HUNDREDS OF TOXIC CHEMICALS PRESENT IN RECYCLED PLASTIC PELLETS

IPEN BRIEF

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IPEN
for a toxics-free future

SUMMARY

An analysis published in 2023 looked at chemicals in recycled plastic pellets collected by IPEN member groups from thirteen countries. The testing identified and quantified 491 chemicals in the recycled plastic, including pesticides, industrial chemicals, PCBs, and other toxic substances. The results add to the increasing evidence that plastic recycling spreads toxic chemicals uncontrollably and is not a solution to the plastics crisis.

A WIDE RANGE OF CHEMICALS ARE KNOWN TO BE PRESENT IN PLASTICS

Chemicals are added to plastics to provide properties such as flexibility, durability, and color. In addition, chemicals formed during production, use, and recycling of plastics are present in the plastic material. A recent report estimated that more than 16,000 chemicals are potentially used or present in plastic materials and products. No information about human health or environmental impacts is available for a majority of these chemicals. However, where information is available, it shows that many of the chemicals have been identified as toxic (often called "chemicals of concern" or "potential concern").

Many chemicals present in plastics are released when plastics are produced, used, recycled, and disposed of. This means that plastics are a source of human exposure to toxic chemicals and environmental contamination throughout their life cycle. For example, many of these chemicals are known to disrupt the endocrine system, leading to health impacts such as reproductive problems, early female puberty, certain types of cancers, and neurobehavioral disorders.

During mechanical recycling, plastics from many sources are mixed and melted to make plastic pellets, which in turn are used to make new products. The chemicals that are present in the plastics going into the recycling process will be carried over to the pellets and

the new products. In this way, recycling leads to an uncontrolled spread of an unknown mixture of chemicals into the new products. While it is technically possible to extract chemicals from plastics using chemical recycling, this method has overall proven itself to be a failure and a false solution to the plastics crisis. In addition, the chemicals extracted from the plastics become toxic wastes that need to be handled in a way that protects human health and the environment from their impacts.

There are some plastics known to contain toxic brominated flame retardants that can be separated out with current techniques, but these are a very small fraction of all plastic waste, and there is no general method to separate out plastics that contain toxic chemicals. Also, the large volume of plastics produced makes it impossible to effectively sort plastic wastes.

The presence of toxic chemicals in recycled plastic products has been shown in many studies, including in food packaging, kitchen utensils, toys and other children's products. In addition, when plastics are heated during the recycling process, new toxic chemicals can be generated, such as the highly toxic chlorinated and brominated dioxins.

Finally, contamination caused by certain uses of plastics can also constitute a source of chemicals in plastics. This includes, for example, pesticide containers, pharmaceutical bottles, and personal care products.

Although some countries and regions regulate certain uses of recycled plastics, for example, in food contact materials, there are currently no international requirements on the monitoring of chemicals in recycled plastics or on making the chemical content of plastic materials and products publicly available and accessible.

COLLECTION OF RECYCLED PELLETS FROM 24 COUNTRIES

In 2020, NGOs in 24 countries visited local, small-scale recycling facilities and purchased bags of recycled High-Density Polyethylene (HDPE) pellets. This type of plastic was selected since it is one of the most used and recycled types of plastic. According to producers and retailers of recycled HDPE, uses include plastic pipes; plastic lumber for playgrounds; picnic tables and outdoor patios; non-food bottles such as detergent containers, cleaning products, conditioners and shampoos; and children's toys.[1]

The pellets were initially analyzed for the presence of the chemical bisphenol A, and several chemicals from the two groups of brominated flame retardants and benzotriazole UV stabilizers.

Following the initial study, 28 samples of pellets from 13 countries were sent for a broader analysis of their chemical content. These pellets were from different batches than the initially analyzed pellets. This analysis included a target analysis looking for specific chemicals and a non-target analysis to capture additional chemicals.

Tab 1: Overview of groups of chemicals detected in the broad analysis of recycled pellets.

CLASS OF CHEMICAL	NUMBER OF CHEMICALS DETECTED
Pesticides and biocides	162
Pharmaceuticals	89
Industrial chemicals	65
Plastic additives	45
Polycyclic aromatic hydrocarbons (PAHs)	21
Food ingredient	12
Polychlorinated biphenyls (PCBs)	12
Surfactants	10
Fragrances	8
UV filters	6
Dye	4
Stimulants	4
Corrosion inhibitor	3
Polybrominated diphenyl ethers (PBDEs)	2
Repellents	2
Human metabolites	2
Polychlorinated naphthalene (PCNs)	1

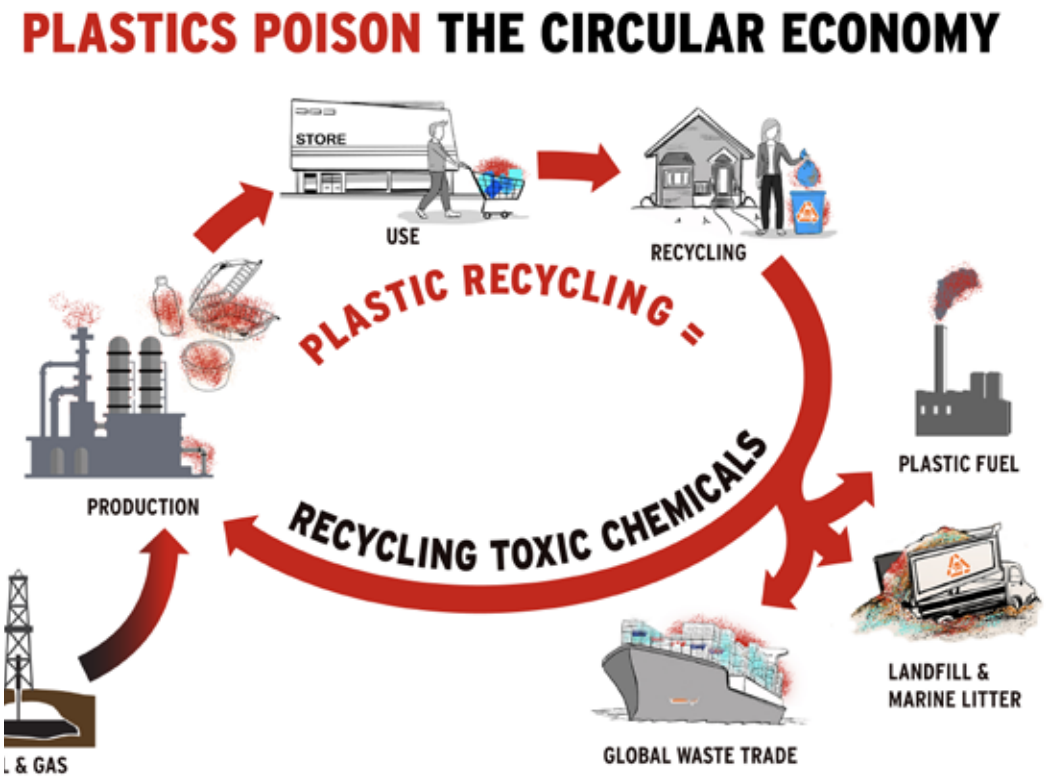
RESULTS IN BRIEF

The initial analysis covered 18 chemicals in total, and two pellet samples contained 16 of these chemicals. More than half of the samples (54%) contained 11 or more chemicals, and 21 pellet samples contained all three targeted groups of chemicals. All the pellet samples contained one or more of the targeted chemicals. A detailed description of the results can be found in the report Widespread chemical contamination of recycled plastic pellets globally.

The broader analysis published in 2023 showed that traces of hundreds of chemicals were present in the recycled pellets. In total, 491 identified chemicals were detected and quantified, and the identity of 170 additional compounds were tentatively annotated. The chemicals were grouped according to their uses, as shown in Table 1. The full list of chemicals is publicly available online.

Overall, 33 chemicals were detected in all the recycled pellets, see table in Annex 3. These included six pesticides, six personal care products, and four pharmaceuticals, in addition to plastic additives and industrial chemicals.

The most commonly detected types of chemicals were pesticides/biocides (162 chemicals) and pharmaceuticals (89 chemicals). None of these chemicals are intentionally added to the plastics but are present as a result of contamination. Only 45 of the chemicals detected are categorized as plastic additives.



WHAT DOES THIS MEAN?

The results show that recycled HDPE pellets contain a wide variety of chemicals not intentionally added to the plastics as well as additives that serve no purpose in the recycled pellets. The sources are most likely a diverse input of plastics to the recycling process, including containers of pesticides, pharmaceuticals, and personal care products. The presence of flame retardants indicates that plastics from electronic waste were used.

While most of the chemicals were present only at low concentrations, the number of chemicals in each pellet sample raises the concern that they can cause combined toxic effects. It is well known that even if chemicals are present in a mixture at concentrations too low to cause impact on their own, many chemicals together can still have a significant impact. In addition, endocrine-disrupting chemicals can have an impact even at low concentrations, which makes them especially relevant when considering potential mixture effects.

Finally, the presence of these chemicals in the recycled pellets highlights the concern that plastic recycling and waste workers are likely being exposed to toxic chemicals at work. This includes direct exposure to pesticides, industrial chemicals, pharmaceuticals, and other residues of toxic substances when workers handle plastic waste, and exposure through air, dust, and water during processes such as washing, compounding, flaking, and melting of plastics.

ACTION IS NEEDED

Recycling has been put forward as a solution to the plastics crisis. However, due to the intentional and unintentional addition of toxic plastic chemicals, recycling plastics means recycling toxic chemicals. Therefore, it constitutes a false solution.

Three things are urgently needed to protect the human right to a clean, healthy, and sustainable environment, including a safe and healthy working environment:

1. The intentional use of toxic chemicals in plastics needs to be eliminated.

2. The unintentional presence of toxic chemicals in plastics needs to be prevented.

3. Mandatory requirements for making information about the chemical content of plastics and their hazard information publicly available and accessible. In addition, mandatory requirements should be put in place to ensure that hazard- and other health-related information is communicated to consumers, workers, and the general public.

The extensive international trade of chemicals, plastics, and plastic waste means that international controls need to be put in place, utilizing all available and emerging tools. These include, for example, multilateral environmental agreements specifically targeting chemicals, such as the Stockholm and Basel Conventions, and chemicals-related Conventions, Resolutions, and Recommendations under the International Labour Organization (ILO) and the World Health Organization (WHO). In addition, the future Plastics Treaty is an opportunity to protect human health and the environment from the harmful effects of plastics throughout their full life cycle.

The Stockholm Convention, which addresses Persistent Organic Pollutants (POPs), can be utilized in several ways:

- POPs in plastics should be listed for global elimination, including groups of POPs with similar properties and related compounds.
- The provision of the Convention that "Wastes containing POPs listed under the Convention, including products and articles upon becoming wastes are not permitted for recycling" must be implemented and enforced.[2]
- Parties to the Convention must meet their obligations to "Develop appropriate strategies for identifying (i) stockpiles consisting of or containing chemicals listed either in Annex A or Annex B and (ii) Products and articles in use and wastes consisting of, containing or contaminated with a chemical listed in Annex A, B or C.[3]

The Basel Convention, which addresses waste management and trade, can be utilized to prevent plastics containing and contaminated with toxic chemicals from being imported into a country as waste, for example, by prohibiting the import of plastic wastes through the Prior Informed Consent procedure or classifying all plastic waste or certain types of plastic wastes as a hazardous waste. The latter would mean that exports will be prohibited from OECD countries to many low- and middle-income countries under the Ban Amendment (Annex VII).[4]

Country obligations arising from ILO International Labour Standards[5] such as the Chemicals Convention (C170) and the Occupational safety and health conventions

(C155, C161 and C187) must be met, and can be utilized further for stronger protection of workers. The hierarchy of controls that prioritizes elimination and substitution of toxic chemicals should also be applied.

Finally, the new Plastics Treaty will be an important instrument to address toxic chemicals in plastics in many ways. To do so, it is important that the Treaty contains strong, legally binding control provisions that call for:

- the elimination of toxic chemicals throughout the full life cycle of plastics;
- mandatory, publicly available, and accessible disclosure of information on chemicals; and,
- measures to control plastic production volumes.

REFERENCES

1 Examples from https://www.letsrecycleit.eu/hdpe-recycling/; https://www.aaapolymer.com/hdpe-recycling/; https://www.plasticexpert.co.uk/plastic-recycling/hdpe-plastic-recycling/ accessed on March 18th, 2024.

2 See Article 6.1.(d).(iii) of the Convention

3 See Article 6.1.(a).(i) and (ii) of the Convention

4 https://ipen.org/documents/basel-ban-amendment-guide

5 https://www.ilo.org/dyn/normlex/en/f?p=NORMLEXPUB:12200:0::NO::P12100_ILO_CODE:

ANNEX 1: ORGANIZATIONS PARTICIPATING IN THE STUDIES

IPEN would like to thank the following NGOs for their instrumental part in these studies (in alphabetical order):

Action sur l'Environnement et le Développement (AED), Republic of the Congo

AGENDA for Environment and Responsible Development (AGENDA), Tanzania

Arnika, Czech Republic

Association pour la Défense de l'Environnement et des Consommateurs (ADEC), Senegal

Centre For Earth Works (CFEW), Nigeria

Centre for Environmental Justice (CEJ), Sri Lanka

Center for Public Health and Environmental Development (CEPHED), Nepal

Centre for Zero Waste & Development, Zambia

Citizen consumer and civic Action Group (CAG), India

Consumers Association of Penang (CAP), Malaysia

Cooperation for Sustainable Development, Kazakhstan

Ecological Alert and Recovery Thailand (EARTH), Thailand

Environmental Ambassadors for Sustainable Development, Serbia

Environment and Social Development Organization (ESDO), Bangladesh

Fronteras Comunes, Mexico

Global Initiative for Environment and Reconciliation (GER), Rwanda

Indowater, Indonesia

Interfacing Development Interventions For Sustainability (IDIS), Philippines

Kenana NGO for Sustainable Development, Egypt

Les Amis de la Terre, Togo

Pesticide Action Network (PANeM), Mauritius

Research Centre for Gender, Family and Environment in Development (CGFED), Vietnam

Rozbudovo, Ukraine

Taller Ecologista, Argentina

Terre et Développement, Cameroon

Toxics Link, India

Wild at Heart Legal Defense Association, Taiwan

ANNEX 2: KEY REFERENCES

This briefing is based on results presented in

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For additional resources, see: https://stoppoisonplastic.org/

ANNEX 3:
CHEMICALS DETECTED IN ALL SAMPLES OF RECYCLED PELLETS

CHEMICAL	USE	MAXIMUM CONCENTRATION DETECTED (NG/L)
N-Ethyl-o-toluenesulfonamide	Plasticizer	24,019,657
4-Hydroxy-1-(2-hydroxyethyl)-2,2,6,6-tetramethylpiperidine	Plastics stabilizer	56,272
DEET	Insect repellent	18,160
Melamine	Plastic component	14,372
Benzophenone-3	Plastics stabilizer	12,844
TMDD	Surfactant	9,060
Palmitoylethanolamide	Pharmaceutical	4,724
Triphenylphosphine oxide	Flame retardant	3,435
Tri(butoxyethyl)phosphate	Flame retardant and plasticizer	3,110
Triphenylphosphate	Flame retardant and plasticizer	1,956
Lauramidopropylbetaine	Personal care and household products	1,951
Azelaic acid	Pharmaceutical	1,673
Lauryl diethanolamide	Personal care and household products	1,598
3,5,6-Trichloro-2-pyridinol	Pesticide (chlorpyrifos metabolite)	1,578
Lauric isopropanolamide	Personal care and household products	1,159
N,N-Dimethyltetradecylamine-N-oxide	Cleaning products	1,023
N_Lauroylethanolamine	Personal care products	1,001
Cotinine	Metabolite of nicotine	876
Tris(1-chloro-2-propyl)phosphate	Flame retardant	571
Diethofencarb	Pesticide	438
Tri-isobutylphosphate	Solvent	436
2-Octyl-4-isothiazolin-3-one	Pesticide	406
Ephedrine	Pharmaceutical	371
2-Benzothiazolesulfonic acid	Rubber and dye production	369
2-(2-Methoxyethoxy)ethanol	Solvent	324
Tetraethylene glycol butyl ether	solvent	309
Methenamine	Pharmaceutical	149
Benzyldimethyltetradecylammonium	Surfactant	135
Dodecane-12-lactam	Monomer for polymerization of polyamide	96
N,N-dimethyldecan-1-amide	Solvent in pesticide formulations	93
Methiocarb sulfone	Pesticide	28
Methyldiethanolamine	Washing and cleaning products	17
Tris(2-chloroethyl)phosphate	Flame retardant and plasticizer	9

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