to work on international responses for combating plastic marine litter and microplastics. In 2018, the Commission will launch a dedicated project to reduce plastic waste and marine litter in East and South-East Asia, where the problem is growing fast. It will also examine possible ways to take action to reduce plastic pollution in the Mediterranean, in support of the Barcelona Convention, and in major world river basins, as a vast proportion of waste plastic is carried by rivers before it reaches the seas. Finally, the Commission will facilitate the cooperation of the outermost regions of the EU66 with their neighbours along the Caribbean Sea, the Indian, Pacific and Atlantic Oceans across different fields, including in waste management and recycling.

2.3. EU Experience in managing disposable plastics and marine plastics

EU Policies and Measures on Disposable Plastics and Marine Plastics

The EU Strategy for Plastics also addresses the growing consumption of "single-use" plastics consumption, i.e. packaging or other consumer products that are thrown away after one brief use, are rarely recycled and prone to being littered. Single-use plastics items are a major source of plastic leakage into the environment, as they can be difficult to recycle, are often used away from home and littered. They are among the items most commonly found on beaches, and represent an estimated 50% of marine litter.

These include small packaging, bags, disposable cups, lids, straws and cutlery, for which plastic is widely used due to its lightness, low cost, and practical features. In addition, the increasing market shares of plastics with biodegradable properties bring new opportunities as well as risks. In the absence of clear labelling or marking for consumers,

and without adequate waste collection and treatment, it could aggravate plastics leakage and create problems for mechanical recycling.

Where waste management is sub-optimal, even plastic waste that has been collected can find its way into the environment. More recycling of plastics used in agriculture (such as plastic mulching films or greenhouses) can contribute to reduce leakages in the environment.

Marine litter from sea-based sources is also significant. Fishing gear abandoned at sea can have particularly harmful impacts through entanglement of marine animals. The EU has already taken steps by setting requirements for Member States to adopt measures to cut the consumption of plastic bags and to monitor and reduce marine litter. EU funding is also being deployed to understand and combat the rise of marine litter, supporting global, national and regional action. EU rules supporting higher recycling rates and better waste collection systems are also important in helping to prevent leakage. In addition, through its upcoming legislative proposal for a revision of the Drinking Water Directive, the Commission will promote access to tap water for EU citizens, therefore reducing packaging needs for bottled water. The criteria for the Ecolabel and Green Public Procurement also promote reusable items and packaging.

Additional measures at EU and national levels can be developed to reduce the unnecessary generation of plastic waste, especially waste from single-use items or over-packaging, and to encourage the reuse of packaging.

Extended Producer Responsibility schemes at national level can also help finance action to curb plastic litter. Targeted deposit schemes can help reduce littering and boost recycling, and have already helped several countries achieve high collection rates for beverage containers.

In order to reduce ship waste, the European Commission and the Strategy put forward a new legislative proposal seeking to improve port reception facilities for ship waste. It was proposed to amend the Directive on Port Reception Facilities to ensure ship-generated garbage and waste collected at the sea can be returned to land for proper management.

On this basis, the Commission will also develop targeted measures to reduce the loss or abandonment of fishing gear at sea. A directive for disposable plastics and fishing gear was proposed in May

2018 with political intentions reached in December. Discussions include deposits, extended producer responsibility, and regeneration targets. The Commission will further study the impact of aquaculture to marine litter and examine various measures to minimize the loss of plastics in aquaculture. Finally, the Commission will continue its efforts to improve understanding and monitoring of marine litter, an essential but often overlooked means of effective prevention and recovery measures.

Progress in Research and Monitoring of Microplastics in the EU

In the EU, 150 000 to 500 000 tonnes of plastic waste enter the oceans every year. This represents a small proportion of global marine litter. In addition to harming the environment, marine litter causes economic damage to activities such as tourism, fisheries and shipping. For instance, the cost of litter to EU fisheries was estimated at about 1 % of total revenues from catches by the EU fleet.

New sources of plastic leakage are also on the rise, posing additional potential threats to both the environment and human health. Microplastics, tiny fragments of plastic below 5mm in size, accumulate in the sea, where their small size makes it easy for marine life to ingest them. They can also enter the food chain. Recent studies also found microplastics in the air, drinking water and foods like salt or honey, with yet unknown impacts on human health. In total, it is estimated that between 75 000 and 300 000 tonnes of microplastics are released into the environment each year in the EU. While a large amount of microplastics result from the fragmentation of larger pieces of plastic waste, significant quantities also enter the environment directly, making it more challenging to track and prevent them.

Microplastics are intentionally added to certain product categories (such as cosmetics, detergents, paints), dispersed during the production, transport and use of plastic pellets, or generated through wear and tear of products such as tyres, paints and synthetic clothes. Currently, the EU Urban Waste Water Treatment Directive is under review with emphasis on microplastics.

Microplastics intentionally added to products represent a relatively small proportion of all those in the sea. However, since they are relatively easy to prevent and in response to public concern, several countries have already taken action to restrict their use, while the cosmetic industry has also taken voluntary action. Bans are under consideration or planned in several Member States and this may lead to fragmentation in the

single market. In line with the REACH procedures for restricting substances that pose a risk to the environment or health, the Commission has therefore started the process to restrict the use of intentionally added microplastics, by requesting the European Chemicals Agency to review the scientific basis for taking regulatory action at EU level.

More research is needed to improve our understanding of the sources and impacts of microplastics, including their effects on the environment and health, and to develop innovative solutions to prevent their dissemination. This can include ways to improve the capture of microplastics in waste water treatment plants, as well as targeted measures for each source. A Cross Industry Agreement for the prevention of microplastic release into the aquatic environment during the washing of synthetic textiles is set to develop first proposals on test methods in 2018. For its part, the Commission will consider measures such as labelling and specific requirements for tyres, better information and minimum requirements on the release of microfibrils from textiles. Extended producer responsibility schemes can also be envisaged, where relevant, to cover the cost of remedial action. Microplastics also need to be monitored in drinking water, where their impact on human health is still unknown.

3. Case Analysis in EU Member States

3.1. The “Green Dot” in Europe

In order to promote waste sorting and recycling, European countries use economic incentives to guide consumer behavior. Since early days, economic policies have been applied to waste management to provide funds for waste treatment, and to stimulate and encourage behavioral change among citizens and manufacturers. Economic policies include regulatory ones and economic incentives. The regulatory policies aim to drive changes in cost structure of products to guide behavior of producers and consumers, urging stakeholders to fulfill their responsibility of waste recycling and waste reducing. Measures include garbage charges (Pay-As-You-Throw), landfill fees (taxes), and deposit refund scheme. Economic incentives, on the other hand, are designed to encourage producers and consumers to take proactive measures to reduce waste. Specific measures include concessional loans, subsidies and so on. At present, landfill fees (taxes) and garbage charges are successful and widely used.

At Member States level, many countries in the European Union use economic policies to encourage

waste sorting and recycling. Waste sorting in the Netherlands adopts different charging standards for different types of waste. For example, recyclable waste such as waste paper and discarded metal can be subsidized, while charges for garbage that cannot be sorted and recycled will be higher. The city of Freiburg, Germany, only charges domestic waste that is sorted and collected in gray bins (waste that cannot be recycled), and encourages sorting of recyclable waste. In Finland, in order to encourage waste sorting among residents, the disposal fee charged for sorted waste is generally about 40% lower than the disposal fees for mixed wastes.

European countries also give full play to the role of industrial organizations. As an information hub, industrial organizations have the advantage of sharing information among different companies within the sector, hence contributing to a circular economy. In Germany industrial organizations serve as a bridge in the management of municipal solid waste. For example, the German Chamber of Commerce and Industry and the Industrial Federation have established an information network. Both companies that produce recyclable waste and companies with demand for fertilizers made of compostable waste can publish their monthly supply and needs the monthly newsletter “Garbage Exchange”. According to the survey, one-quarter of the suppliers can successfully find a market for their scrap materials, while one-third of the demand side can be provided with materials they need through the platform. France, Italy, Denmark, the Netherlands and other countries have also established similar institutions, and there are also extensive exchanges and cooperation between industrial organizations across countries.

Alternative materials (such as bio-based plastics or plastics produced from carbon dioxide or methane) offer the same functions as traditional plastics with potentially lower environmental impacts. Such materials are under development and currently account for only a small fraction of the market. Evidence shows that increasing use of these alternatives is more sustainable and helps reduce our dependence on fossil fuels.

3.2. Case Analysis: Plastic Pollution Management in the EU

The Member States have taken proactive measures against plastic bags through initiatives and legislation. The Austrian government departments in charge of agricultural, forestry, environmental, and marine matters, for example, have worked with the major producers of plastic bags and NGOs to launch an initiative “Goodbye, plastic bags” to reduce the

production and consumption. Under the initiative, the use of plastic bags in Austria will be halved by 2019. At the national level, some Member States have introduced tax policies restricting the production and use of plastic bags, such as Belgium (2007), Denmark (1994), Hungary (2011), Ireland (2001), Malta (2009), Portugal (2015) and the UK (2017) where single-use plastic bags and plastic tableware are taxed.

In addition, some countries have developed policies for plastic microbeads in cosmetics. Italy, Sweden, France, Finland, the United Kingdom among other countries will completely ban the use of micro-plastics for cosmetics; in Austria, cosmetics that do not contain micro-plastics are labeled as eco-friendly; Germany has included micro-plastic particles into its marine environmental monitoring program. Belgian has published manual to instruct industries to prevent the leakage of micro-plastics into the environment.

Similarly, some countries have introduced policies regulating plastic packaging. For example, Bulgaria, Croatia, Finland, Estonia, the Netherlands, Malta and Poland have detailed provisions regulating the production, consumption, disposal and recycling of packaging materials. Countries such as Spain, Sweden and the United Kingdom have implemented producer responsibility schemes to regulate the recycling of plastic products and packaging.

3.3. Case Analysis: Response to Marine Plastic Pollution in EU Member States

Policies to Address Plastic Litter Reaching the Sea

Many countries in the European Union have established domestic waste laws and regulations or plans for plastics to prevent leakage of plastics into the ocean, such as waste management plans, regulations and rules in Ireland, Italy, the Netherlands, Greece, Denmark, Germany, Finland, Spain, and the United Kingdom. In addition, some countries have adopted regional and international conventions as legal tools to reduce sea-based waste. For example, the International Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matters adopted by Finland and Malta; MARPOL 73/78 adopted by Belgium, Germany, Greece, Ireland, Romania and other countries.

Policies to Address Existing Plastic Litter in the Sea

In Europe, policies dealing with existing plastic waste in the ocean is mostly related to scientific research, monitoring projects and clean-up operations.

In fishery, OSPAR states claim to have implemented the Marine Litter Action Plan to mobilize fishermen to transport litter caught on the sea to ports to remove marine litter. Eight countries including Germany, the Netherlands and the United Kingdom have implemented the program; France, Italy, Spain and other nine countries have taken measures such as collecting lost or abandoned fishing nets and other waste, redesigning fishing gears and others to reduce marine debris.

In terms of project monitoring, the French Ministry of the Environment, Energy and the Sea focuses, highly concerned with cigarette butts and their toxicity, is looking into the environmental impact and recyclability. 8 European countries including Greece, the Netherlands and Portugal have developed marine waste research plans and monitoring programs. The Austrian ministries in charge of agriculture, forestry, environment, and water affairs have jointly implemented the Danube River monitoring scheme. Bulgaria and Greece have jointly conducted water quality control and monitoring of the beach.

In terms of research on potential measures, Lithuania has studied types and quantities of the waste and the channels through which it gets into the marine environment and the damage it has caused; the Dutch government has conducted research on improving the methods of monitoring micro-plastics, developed methods to monitor micro-plastics in freshwater and assessed the possibility of monitoring river debris.

In terms of waste disposal, the Netherlands, Poland and Sweden among nine countries have also carried out beach and ocean cleanup operations, including awareness raising campaign against littering, supporting volunteers in beach cleanup activities, and collecting waste in waterways and ports; Lithuania has developed laws and regulations for land waste management in coastal cities.

Recommendations on EU-China Cooperation in the Area

Based on China's situation and the EU's experience in the field, in order to further enhance China's capacity in managing plastic waste and marine plastics pollution, this short paper suggests the following recommendations for consideration:

First, cooperate with the EU in building a sound legal system for the prevention and control of plastic waste pollution and marine plastics pollution. Although China has established a preliminary policy and legal framework to regulate plastics,

it requires further improvement through learning from EU experience. For example, China's "Restricting Order on Plastic Bags" has been in place for 10 years, but the effect is minimal. The fundamental reason lies in the fact that the "Order" has not penetrated into every corner of the consumer market and the supporting measures, as well as punishments and incentives are lacking. In this regard, it is recommended to draw on the EU experience to revise and upgrade the "Restricting Order" as soon as possible to regulate the use of plastic bags in e-commerce, express delivery, and take-out food industries. On top of a sound policy framework, it also requires a consistent mechanism for effective implementation and enforcement. Timely revision of relevant laws and regulations on pollution prevention and control (Marine Environment Protection Law, Water Pollution Prevention and Control Law, Solid Waste Pollution Prevention and Control Law), as well as on urban and rural planning shall be carried out to ensure that prevention and control of marine plastic waste pollution is explicitly incorporated. Relevant standards and technical specifications shall be updated. The EU's experience in coordinating different departments to work together in this regard is of high relevance to China in building such a coordination mechanism.

The second is to learn from the EU in whole-process management and regulation of plastic wastes and marine plastics. Strict regulation for all links in marine

plastics management, from production, utilization, recycling to land plastic wastes reaching the sea and marine litter, shall be put into force with reference to European experience. In production, the use of environmentally-friendly and recyclable materials shall be encouraged to replace plastics production. Efforts shall also be made to extend the service life of plastic products and to improve the recycle rate and reuse rate of plastic products. Learn from the EU in eco-labeling and ecological design of plastic products to enhance public's understanding in plastics and encourage behavioral change. Market and non-market means and incentives to stimulate company-level changes is another key area for exchanges with the EU. The objective is to guide companies to drop microbeads in developing personal-care products and to encourage them to find more natural and degradable matte particles, so as to phase out the use of microplastics in personal-care products and detergents. Moreover, the EU's experience in land-sea planning can serve China well. For example, China can learn from the EU in land-based waste control and in establishing standards for plastic

waste content in sewage outlets (to sea and river). It is also necessary to improve the coastal city's capacity of plastic waste collection, interception and disposal in urban sewage and rainwater pipeline networks. The role of the "Bay/River/Lake-Chiefs" in supervising and managing plastic waste in bays, rivers, lakes and bays shall be further clarified and strengthened, and piling of garbage near the coast as well as illegal dumping of garbage into the sea shall be strictly prohibited. Finally, the EU sets a great example in fishery and ship waste management. Drawing on the European experience, China shall further improve its waste disposal facilities in fishery and improve waste collection and centralized treatment of waste from aquaculture and cruise tours. The use of plastic facilities shall be restricted or prohibited in aquaculture, and illegal discharge of ship garbage and cargo residues into the sea shall be strictly prohibited. Centralized collection and on-shore reprocessing of ship wastewater and ship waste shall be promoted.

Thirdly, cooperate with the EU in transboundary treatment of plastic waste. As an economic community, the European Union, consisting of different sovereign states, is a micro-international bloc whose recycling and recycling of plastic waste have gone beyond national boundaries. The transfer, transport and trade of the plastic waste entails EU-wide regulation, coordination and enforcement. Given the rich experience the EU has in dealing with and responding to the issues above, it will serve China to cooperate with the EU in this area.

Finally, cooperate with the EU in global governance of plastic waste and marine plastic pollution. Plastic waste is a global concern as it derives from diverse land-based sources and drifts about on the sea. A challenge of such scale should be addressed by concerted efforts of all countries. EU-level policies and regional ocean conventions play a very important role in the prevention and control of marine debris in member countries. China should also step up the cooperation with the EU in this field to be part of the international efforts in addressing global plastic waste and marine plastic pollution, and make realistic commitments to act responsibly a major country.

Marine Plastics Pollution

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