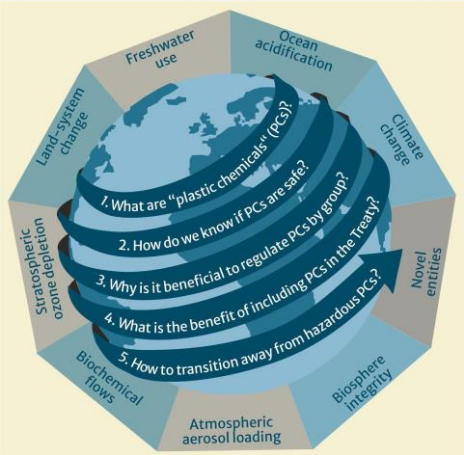
Plastic Chemicals

Plastics are a source of pollution throughout their entire life cycle from extraction, involving releases of greenhouse gases (GHGs), micro- and nanoplastic (MNPs) contamination, and hazardous chemicals such as endocrine disruptors, causing exposure to humans and the environment. This policy brief focuses on plastic chemicals of concern, which spans from extraction of feedstocks, through conversions to monomers, polymerization, formulation, and molding, use, management, and removal and remediation. Plastics can deposit chemical contaminants over time into everything, such as food, water, soil, clothing, air and living organisms, including humans.



1. What are "plastic chemicals" (PCs)? All plastics consist of chemicals, including the polymer backbone. Therefore "plastic chemicals" include all chemicals used or present during the manufacturing process or present in plastic polymers and products, intentionally and non-intentionally added, including degradation products. Because complex mixtures of plastic chemicals can be released throughout the full life cycle of plastics and because significant exposures and human health impacts can originate from many of them, there is a mandate to address them in the treaty (1).

2. How do we know if plastic chemicals are safe? While **PBMT** criteria are defined in the Stockholm convention (2), it doesn't cover most plastic chemicals (no Multilateral Environmental Agreement (MEA) does): **(P)** Plastic chemicals can be very **persistent** with long-half lives in diverse media and have very low degradation rates (3, 4) depending on their destination; **(B)** If taken up into organisms and transferred through the food chain, plastic chemicals fulfill the criteria for **bioaccumulation** (5-11); **(M)** Plastic chemicals that are **mobile** floating and mixed with water or air (e.g. PFAS) can contaminate seawater and atmosphere and travel long distances (12-16); **(T) Toxicity** to humans and wildlife can be elicited by plastic chemicals (17). Based on their physical-chemical toxicity as a function of the shape, size, density, polymer composition and associated chemicals (e.g., POPs, hydrocarbons and metals), microplastics can be toxic to organisms, inflicting either immediate adverse health effects in the short term, or sublethal effects in the long-term (18-23). Further, persistence can be a more significant issue than toxicity, and endocrine disrupting compounds are hazardous but are seldom covered by "PMBT" criteria.

3. Why is it beneficial to regulate plastic chemicals by group?

Upwards of 16,000 plastic chemicals, including polymers of specific concern are now identified, and assessing them individually is not feasible16. Some have already been banned or phased out, but for over half (>8000) there is no assessment available that evaluates their safety. Grouping related plastic chemicals assists in identifying those of greatest concern and will prioritize them for assessment and mitigation. We know which 15 groups are of greatest concern in terms of hazard and these groups are primarily based around their functional role in plastic materials (15). Regulating these chemicals by group in the treaty will benefit human health in line with the best available science, and would only apply to these chemicals when used in plastics, leaving non-plastic applications unaffected.

4. What would be the benefit of including plastic chemicals in the Treaty?

While several international, national and regional regulations exist that regulate chemicals, the vast majority do not address plastic chemicals across the full lifecycle. The Rotterdam Convention (24) deals with trade and information exchange, the Basel Convention (25) deals with transboundary movements of hazardous wastes, only addressing end-of-life. The Stockholm Convention (26) regulates production and use of a narrow set of defined organic chemicals with very specific properties. Due to the often proprietary composition of plastics, plastic chemicals are outside the scope of most multilateral environmental agreements (MEAs) and therefore are not regulated by them. This also includes the Globally Harmonised System, Global Framework on Chemicals, and the future Science Policy Panel on Chemicals, Pollution and Waste, none of which are legally binding, fully funded, or suited to address plastic chemicals. In total, global, national, and regional regulations address less than 6% of plastic chemicals, leaving 94% of plastic chemicals unregulated.

5. How to transition away from hazardous plastic chemicals?

Member states are looking to bio-based plastics and those with biodegradable properties in an effort to transition away from conventional fossil-fuel plastics. Bio-based plastics are derived partly or wholly from renewable resources and biodegradable plastics are composed of renewable or fossil-based carbon sources, but which can undergo biodegradation under specific conditions found in composting facilities (27). These 'plastic alternatives' require plastic chemicals to achieve certain physical and chemical properties, similar to their fossil fuel-based or non biodegradable counterparts (28) . The same plastic chemicals used in fossil-based and non biodegradable plastics are often used in plastic alternatives, and new / different chemicals may be required to achieve the same functionality as traditional plastics (29). Thus, bio-based plastics do not eliminate the need for potentially hazardous chemicals (30), and biodegradable plastics may release a wide range of degradation products, with quicker release of chemicals into localized areas (29). Thus they may have the same or greater toxicity compared to conventional plastics. Chemical simplification, regulating hazardous chemical families, and using less plastic or more sustainable alternatives (e.g. glass) supported by systems change (e.g. decentralised deposit or return schemes and sanitation stations and supportive financial mechanisms) are ways to transition from the status quo.

In conclusion, any delay in addressing ongoing contamination from plastic chemicals will have negative implications for the environment and for human health20.

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Please cite as: Scientists' Coalition for an Effective Plastics Treaty (2024) Plastic Chemicals. September. DOI: 10.5281/zenodo.13833858.

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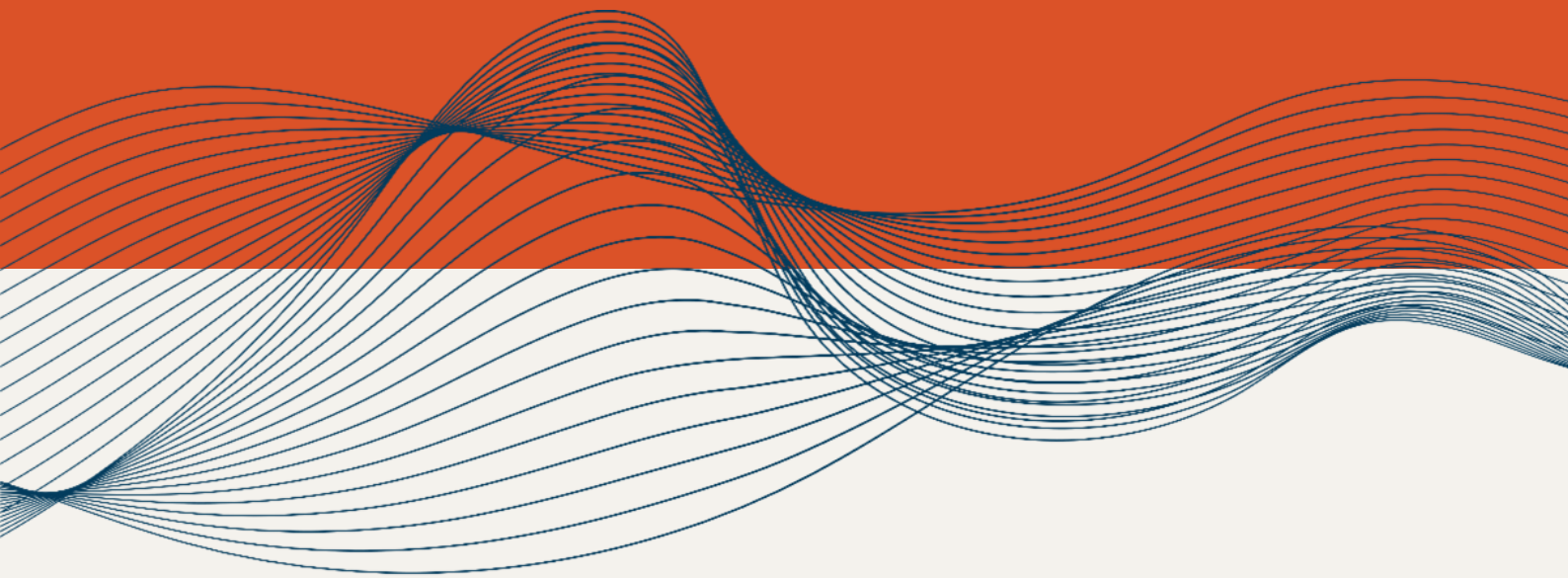

Scientists' Coalition for an Effective Plastics Treaty