PLASTIC WASTE TRADE

THE HIDDEN NUMBERS

March 2023

UNIVERSITY OF GOTHENBURG

The Last Beach Cleanup

MIKROPLASTİK ARAŞTIRMA GRUBU

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PLASTIC WASTE TRADE: THE HIDDEN NUMBERS

March 2023

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IPEN is a global network of more than 600 Participating Organizations in over 125 countries, primarily developing and transition countries. IPEN works to establish and implement safe chemicals policies and practices that protect human health and the environment, for a toxics-free future for all.

The Last Beach Cleanup: Founded by an independent chemical engineer, The Last Beach Cleanup focuses on bringing the facts to the forefront to promote proven and practical solutions to end plastic pollution.

Microplastic Research Group The Microplastics Research Group is a research team that conducts studies on plastic pollution within the framework of Çukurova University, Türkiye. The group mainly carries out research on the sources and effects of plastic pollution in the Mediterranean Sea and its coasts. Additionally, the group conducts research on the effects arising from Türkiye's plastic waste imports.

The Environmental Toxicology – Plastics Research Group focuses on sources, fate and effects of plastics, plastic associated chemicals and microplastic particles in aquatic ecosystems. The group also works with global scale environmental threats of plastics via multidisciplinary networks.

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BACKGROUND

Though they only account for 16 percent of the world's population, high-income countries generate about 34 percent of the world's waste.[1] A large portion of the generated wastes are plastics, which often contain toxic chemicals.

Historically, high-income countries have exported a significant amount of plastic waste under the guise of recycling. This toxic plastic waste trade harms human health and the environment locally and globally. But current reporting systems often underestimate the volumes of plastic wastes that are traded globally, leading to a frequent underestimation of the plastic waste trade by researchers who generally rely on this reporting system.

A recent analysis found that the overall plastic trade is more than 40% higher than previous estimates,[2] and even this number fails to reflect the trade of plastics and wastes in textiles, rubber, plastic contamination of paper bales, and other sources. The real amount of plastics and plastic wastes, and of toxic chemicals contained in plastics and wastes that move globally via trade is likely to be even higher.

Plastics are a complex group of materials, and it has been estimated that in total 10,000 chemicals are used to produce plastics.[3] Of these, approximately one-fourth are chemicals of known concern,[3] including carcinogens and endocrine disruptors. For many of the remaining chemicals, there is a lack of data, meaning that the number of chemicals of concern is likely to be higher. These toxic chemicals leach into land, water, and air as particulates and gasses.

A recent study concluded that we are exceeding the safe operating space for humanity since the volumes and rates at which we are producing new chemicals and plastics are beyond our ability to mitigate risks and prevent harm, threatening to destabilize Earth system functions.[4] Global contamination is now a fact, as chemicals and microplastics are found in every niche on the planet, with plastics playing a significant role in the transport of chemicals.[5-7] Toxic chemicals also affect human health from the beginning of the plastics life cycle during fossil fuel extraction and production, during use, and through to the end of life at the waste stage.

High-income countries frequently export plastic wastes to countries that lack the infrastructure to handle these and their own wastes in an environmentally sound manner. Toxic chemicals then enter into food chains at sites where plastic waste is dumped, landfilled, recycled, incinerated, and burned in the open.[8, 9] Many of the chemicals used in plastics as well as those generated when burning plastics are persistent organic pollutants, meaning that they will stay in the environment for a long time. They can also be transported over large distances via water and in the atmosphere.

As plastic production increases, plastic wastes will also skyrocket. Estimates show we will produce 26 billion tonnes of plastic waste by 2050. We cannot manage this level of waste generation sustainably, and without global policies to reduce plastic production, there will continue to be an unequal exchange of plastic wastes from high-income countries to low- and middle-income countries.

HS 3915 – A USEFUL BUT VERY LIMITED TOOL

The UN Comtrade database provides data on international trade through a set of codes. These are organized by the Harmonized Commodity Description and Coding System (HS). When the plastic waste trade is analyzed, the analysis is often limited to looking at the UN Comtrade code HS 3915 which has the descriptor, "Waste, parings, and scrap, of plastics." This category only captures a subset of the total plastic waste trade. Because the HS system is not designed to identify different types of materials but is more focused on product types,[2] HS 3915 fails to include plastic wastes that may be coded in several other product categories. The result is that materials coded as HS 3915 reflect only the tip of the plastic waste iceberg and do not tell the whole story.

Moreover, comparisons of HS 3915 with the total amounts of plastic wastes that are generated would give a false impression that the volumes of plastic wastes that are being traded are only a few percent, but such analyses neglect to include all the other ways that plastic wastes are coded under the HS system and traded globally. For example:

Synthetic textiles are one category of plastic wastes that are unaccounted for by HS 3915. These plastic wastes partly fall under HS 5505 (Waste (including noils, yarn waste and garneted stock) of synthetic fibers) but could also fall under other categories.[10] For example, one category that is not classified as wastes but that often ends up consisting of high levels of plastic wastes is HS 6309 (Worn, clothing, accessories). This category includes both synthetic and natural textiles, but estimates have shown that approximately 60-70% of all textiles are synthetic,[11] meaning that it can be assumed that the composition of HS 6309 contains roughly 60-70% plastics. The trade in worn textiles has been described as a complex network of special economic trading zones and networks of global re-exporting hubs, and crucial parts remain undocumented. While exporting worn clothing is often claimed to be a way of recycling or reusing them, estimates have shown that 40% of worn clothes are deemed worthless on arrival and therefore end up dumped in landfills.[12]

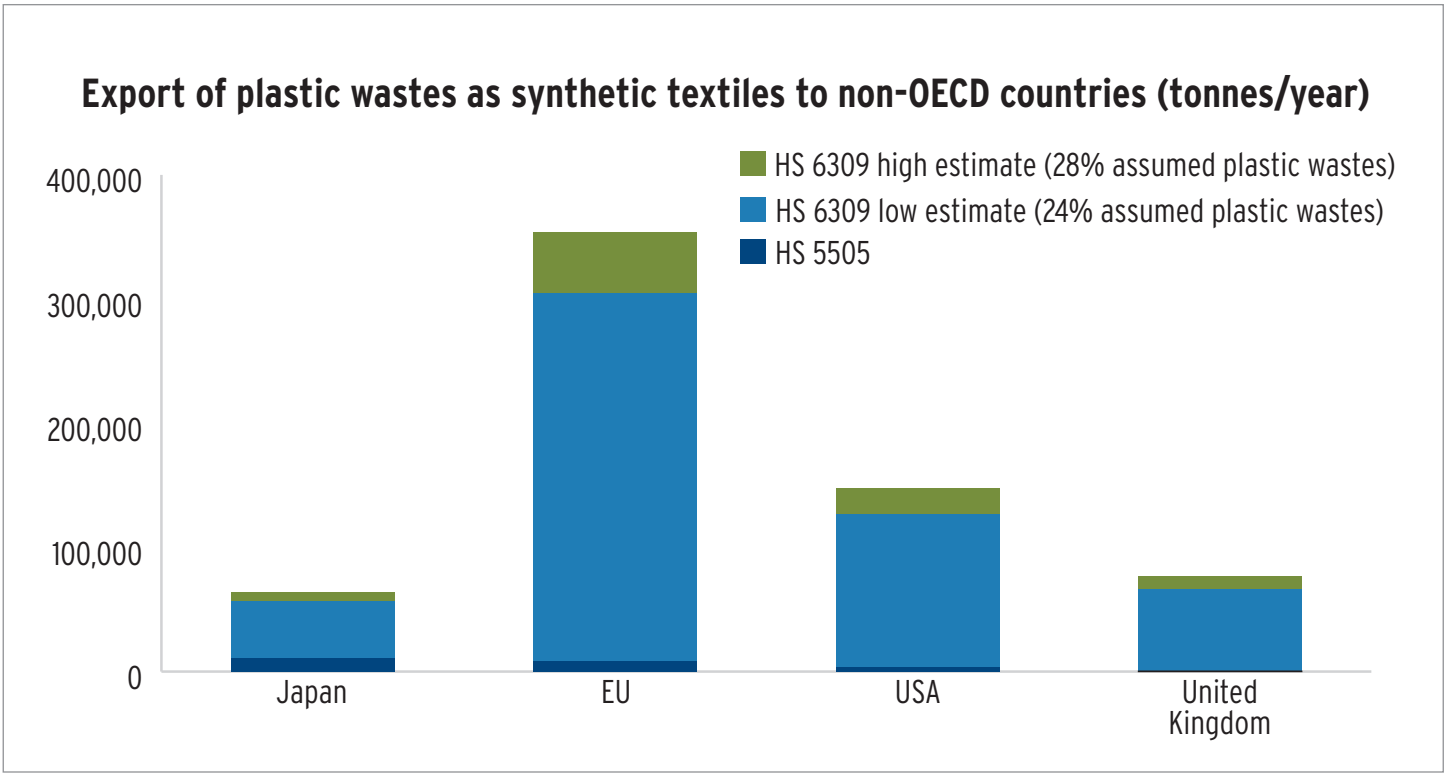

Figure 1 Export of plastic wastes in 2021 as synthetic textiles under HS 5505 and HS 6309, assuming that 24-28% of HS 6309 consists of plastic wastes.

The UN Comtrade data from 2021 for HS 6309 for Japan, EU, USA and the United Kingdom show that textiles are traded in high volumes to non-OECD countries. If 60-70% of those are considered plastics, and 40% are considered wastes, it means that 24-28% would be plastic wastes. This translates to more than half a million tonnes of plastic wastes exported from Japan, EU, USA and the UK to non-OECD countries under HS 6309 in 2021 (Figure 1). Approximately half of those exports were from the EU. It is also important to note that even with the lowest estimates, the plastic waste trade volumes under HS 6309 are 4 to 207 times higher than the volumes of waste reported under the waste of synthetic fibers, HS 5505. Thus, a significant source of plastic wastes come from the combined amounts in HS 6309 and HS 5505 and are missed by counts looking only at HS 3915.

A 2022 study investigated the secondhand trade of textiles to east Africa and found that there is no infrastructure that can handle the high volumes of plastic wastes that are imported as worn clothes. Textile wastes are therefore dumped widely and burned openly.[12] These practices result in the spread of toxic chemicals in the air, land, and water of importing countries since synthetic textiles can contain a wide variety of toxic chemicals, including flame retardants, bisphenols, quinoline, and benzotriazoles.[13]

Plastics Contamination in Mixed Paper Bales, which is part of the reported exports of HS 4707900000 (Waste, Scrap, Including Unsorted, Paper, Paperboard), are another category unaccounted for under HS 3915. Paper bales are exported as unsorted paper waste, which is imported by several countries. It is unknown what the level of plastic contamination of paper bales is, but estimates range from 5-30%.[14, 15] To estimate the volumes of plastic waste exports under this category, we multiplied UN Comtrade data by 0.05 and 0.3 respectively (Figure 2). Given the large uncertainties in the data, the total estimates for exports from the four regions to non-OECD countries vary between 0.2-1.3 million tonnes in 2021.

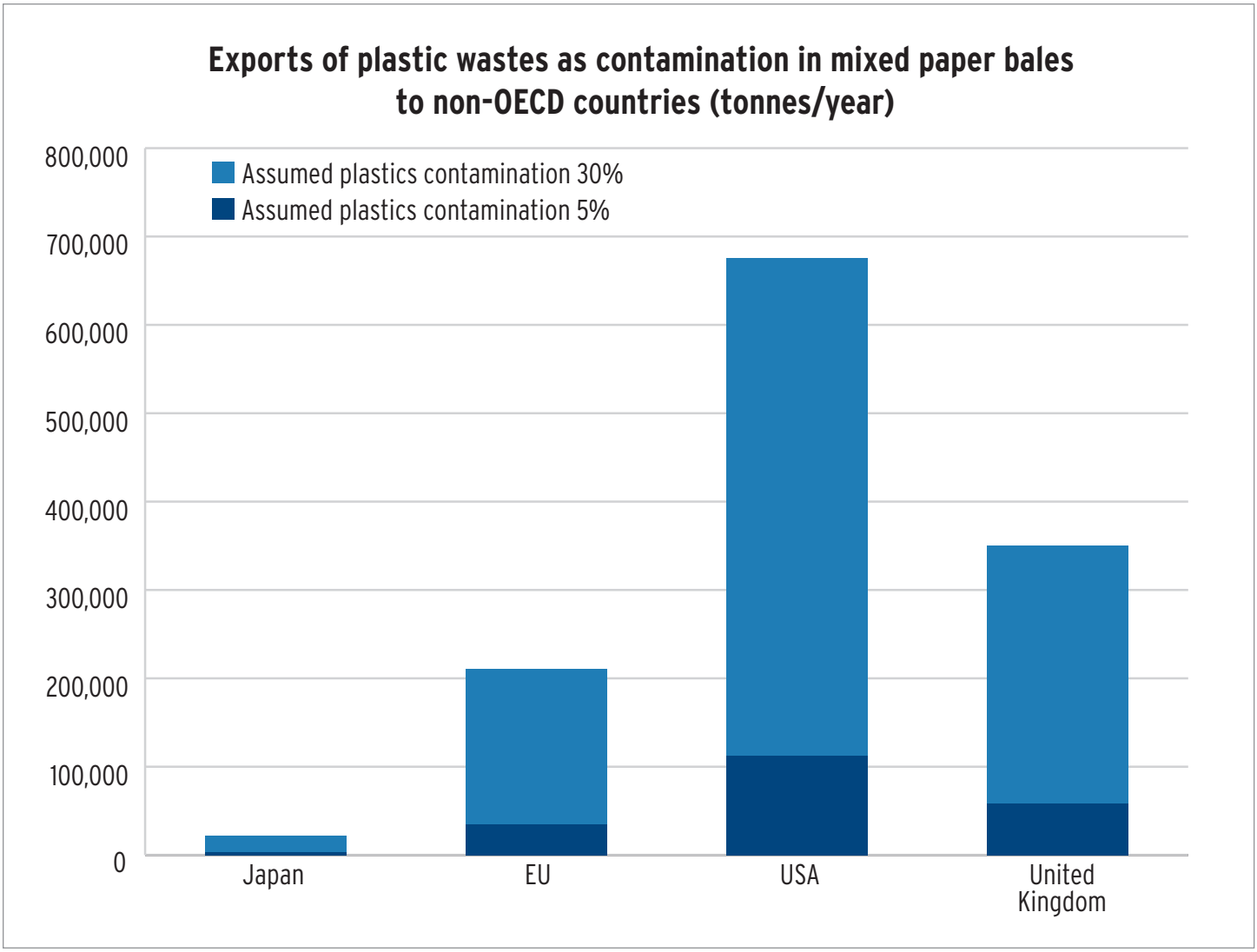

Figure 2 Export volumes in 2021 of plastic wastes as contamination in mixed paper bales, with an assumed contamination of 5-30%

PLASTICS CONTAMINATION IN MIXED PAPER BALES AND TEXTILES

We combined the estimated volumes for plastic waste trade for paper bales and textiles and compared the results with the volumes reported under HS 3915. The results showed that if only HS 3915 is considered, Japan is the biggest exporter to non-OECD countries with a total of 560,000 tonnes. However, when other types of plastic waste exports are included, the relative export and the total volumes change (Figure 3).

With the lowest estimate of plastic waste combining textiles and paper bales, where paper bales are assumed to have a 5% contamination and 24% of worn clothing is estimated to be plastic wastes, the EU would be the biggest exporter to non-OECD countries. With the higher estimates, of 30% contamination in paper bales and 28% plastic wastes in worn clothing, the US would be the highest exporter, as they export more paper bales.

When accounting for the range of estimates of the volume of plastic waste exports from contamination in paper bales and plastic wastes in textiles, the total exported plastic wastes from Europe is 1.7-2.2 times higher, compared to when only HS 3915 is included. For the US it is 1.9-4.2 times higher and for the UK it is 6-18 times higher. Japan does not export a lot of paper bales or textiles, so the numbers do not change a lot (1.1-1.2 times higher). If all four are combined the total amount of exported plastic wastes from these regions are 1.6-2.4 times higher, compared to when only HS 3915 is included.

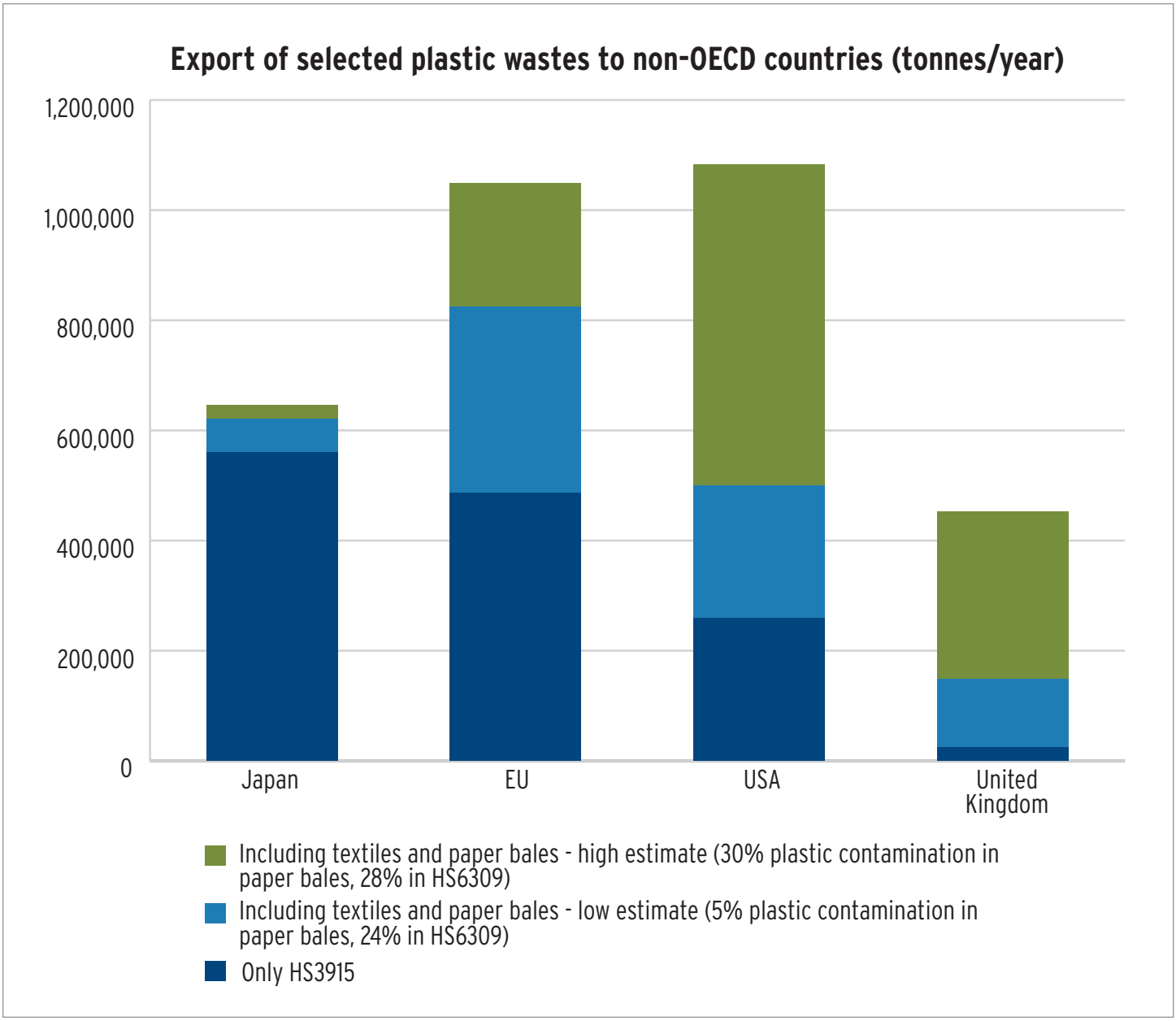

Figure 3 Data from 2021 on waste exports to non-OECD countries from Japan, EU, USA and the United Kingdom. Volumes in HS 6309 have been adjusted by multiplying with 0.24 and 0.28 to give a low and high estimated plastics content, similarly volumes on HS 4707900000 have been adjusted by multiplying with 0.05 and 0.3.

OTHER HIDDEN PLASTIC WASTE

It is important to note that these numbers still only provide a part of the story since the data is incomplete, and plastic wastes can fall under many other categories that cannot be estimated from UN Comtrade waste export data, either because the full datasets are not available or because it is not known how much plastic wastes are within those categories. Some examples include:

Electronic and electrical waste/E-waste, which are reported under HS 8549 (Electrical and electronic waste and scrap). These contain around 20% of plastics by weight [16]. Less than 20% of e-waste is collected and recycled properly.[16] Moreover, the trade in e-waste has experienced a rapid increase in the last two decades [17] and estimates suggest that 7-20% of the total electronic and electrical waste that is generated is traded globally.[10] These types of plastics often contain high concentrations of toxic flame retardants.[18]

Rubber Many people think of rubber as a natural material but most rubber products are from synthetic (plastic) rubber or a mix of natural and synthetics, as is the case with auto tires. Estimates suggest that end-of-life tires, a large waste category, will continue to grow and by 2023, 1.2 billion tires will be discarded annually.[19] Between 2013 and 2018, the international trade in rubber waste increased from 1.1 million tonnes to nearly 2 million tonnes, equivalent to 200 million tires.[19]

Rubber would be split between different categories, including HS 4004 (Waste, parings, and scrap of rubber (other than hard rubber) and powders and granules obtained therefrom) and HS 401220 (Rubber; used pneumatic tires). In 2019 the main importers of HS 4004 from Europe were India, Türkiye, and Morocco.[20]

Rubber products contain many toxicants (such as PAHs and metals) and rubber wastes are often incinerated, which leads to emissions of dioxins, furans,[20] and PCBs.[21] There is a vast trade of used, imported tires sent to backyard pyrolysis (plastic burning) operations that do not comply with environmental regulations.[22] A 1997 EPA report said emissions from burning tires included dioxins, sulphur oxides, and a range of metals including mercury and arsenic.[22]

Refuse Derived Fuel (RDF), also known as process engineered fuel, alternative fuel, solid recovered fuels, and other names,[23] is a more recent, creative way that the industry hides the plastic waste trade. RDF would sometimes be reported under HS 38251000 (Municipal waste),[24] which often comprises a large portion of plastic wastes. However, RDF is not reported as plastic waste and in Australia, plastics have been repurposed as RDF to circumvent the country's export ban on unprocessed plastic wastes.[25] Emissions from facilities that burn RDF are laced with dioxins and furans, which are highly toxic chemicals produced by burning plastic and other materials made with chlorine.[25, 26]

PLASTIC WASTE TRADE HARMS WASTE MANAGEMENT IN RECEIVING COUNTRIES

Countries that receive plastic wastes are affected in multiple ways. Due to toxic chemicals in plastics, these wastes can affect human health and the environment in local communities where wastes are discarded. For example, in 2022 an investigation on paper bales exported to India showed that the plastics contamination had significant consequences for human health and the environment.[14] Similarly, in 2019, a study in Indonesia collected eggs from sites where imported plastic wastes are dumped, burned for fuel, or burned to reduce their volumes. The eggs were analyzed for toxic chemicals and the results showed that the eggs contained very hazardous chemicals, including chemicals that are banned internationally such as polychlorinated biphenyls (PCBs), short chained chlorinated paraffins (SCCPs), polybrominated diphenyl ethers (PBDEs), and perfluorooctane sulfonate (PFOS).[8]

Additionally, the imported waste affects recycling capacity and displaces domestic collection, sorting, and recycling capacities. The major recipients of plastics wastes are often importing higher volumes of plastics than their waste management is scaled to handle.[27] This means that neither the waste generated within the country nor the imported waste can be managed in an environmentally sound manner, leading to large volumes of wastes ending up being dumped, left in landfills, or burned.[27, 28] For example, Türkiye produces 32 million tons of municipal wastes (MSW) annually, making it one of the top four highest volumes of MSW in Europe. The share of plastic wastes in the MSW varies between 10-15% (between 3.2 to 4.8 million tons). However, the plastic waste collection rate in Türkiye is between 10-20%.[29] Without these imports, Türkiye would have double the capacity to handle their domestically generated plastic wastes.[29]


2.24
KIRKLAND
DRINKING WATER
Red Bull
Corrugated Recycles

WASTE TRADE TRENDS

Historically, high-income countries have been producing and consuming the most plastics and unsurprisingly they are also the countries that are exporting the most plastic wastes. When looking at the cumulative exports between 1998-2016 of HS 3915, 87% of plastic wastes have been exported from high-income countries.[30] Prior to its import ban, China was the main importer of HS 3915 and had imported an estimated 45% of the global waste shipped under that category.[30] After the ban, these exports have been rerouted to other countries such as Indonesia, Vietnam, Malaysia, the Philippines, and Türkiye.[31]

Meanwhile, the production of plastics continues to increase and it has been estimated that globally we will have produced 26 billion tonnes of plastic wastes by 2050.[32] This level of waste generation is not possible to manage sustainably and predictions indicate that, despite national bans in some countries and amendments to the Basel convention, the unequal exchange of plastic wastes between high-income countries and non-high-income countries will continue.[31] In fact, data has shown that the overall global waste trade is increasing.[17] Between 2004 and 2021, the EU's exports of wastes to non-EU countries (mainly Türkiye, India, and Egypt) increased by 77%.[33]

CONCLUSIONS AND RECOMMENDATIONS

It is not possible to calculate the precise volumes of plastic wastes that are traded, due to a lack of transparency in waste trade numbers. These numbers are not adapted to trace specific material categories. The hidden numbers are therefore likely high and current estimates only include a small fraction of the traded plastic wastes.

The current high production volume of plastics makes it impossible for any country to manage the massive volume of wastes that are generated. Still, the trends over the last decades show that the amounts of plastic wastes are increasing, the waste trade is increasing, and the trade of plastic wastes in categories that include plastics that contain very toxic chemicals, such as electrical and electronic wastes, are increasing. To develop sustainable waste management practices for the future, the production of plastics needs to decrease, and plastics should only be used when they are essential for the functioning of society.

Ideally, new provisions should regulate markets to require simplified products containing few polymers, and fewer (non-toxic) chemicals, with requirements for reporting and transparency, throughout the plastics life cycle. It is crucial that the plastics that are produced do not contain toxic chemicals as these chemicals are transported with plastics and plastic wastes all over the world, where they hinder recycling, harm workers' health, and contaminate food chains. Plastic producers should be held responsible for the harm caused to the environment and human health by plastics throughout their life cycle, including as wastes.

Lastly, countries that are major producers of plastic wastes must take responsibility for their own plastic waste and stop exporting all plastic wastes (and waste-derived products, such as RDF) to other countries, and especially to countries that lack the capacity to manage their own plastic wastes in an environmentally sound manner.

REFERENCES

1. Kaza, S., Yao, L., Bhada-Tata, P., & Van Woerden, F. (2018). What a waste 2.0: a global snapshot of solid waste management to 2050. World Bank Publications.
2. Barrowclough, D., Deere-Birkbeck, C., & Christen, J. (2020). Global trade in plastics: insights from the first life-cycle trade database. UN.
3. Wiesinger, H., Wang, Z., & Hellweg, S. (2021). Deep dive into plastic monomers, additives, and processing aids. Environmental science & technology, 55(13), 9339-9351.
4. Persson, L., Carney Almroth, B. M., Collins, C. D., Cornell, S., de Wit, C. A., Diamond, M. L., Fantke, P., Hassellöv, M., MacLeod, M., Ryberg, M.W., Søgaard Jørgensen, P., Villarubia-Gomez, P., Wang, Z., & Hauschild, M. Z. (2022). Outside the safe operating space of the planetary boundary for novel entities. Environmental science & technology, 56(3), 1510-1521.
5. Su, L., Xiong, X., Zhang, Y., Wu, C., Xu, X., Sun, C., & Shi, H. (2022). Global transportation of plastics and microplastics: a critical review of pathways and influences. Science of The Total Environment, 154884.
6. Yamashita, R., Tanaka, K., Yeo, B. G., Takada, H., van Franeker, J. A., Dalton, M., & Dale, E. (2019). Hazardous chemicals in plastics in marine environments: international pellet watch. Hazardous chemicals associated with plastics in the marine environment, 163-183.
7. Tanaka, K., Watanuki, Y., Takada, H., Ishizuka, M., Yamashita, R., Kazama, M., ... & Nakayama, S. M. (2020). In vivo accumulation of plastic-derived chemicals into seabird tissues. Current Biology, 30(4), 723-728.
8. Petrlik, J., Ismawati, Y., DiGangi, J., Arisandi, P., Bell, L., & Beeler, B. (2019). Plastic waste poisons Indonesia's food chain. IPEN
9. Petrlik, J., Bell, L., Beeler, B., Møller, M., Jopkova, M., Arisandi, P., Brabcova, K., Carcamo, M., Chávez Arce, S.C., Dizon, T., Ismawati Drwiega, Y., Kuepouo, G., Mng'anya, S., Ochieng Ochola, G. & Skalsky, M. (2021). Plastic waste disposal leads to contamination of the food chain. IPEN
10. Forti, V., Peter Baldé, C., Kuehr, R., & Bel, G. (2020). Quantities, flows, and the circular economy potential. The Global E-waste Monitor 2020, 1, 1-120.
11. EEA (2020) Plastic in Textiles: towards a circular economy for synthetic textiles.
12. Cobbing, M., Daaji, S., Kopp, M., & Wohlgemuth, V. (2022). Poisoned Gifts From donations to the dumpsite: textiles waste disguised as second-hand clothes exported to East Africa.
13. Rovira, J., & Domingo, J. L. (2019). Human health risks due to exposure to inorganic and organic chemicals from textiles: A review. Environmental Research, 168, 62-69.
14. Ha, K.O. (2022) Amazon Packages Burn in India, Final Stop in Broken Recycling System. Bloomberg.
15. Paben, J. (2022) Editor's perspective: First look at a retooled paper mill. Resource recycling.
16. Industrial Fasteners and Components. Plastics in Electrical & Electronic Equipment: High Growth Sectors. 2018; Available from: http://www.fastenercomponents.com/news/plastics-in-electrical-electronic-equipment-high-growth-sectors/.
17. Barrie, J., Schröder, P., Schneider-Petsinger, M., King, R., & Benton, T. (2022). The role of international trade in realizing an inclusive circular economy. Chatham house.
18. Ma, Y., Stubbings, W. A., Cline-Cole, R., & Harrad, S. (2021). Human exposure to halogenated and organophosphate flame retardants through informal e-waste handling activities-A critical review. Environmental Pollution, 268, 115727.
19. Abbas-Abadi, M. S., Kusenberg, M., Shirazi, H. M., Goshayeshi, B., & Van Geem, K. M. (2022). Towards full recyclability of end-of-life tires: Challenges and opportunities. Journal of Cleaner Production, 134036.
20. Braithwaite, C. (2021). End of Life Tyre Rubber: Assessment of Waste Framework Directive End-of-Waste Criteria. 2021, European recycling industries' confederation european tyre and rubber manufacturers association.
21. Lönnermark, A., & Blomqvist, P. (2005). Emissions from tyre fires.SP Swedish National Testing and Research Institute.
22. JohnGeddie, S.V. & Brock, J. (2019). Trading tires: how the west fuels a waste crisis in Asia. Reuters.
23. Bell, L. & Takada, H. (2021) Plastic Waste Management Hazards. Waste-to-energy, chemical recycling, and plastic fuels. 2021, IPEN.
24. Geminor UK Ltd. (2020) Notification document for transboundary movements/shipments of waste – GB01-EA Download at https://bit.ly/3ZAnUUS
25. Bremmer, J. (2022). Australian Refuse Derived Fuel: Fuel Product of Plastic Wste Export in Disguise? National Toxics Network/ IPEN.
26. Shah (2013). Understanding Refuse Derived Fuel. Global Alliance for Incinerator Alternatives.
27. EIA (2021) The Truth Behind Trash - The scale and impact of the international trade in plastic waste.
28. Winterstetter, A., Veiga, J. M., Sholokhova, A., & Šubelj, G. Country-specific assessment of mismanaged plastic packaging waste as a main contributor to marine litter in Europe. Frontiers in Sustainability, 3, 166.
29. Gündoğdu, S., & Walker, T. R. (2021). Why Turkey should not import plastic waste pollution from developed countries?. Marine Pollution Bulletin, 171, 112772.
30. Brooks, A. L., Wang, S., & Jambeck, J. R. (2018). The Chinese import ban and its impact on global plastic waste trade. Science advances, 4(6), eaat0131.
31. Zhao, C., Qi, X., Wang, J., Du, F., & Shi, X. (2022). Predicting possible new links to future global plastic waste trade networks. Sustainability, 14(8), 4692.
32. Geyer, R., Jambeck, J. R., & Law, K. L. (2017). Production, use, and fate of all plastics ever made. Science advances, 3(7), e1700782.
33. Eurostat. (2022). What are the main destinations of EU export of waste. Available from: https://ec.europa.eu/eurostat/web/products-eurostat-news/-/ddn-20220525-1.

ANNEX

RAW DATA

Table 1 Estimated volumes (tonnes) of plastic wastes in different HS categories exported to non-OECD countries in 2021.

CATEGORY	JAPAN	EU	USA	UNITED KINGDOM
HS 47079000 low estimate (assumed plastic contamination 5%)	3,667	35,034	112,497	58,363
HS 47079000 high estimate (assumed plastic contamination 30%)	22,002	210,205	674,981	350,178
HS 6309 low estimate (24% assumed plastic wastes)	45,923	295,574	123,757	65,911
HS 6309 high estimate (28% assumed plastic wastes)	53,577	344,836	144,383	76,896
HS 5505	10,543	8,647	3,270	317
HS3915	560,730	485,791	259,693	24,793

PHOTOGRAPHY

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