LABPLAS

Horizon 2020
European Union Funding
for Research & Innovation

LABPLAS

Land-Based Solutions for Plastics in the Sea

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101003954

D8.4 Policy briefs on SMNP for EU officials and international policymakers (definitive version)

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List of participants:

Nº	Participant name	Acronym	Country	Type
1	UNIVERSIDADE DE VIGO	UVI	SPAIN	HES
2	UNIVERSIDADE DA CORUÑA	UDC	SPAIN	HES
3	Bundesanstalt fuer Gewaesserkunde	BfG	GERMANY	RTO
4	LABORATORIO IBERICO INTERNACIONAL DE NANOTECNOLOGIA	INL	PORTUGAL	RTO
5	KATHOLIEKE UNIVERSITEIT LEUVEN	KUL	BELGIUM	HES
6	HELMHOLTZ ZENTRUM FUR OZEANFORSCHUNG KIEL	GEOMAR	GERMANY	RTO
7	NATIONAL OCEANOGRAPHY CENTRE	NOC	UNITED KINGDOM	RTO
8	SORBONNE UNIVERSITE	SU	FRANCE	HES
9	OPEN UNIVERSITEIT NEDERLAND	OUNL	NETHERLANDS	HES
10	LEIBNIZ INSTITUTE FOR BALTIC SEA RESEARCH	IOW	GERMANY	RTO
11	ASSOCIACAO PARA O DESENVOLVIMENTO DO ATLANTIC INTERNATIONAL RESEARCH CENTRE	AC	PORTUGAL	RTO
12	UNIVERSIDADE FEDERAL DO SAO PAULO	UNIFESP	BRAZIL	HES
13	BASF SE	BASF	GERMANY	LE
14	TG ENVIRONMENTAL RESEARCH	ER	UNITED KINGDOM	SME
15	CONTACTICA S.L.	CTA	SPAIN	SME
16	STICHTING EGI	EGI	NETHERLANDS	Non-P
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Executive summary:	This report corresponds to Deliverable 8.4 Policy briefs on SMNP for EU officials and international policymakers (definitive version), resulting from Task 8.2 of the LAPBLAS project. It presents four policy briefs on (1) Tyre particle emissions (2) Biodegradable plastics, (3) Plastic additives and (4) Guidelines for analytical methods of plastics.

Version	Date	Comments
1.0	12/12/2024	Initial version
2.0	05/03/2025	Version including comments from reviewers
3.0	18/03/2025	Final version

Disclaimer

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ABBREVIATIONS AND ACRONYMS

Abbreviation / Acronym	Description
EU	European Union
SMNP	Small, micro and nano- plastics
LABPLAS	LAnd Based solutions for PLAstics in the Sea
LoD	Limit of detection
WP	Work Package

1 INTRODUCTION

Plastic is pouring from land into our oceans at a rate of nearly 10 million tonnes a year. Once in the sea, plastics fragment into particles moving with the currents and ocean gyres before washing up on the coastline. The smaller the size the higher the risk posed by these particles to organisms and human health. Because small, micro- and nano-plastics (SMNP) cannot be removed from oceans, proactive action regarding research on plastic alternatives and strategies to prevent plastic from entering the environment should be taken promptly. The LABPLAS project is a 48-month project whose vision is to develop new techniques and models for the detection and quantification of SMNP. Specifically, the LABPLAS Project determines reliable identification methods for a more accurate assessment of the abundance, distribution, and toxicity determination of SMNP and associated chemicals in the environment. It also develops practical computational tools that should facilitate the mapping of plastic-impacted hotspots and promote scientifically sound plastic governance.

This document corresponds to Deliverable 8.4 “Policy briefs on SMNP for EU officials and international policymakers (definitive version)”. This deliverable results from Task 8.2 (Action-oriented knowledge transfer to policymakers and other relevant stakeholders) of WP8 (Governing Plastic). Four policy briefs, addressing (i) the problem of tyre particle emissions, (2) the issue of biodegradable plastics, (3) plastic additives and (4) guidelines for analytical methods of plastics are presented in this document. Annex 1 includes the four policy briefs.

2 DEFINITIVE POLICY BRIEFS

The aim of Task 8.2 is to transfer the knowledge, insights and tools developed in the LABPLAS project, including the lessons learnt in the case studies, in an action-oriented manner to policymakers and other relevant stakeholders so that they can apply these lessons, knowledge, insights and tools to reduce (micro)plastics emissions.

To carry this, different subtasks are defined. Under subtask 8.2.2, findings and results of the project that are relevant to the Literacy of the Oceans have been gathered and prepared to be shared with targeted stakeholders, in the form of a preliminary version (D8.6) and a definitive version of policy briefs (D8.4).

In subsections below it is described the final version of the policy briefs (D8.4). The preliminary versions (D8.6) were presented the first version of the policy briefs on tyre particle emissions and biodegradable plastics, which have been updated in this final version (D8.4), and two new policy briefs has been developed, one dealing with the issue of plastic additives and the other one with guidelines for analytical methods of plastics.

Additionally, an interactive version of the policy briefs has been developed and is available on the LABPLAS Project Learning Hub, which complements the document version included in this deliverable.

2.1 Policy brief “Driving towards cleaner oceans: addressing the threat of car tyre emissions”

The use of vehicles on wheels as a means of transport has become an integral part of modern life, but this comes at an increasing environmental cost. Nowadays, it is becoming increasingly recognized that a major source of river and ocean plastic pollution comes from vehicle tyre wear. Urgent actions are required to address this, as to date, particulate emissions from tyres are not yet fully regulated in the EU. The LABPLAS Project policy brief “Driving towards cleaner oceans: addressing the threat of car tyre emissions” (Figure 1) focuses on the problem of particle emissions from car tyres and provides recommendations for policymakers to address this problem.

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POLICY BRIEF

Driving Towards a Cleaner Future:
Addressing the Threat of Car Tyre Emissions

1	1	3	3	5
Summary	Description of the Problem	Relevance to Legislation	Policy Challenges	Policy Recommendations

Summary

The use of wheeled vehicles as a primary means of transportation has become integral to modern life, but it may carry a significant environmental cost. One source of microplastic pollution is the wear and tear of vehicle tyres. Despite this, particulate emissions from tyres remain largely unregulated in the EU. This policy brief highlights the issue of tyre particle emissions and offers recommendations for policymakers to address this growing concern.

Description of the Problem

The abrasion of car tyres moving on the road surface creates small particles that are released into the environment, where they can harm ecosystems and human health.

Once released, these tyre wear particles (TWP) stay on land and accumulate in soils, while a fraction ends up in freshwater and marine systems. Car tires are indeed now considered to be a major source of river and ocean microplastics, with studies estimating that between 5 to 10% of the total amount of plastics ending up in our oceans comes from TWP (IUCN, 2017)[1].

Micronized tyre rubber and tyre wear particles have recently gained global attention, as they have been detected in surface waters, soils, sediments, air, and wastewater treatment plant samples. In some cases, these particles may even reach the ocean when roadside drainage systems discharge untreated road runoff directly into rivers and the sea.

1

Figure 1. Front page of the LABPLAS project policy brief “Driving towards cleaner oceans: addressing the threat of car tyre emissions”

2.2 Policy brief “Supporting environmentally safe biodegradable plastics”

Biodegradable plastics can help reduce the accumulation of plastic in the environment. However, the use of ambiguous terms such as biopolymers and bioplastics, and the lack of reliable labeling information, can mislead consumers. Furthermore, there is a need for a better understanding of environmental biodegradability and the development of improved testing methods and certification schemes. Challenges regarding biodegradable plastics are addressed in the LABPLAS Project policy brief “Supporting environmentally safe biodegradable plastics” (Figure 2). The policy brief also provides insights and recommendations for policymakers to better develop the legislative framework.

In addition, WP6 activities in coordination with the analysis of additives in Task 4.4 made progress in the explanation of the ecotoxicity of specific environmental plastic typologies based on their chemical composition. This work is presented in D4.6 “Final Report on the presence of additives in the analysed field samples”.

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POLICY BRIEF Supporting Environmentally Safe Biodegradable Plastics

1	1	3	3	5
Summary	Description of the Problem	Policy Challenges	Relevance to Legislation	Policy Recommendations

Summary

Plastic pollution is a major environmental problem that requires urgent action. Biodegradable plastics can help reduce the accumulation of plastic in the environment, when used in specific and relevant applications. However, the use of ambiguous terms such as biopolymers and bioplastics needs to be discouraged, and the existing labelling should be improved to enable informed consumer choice.

Furthermore, there is a need for a better understanding of environmental biodegradability and development of improved testing methods and certification schemes. This policy brief highlights current challenges regarding biodegradable plastics and provides recommendations for policymakers to better develop the legislative framework.

Description of the Problem

Biodegradable plastics were developed, as an alternative to conventional plastics, for specific applications. These types of plastics have the same properties and behaviour as conventional plastics but can be metabolized by microbes into carbon dioxide and biomass. Hence, the introduction of biodegradable plastics in specific applications such as mulch films could potentially help prevent the accumulation of persistent (micro and nano) plastics in the environment.

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Figure 2. Front page of the LABPLAS project policy brief "Supporting environmentally safe biodegradable plastics"

2.3 Policy brief "Plastic additives"

Plastic additives are compounds incorporated into plastic materials to enhance their characteristics and optimize the production process. Every plastic product contains these additives in small quantities, typically a few weight percentage units. While they are useful, these substances can leach into the environment during the plastic's life cycle, posing a risk to ecosystems and potentially contaminating the human food chain. The complex and diverse chemical nature of plastic additives makes it difficult to regulate them and the lack of comprehensive environmental data hinders accurate risk assessments. These challenges are addressed in the LABPLAS Project policy brief "Plastic Additives" (Figure 3) giving key policy recommendations to face them.

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POLICY BRIEF Plastic Additives

1	1	3	3	4
Summary	Description of the Problem	Policy Challenges	Relevance to Legislation	Policy Recommendations

Summary

Plastic additives are substances added to plastic material to improve its properties and enhance the manufacturing process. All plastic objects contain additives in amounts of a few units in weight percentage. Although useful, throughout the life cycle of plastic material, these additives may be released into the environment, with the potential to disrupt ecosystems and enter the human food chain. The complex and diverse chemical nature of plastic additives makes it difficult to regulate them and the lack of comprehensive environmental data hinders accurate risk assessments. There is a need to ensure these additives are chemically safe for humans and the environment, as well as to improve regulations and public awareness, encouraging responsible consumption.

Description of the Problem

Plastic additives encompass a plethora of substances with diverse functions in the plastic industry. They provide essential improvements to the physical and chemical properties of the material, like flexibility and colour, increase the resistance to fire, light and high temperatures, and can improve the manufacturing process by reducing costs.

Source: Modified from UNEP (2023)

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Figure 3. Front page of the LABPLAS project policy brief "Plastic Additives"

2.4 Policy brief "Guidelines for analytical methods of plastics"

Plastic contamination in environmental and biological systems is a growing concern due to its potential impacts on ecosystems and human health. Ensuring the accuracy and comparability of analytical results requires standardized sampling approaches (*e.g.*, spatial and temporal resolution) and robust analytical and handling procedures that define key parameters such as limits of detection (LoD) and analytical blanks. This policy brief identifies key challenges in establishing harmonized analytical protocols and provides recommendations to improve the reliability of plastic sampling and analysis. An example of a unified approach for assessing plastic pollution in a specific environment is included based on the results presented in the D2.1 "Harmonisation of Sampling Methods'.


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POLICY BRIEF Guidelines for Analytical Methods of Plastics

1	1	2	2	5
Summary	Description of the Problem	Relevance to Legislation	Policy Challenges	Policy Recommendations

Summary

Plastics contamination in environmental and biological matrices is a growing concern due to its potential ecological and human health impacts. The reliability and comparability of analytical results depend on standardized sampling techniques (e.g. spatial and temporal resolution) and analytical and handling methods that define key parameters such as limits of detection (LoD) and analytical blanks. This policy brief outlines key challenges in establishing harmonized analytical protocols and provides recommendations to improve the robustness and reproducibility of plastic sampling and analysis.

Description of the Problem

Plastics (macro, micro and nanoplastics[1]) are found everywhere in the environment – in water, soil, air, and biological tissues. Each matrix presents unique challenges for extraction and analysis, necessitating tailored methodologies. For instance, the presence of organic matter in soil or biota can interfere with detection techniques, requiring additional sample preparation steps. The use of different analytical methods has led to significant variability in reported concentrations and composition. Factors such as background contamination, instrumental sensitivity, and laboratory-specific procedures impact data quality. **Establishing clear guidelines to overcome common sampling and analytical challenges** is critical to ensure the accuracy and comparability of results across different studies and regulatory frameworks.

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Figure 4. Front page of the LABPLAS policy brief "Guidelines for analytical methods of plastics"

ANNEX 1: POLICY BRIEFS

POLICY BRIEF

Driving Towards a Cleaner Future: Addressing the Threat of Car Tyre Emissions

Summary

The use of wheeled vehicles as a primary means of transportation has become integral to modern life, but it may carry a significant environmental cost. One source of microplastic pollution is the wear and tear of vehicle tyres. Despite this, particulate emissions from tyres remain largely unregulated in the EU. This policy brief highlights the issue of tyre particle emissions and offers recommendations for policymakers to address this growing concern.

Description of the Problem

The abrasion of car tyres moving on the road surface creates small particles that are released into the environment, where they can harm ecosystems and human health.

Once released, these tyre wear particles (TWP) stay on land and accumulate in soils, while a fraction ends up in freshwater and marine systems. Car tires are indeed now considered to be a major source of river and ocean microplastics, with studies estimating that between 5 to 10% of the total amount of plastics ending up in our oceans comes from TWP[1].

Micronized tyre rubber and tyre wear particles have recently gained global attention, as they have been detected in surface waters, soils, sediments, air, and wastewater treatment plant samples. In some cases, these particles may even reach the ocean when roadside drainage systems discharge untreated road runoff directly into rivers and the sea.

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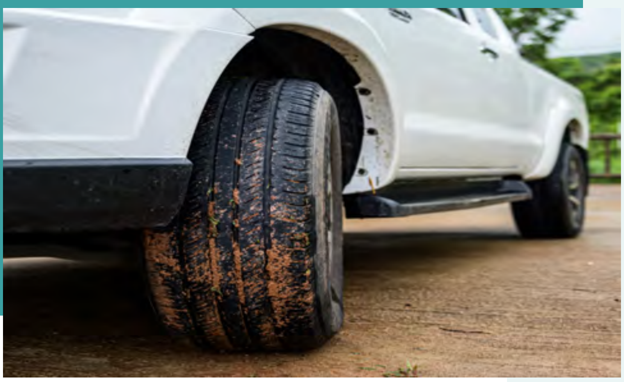
After heavy rainfall, stormwater runoff carries particles into drainage systems, sewers, wastewater treatment plants, and rivers, potentially reaching the ocean."

The extent to which tyre wear particles become trapped in sediments during their journey is still unknown.

Airborne transport is another concern, as wind can carry microplastics, allowing them to remain suspended in the atmosphere and eventually deposit on land or even the oceans, far from their sources. From a life cycle perspective, tyre reuse (e.g., as infill for artificial turfs) and improper disposal also contribute to microplastic pollution.

Tyre wear particles (TWP) can be as small as traffic-related pollution particles from car exhausts, measuring less than 2.5 microns, and might negatively impact human health. The complexity of the environmental issue is compounded by the diverse range of potentially harmful compounds in TWP, including fillers (e.g., carbon black, clay, silica, and calcium carbonate), stabilizers (antioxidants, antiozonants, and waxes), cross-linking agents (sulfur, accelerators, and activators), and secondary components like pigments, oils, resins, and short fibers.



Vehicles, from personal cars to commercial trucks, play a vital role in society and the economy, making it a significant challenge to address tyre particle emissions. The anticipated increase in road traffic, including the rise of electric vehicles (generally heavier than gasoline-powered cars), may likely exacerbate TWP emissions. According to EU projections, passenger transport is expected to increase by 42% by 2050, and freight transport by 60% [2]. The growing car fleet, especially the popularity of heavier vehicles like SUVs, further contributes to this issue. Without intervention, pollution from TWP is very likely to rise.

For all these reasons, it is essential to develop and implement strategies to (1) reduce TWP emissions, (2) minimize their flow into land and aquatic systems, and (3) mitigate their toxicological impact on biota and human health.

Currently, no specific EU regulation directly addresses TWP emissions, partly due to the absence of a standardized tyre wear test. Nonetheless, regulations, like the EU emissions standards and the Tyre Labelling Regulation may indirectly tackle the issue.

It is expected that limits for TWP emissions from vehicles will be set in 2025 under the Euro emissions standards. Additionally, the EU has established the Tyre Labelling Regulation, which requires all tyres sold in the EU to be labeled with information on their fuel efficiency, wet grip, and external rolling noise. This regulation encourages consumers to make more informed purchase decisions and, might lead to manufacturing tyres with increased wear and/or rolling resistance.

Regulations and directives need to, among others:

- Encourage the adoption of technologies that reduce tyre emissions into the environment and associated chemical hazards.
- Push forward the use of alternative modes of transportation.
- Promote responsible tyre disposal.

Relevance to Legislation

The Euro 7 standards will be the first global emission regulations to go beyond controlling exhaust pipe emissions and establish additional restrictions on brake particulate emissions, as well as regulations on microplastic emissions from tires. These requirements will be applicable to all types of vehicles, including electric ones.

▷ https://ec.europa.eu/commission/presscorner/detail/en/ip_22_6495

The EU tyre label regulation (EU 2020/740)

▷ https://www.etrma.org/key-topics/tyre-regulations

EU planned actions to tackle the issue of plastic pollution addressing both intentional and unintentional sources of microplastics

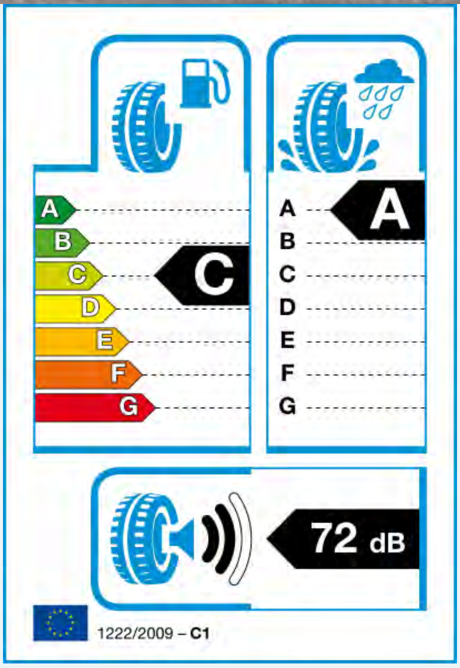
▷ https://environment.ec.europa.eu/topics/plastics/microplastics_en

Policy Challenges

The generation of TWP is complex and can be influenced by various factors, including tyre characteristics, vehicle design, road surface conditions, driving behaviour, tyre maintenance, traffic composition and intensity, and weather conditions. One of the greatest policy challenges is the limited understanding of TWP and its influencing factors, largely due to the lack of effective methods for detecting these particles. This has created significant knowledge gaps regarding the sources, emission drivers, fate, and impacts of TWP on both the environment and human health.

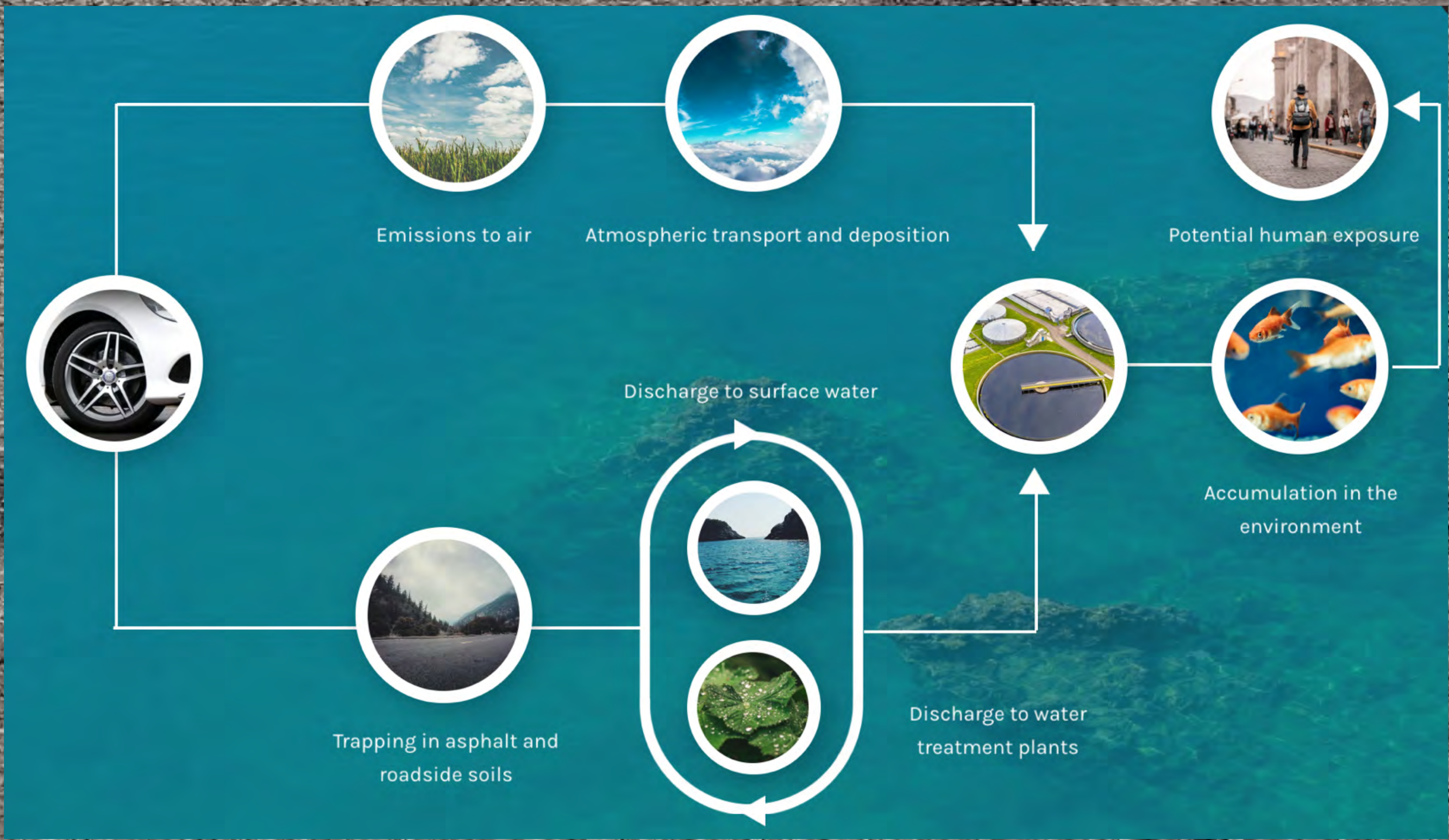
To reduce TWP generation and capture emitted particles, dedicated research and technology development are required to explore mitigation measures, assess their feasibility, and evaluate their potential effectiveness.

The LABPLAS project aims to develop reliable analytical methods for determining microplastics and tyre wear markers in environmental samples, such as road dust and water run-off. This will help to evaluate the contribution of run-off waters to microplastic emissions. The project also seeks to identify the main sources, transport mechanisms, and fate of microplastics and TWP, in order to fill knowledge gaps and propose targeted mitigation measures that are effective in reducing their impact on the environment.



Tyre Labelling Information. Source: European Commission's Impact Assessment SEC (2008) 2860. Test methods set out on Regulation EC 12272009.

Sources, transport mechanisms and fate of microplastics and TWP (figure below). Source: LABPLAS project.



Policy Recommendations

- Focus on clean-up and retention technologies in drainage systems in road networks to collect the emitted particles, such as sediment interception systems, hydrocarbon interception systems and storm water attenuation systems. This measure does not reduce emission of particles but decreases their accumulation in the environment.
- Promote the reduction of journeys taken by car, replacing them by public transportation and rail. This reduced car usage would be an effective policy solution to decrease particle emissions, since these emissions depend on the distances travelled by vehicles.
- Incentivize the research and adoption of to tire (design) innovations reducing the amount of plastic released through wear and tear, such as using more durable and natural materials as well as improving the lifespan of tyres.
- Require that regulations and standards addressing plastic pollution reduction consider TWP and its characteristics, including the different types of tyres and road conditions determining abrasion.
- Regulate the use of additives and chemical substances in tyre production, such as setting maximum limits, and encouraging the use of safer alternatives. y models, which will reduce TWP emissions.

- Collaborate with international partners including car tyre manufacturers, city planners, asphalt engineers, and the wastewater industry, among others, to ensure effective policies and regulations.
- Promote responsible tyre disposal practices, like requiring tyre retailers to take back used tyres from customers and foster sustainable end-of-life programs for tyres as well as incentivize owners of older cars to replace them with newer, more environmentally friendly models.
- Target driver awareness and behaviour to ensure conscious driving, which will reduce TWP emissions.
- Promote research and development to harmonize sampling, sample preparation, and analytical methods, improving understanding of tyre wear particle issues and offering scientifically grounded guidance to policymakers.

Sources

1 IUCN (2017). Primary Microplastics in the Oceans: A Global Evaluation of Sources. (Boucher, J. and Friot D.) Gland, Switzerland. 43pp.

2 EC (2019). Transport in the European Union – current trends and issues. Brussels, Belgium: DG MOVE. 171 pp.

Interactive version

https://labplas.eu/learning-hub/

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POLICY BRIEF

Supporting Environmentally Safe Biodegradable Plastics

Summary

Plastic pollution is a major environmental problem that requires urgent action. Biodegradable plastics can help reduce the accumulation of plastic in the environment, when used in specific and relevant applications. However, the use of ambiguous terms such as biopolymers and bioplastics needs to be discouraged, and the existing labelling should be improved to enable informed consumer choice.

Furthermore, there is a need for a better understanding of environmental biodegradability and development of improved testing methods and certification schemes. This policy brief highlights current challenges regarding biodegradable plastics and provides recommendations for policymakers to better develop the legislative framework.

Description of the Problem

Biodegradable plastics were developed, as an alternative to conventional plastics, for specific applications. These types of plastics have the same properties and behaviour as conventional plastics but can be metabolized by microbes into carbon dioxide and biomass. Hence, the introduction of biodegradable plastics in specific applications such as mulch films could potentially help prevent the accumulation of persistent (micro and nano) plastics in the environment.

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In parallel to biodegradable materials, bio-based plastics have been developed in an effort to strive for a circular use of resources and for defossilization. However, the term biopolymer or bioplastics is often used to describe both bio-based and biodegradable plastics, although the products often do not fulfill both requirements.

Examples include terms such as bio-PE or bio-PET that contain the prefix bio- to describe products that are bio-based but are not biodegradable. This ambiguous terminology results in confusion for consumers. Such confusion is further amplified by similar green marketing claims such as "self-destructing" or "undergoing biotransformation", which are sometimes misused to refer to oxo-degradable technologies and which has nothing to do with biodegradable plastics and can mislead consumers.

There is more

Over the years, great efforts have been put into the development of standard methods, certification schemes and labels to assess plastic biodegradability and renewable content. However, green claims are often not appropriately regulated by a legislative framework.

For applications in which the use of biodegradable plastics is considered beneficial, the materials used should be certified through recognized schemes based on validated and standardized tests.

Still, there is a need for a deeper understanding of environmental biodegradability, as well as for further development of test methods and certification schemes. Environmental conditions vary substantially depending on the climate zone, nutrient availability and microbial consortia. Additionally, current test methods require long testing times and high costs (e.g. testing for soil and marine biodegradability is currently performed for up to two years) and are only partially suitable to investigate slow degrading materials.

Therefore, methods with high environmental relevance and reproducibility and shortened testing times are necessary to complement the already existing methods. Nevertheless, gaps are still present, such as specific methods for the plastic products designed for use in the marine and freshwater environments.

All these aspects are key for the sustainable development of environmentally safe and sustainable biodegradable materials capable of replacing persistent conventional plastics and ensuring that the cure will not be worse than the disease.

Environmentally biodegradable materials and products should be truly benign in the application and at their typical end of life.

This is already part of existing testing schemes and certifications such as mandatory ecotoxicity testing of intermediate products and additives.

The ecotoxicity of the materials and all their components, *e.g.* additives, as well as their intermediate biodegradation fragments in the micro and nano-size range should be investigated.

Policy Challenges

The current greatest policy challenge is to support consumer choices to deal with biodegradable and biobased plastics. Specifically, the need for a uniform and transparent terminology that does not confuse the consumer. The EC identified the lack of reliable labeling information on those products as a problem but associates this problem only to the use of the confusing term "biopolymer", which encompasses bio-based plastics (BBP) and biodegradable and compostable plastics (BDCP).

In fact, these two materials are very different in terms of the environmental problems they target and the end-of-life management they demand: the waste of bio-based plastics (BBP) must be managed just like conventional plastics, whereas biodegradable and compostable plastics (BDCP) facilitate composting and may reduce the environmental impacts associated with accidental loss.

The LABPLAS Project aims to provide scientific information to plastic producers, regulatory agencies and certifiers (TUV Austria, DIN) to manufacture, certify and label biodegradable plastic materials. The goal is to further improve the available standard methods to ultimately give consumers access to clearer and more trustworthy information when making their purchasing decisions.

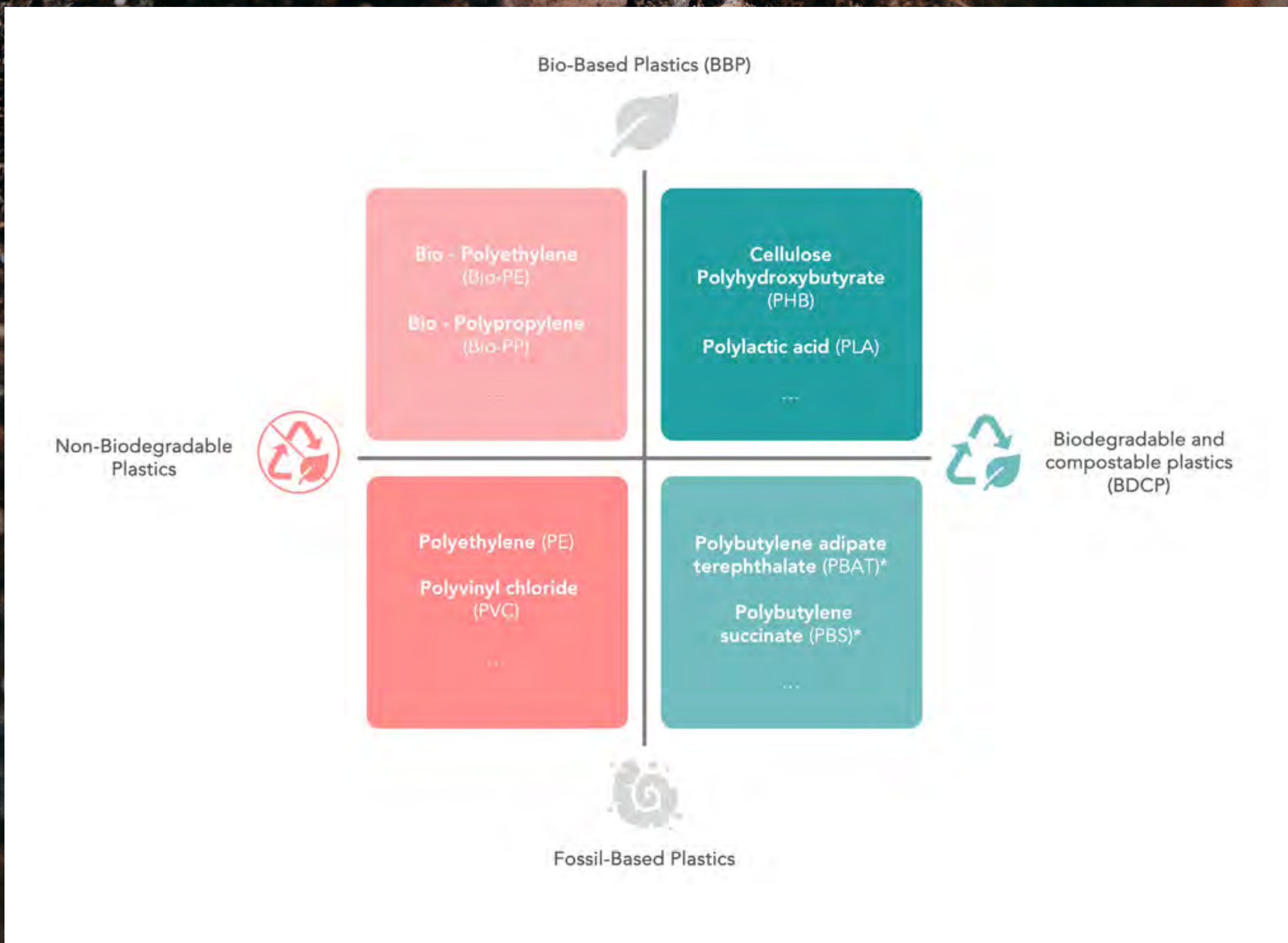
Relevance to Legislation

- Plastics Strategy (2018)
- SUP Directive (Directive EU 2019/904)
- Packaging and packaging waste Regulation
- Revision of the Waste Framework Directive
- Green Claims Directive (Product Environmental Footprint)
- Intentionally added microplastics
- Empowering consumers in the green transition Directive
- Eco-design for Sustainable Products Regulation

Bio-Based plastics are made from biological resources (using plant-based sources, naturally existing structures, or generated through biological processes like microbial activity), rather than relying solely on fossil raw materials. However, they are not necessarily biodegradable or compostable.

Bio-Degradable plastics can be biodegraded by microorganisms into CO^2, water, and biomass. The efficiency and outcome of biodegradation are contingent upon various factors, including the environmental conditions specific to the given location and the nature of the material or application. For example, compostable plastics are biodegradable under industrial composting conditions.

Using the terms "biodegradable" or "compostable" alone without specifying the applicable standards or environments where the degradation process occurs, is deceptive.



Policy Recommendations

BioPlastics

The general term "bioplastics" as well as the general prefix "bio-" on final products is misleading and akin to greenwashing.

Bio-based & biodegradable products should be clearly differentiated. For both classes of materials, renewable content and biodegradability claims should be regulated by law. They should refer to the exact properties of the products and their intended end of life, determined through internationally recognized and accepted standards and certifications.

Biodegradability & Ecotoxicity Test Methods

More efforts must be invested in the development of new biodegradability and ecotoxicity test methods.

Cost-effective, ecologically relevant and high throughput standard tests representative of biodegradation under environmentally realistic conditions to complement existing methods and standards are needed.

Shortened testing times as well as complementary testing for slow-degrading materials should be developed. Validation of these test methods should be performed through relevant field testing. Ecotoxicity tests should be developed to take into consideration fragmentation scenarios and reflect realistic scenarios (*e.g.*, concentrations).

In addition, minimum criteria should be defined for biodegradation and ecotoxicity studies published in the literature to be considered for the drafting of regulations.

Sources

European Bioplastics (2021). Claims on biodegradability and composability on products and packaging. Berlin: European Bioplastics. 3 pp.

European Commission (2022). COM(2022) 682. Communication from the commission to the European Parliament, the Council, The European Economic and Social Committee and the Committee of the Regions. EU policy framework on biobased, biodegradable and compostable plastics. 14pp.

Interactive version

https://labplas.eu/learning-hub/

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POLICY BRIEF

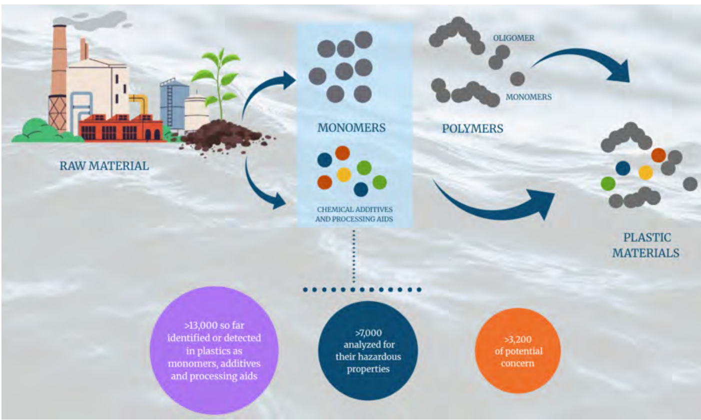
Plastic Additives

Summary

Plastic additives are substances added to plastic material to improve its properties and enhance the manufacturing process. All plastic objects contain additives in amounts of a few units in weight percentage. Although useful, throughout the life cycle of plastic material, these additives may be released into the environment, with the potential to disrupt ecosystems and enter the human food chain. The complex and diverse chemical nature of plastic additives makes it difficult to regulate them and the lack of comprehensive environmental data hinders accurate risk assessments. There is a need to ensure these additives are chemically safe for humans and the environment, as well as to improve regulations and public awareness, encouraging responsible consumption.

Description of the Problem

Plastic additives encompass a plethora of substances with diverse functions in the plastic industry. They provide essential improvements to the physical and chemical properties of the material, like flexibility and colour, increase the resistance to fire, light and high temperatures, and can improve the manufacturing process by reducing costs.



Source: Modified from UNEP (2023)

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However, some chemicals used as plastic additives, such as trace metals or phthalates, have been already restricted from many applications due to their toxicity, and others like bisphenols or benzophenones raise increasing concern due to their potential to disrupt the normal functioning of hormones.

UNEP has recently brought to focus the issue of chemical additives[1]. More than 13,000 chemicals are associated with plastics and plastic production across a wide range of applications, of which over 3,200 additives, processing aids and non-intentionally added substances are of potential concern due to their hazardous properties.

Plastic goes through a life cycle, starting with the extraction of raw materials and ending with its recovery, reuse, recycling, or final disposal. Additives are not chemically bonded to the polymer and throughout this cycle, can migrate from the plastic to its surroundings, be it food, water, or soil. Migration can be engineered, and sometimes beneficial, but its unintended occurrence can result in harmful exposure, and its extent depends on the characteristics of the plastic material, the chemical in question and environmental conditions.

Most of the plastics are still incinerated and/or disposed of in landfills or dumpsites, the EU policies prompted an increase in recycling (*e.g.* carrier bags, drinking bottles).

Chemical additives hinder recycling as an end-of-life alternative. An example is the case of Brominated Flame Retardants (BFRs), recognized endocrine disruptors, which have been incorporated into recycled products, making recyclers face difficulties in ensuring the precise composition of secondary materials, which constrains the recycling process.

The composition of a plastic product in terms of additives is unknown even for the manufacturer, due to limited disclosure by original producers, the addition of multiple chemicals during different steps of the plastic item production, and the complex composition of many current plastic products such as copolymers, heteropolymers, or multilayers. Assessing the quantities and types of additives present in a plastic item by chemical analyses is extremely difficult and expensive due to the complexity and diversity in the chemical nature of additives and thus in the required analytical techniques. Therefore, the information on the qualitative composition of any commercialized plastic should be compulsory to allow consumers to make informed decisions and improve end-of-life management and circularity. Similarly, the complex chemical nature of additives and thus their environmental behaviour and effects towards biota remains poorly understood.

Data on the leachability and ecotoxicity of additives in the environment **is limited and inconsistent,** thus **their impact is yet to be fully explored** and progress is needed to standardise toxicity testing methods.

Policy Challenges

- **Limited Knowledge of Plastic Composition:** Plastic composition is not disclosed due to intellectual property agreements. The EU still lacks a comprehensive information base on all substances. Polymers are not subject to registration under REACH and information on low and medium-tonnage substances under REACH does not fully allow to identify critical hazard properties.

- **Inadequate Real-World Testing**: The standard's laboratory testing methods fail to accurately replicate real-world conditions, potentially leading to misleading conclusions. Different aspects such as the complexity of the polymer matrix, migration and release mechanisms, analytical limitations and presence of Non-Intentionally Added Substances (NIAS) should be considered.

- **Insufficient Evaluation of Additive Toxicity:** The current assessments are insufficient to ensure the additives are harmless to real-world ecosystems and the wildlife they support. There is an absence of restrictions on constituents like trace metals or substances of very high concern (SVHCs).

- **Limited Environmental Scope:** There is a necessity for comprehensive testing across diverse ecosystems (open-air, terrestrial, freshwater and marine environments, landfills, and ecosystems under anaerobic conditions) to prevent and identify adverse environmental impacts.

Relevance to Legislation

- Circular Economy Action Plan. Registration, Evaluation, Authorisation and Restriction of Chemicals
- Chemicals Strategy for Sustainability "Human biomonitoring studies in the EU point to a growing number of different hazardous chemicals in human blood and body tissue, including certain pesticides, biocides, pharmaceuticals, heavy metals, plasticisers and flame retardants"
- Global Action on Plastics
- Packaging Waste (Law and Publications tabs) – Revision of the Packing and Packaging Waste Directive
- Microplastics (Waste Framework Directive)
- Single-Use Plastics Directive
- RoHS Directive (Restriction of Hazardous Substances in Electrical and Electronic Equipment)
- The Stockholm Convention
- Guidelines of the European Chemicals Agency (ECHA)

Policy Recommendations

- **Encourage Comprehensive Real-World Testing:** Toxicity testing methods must be expanded to consider the full food chain in each ecosystem compartment and shall also focus on the bioavailability of contaminants to more accurately evaluate their ecotoxicological impacts

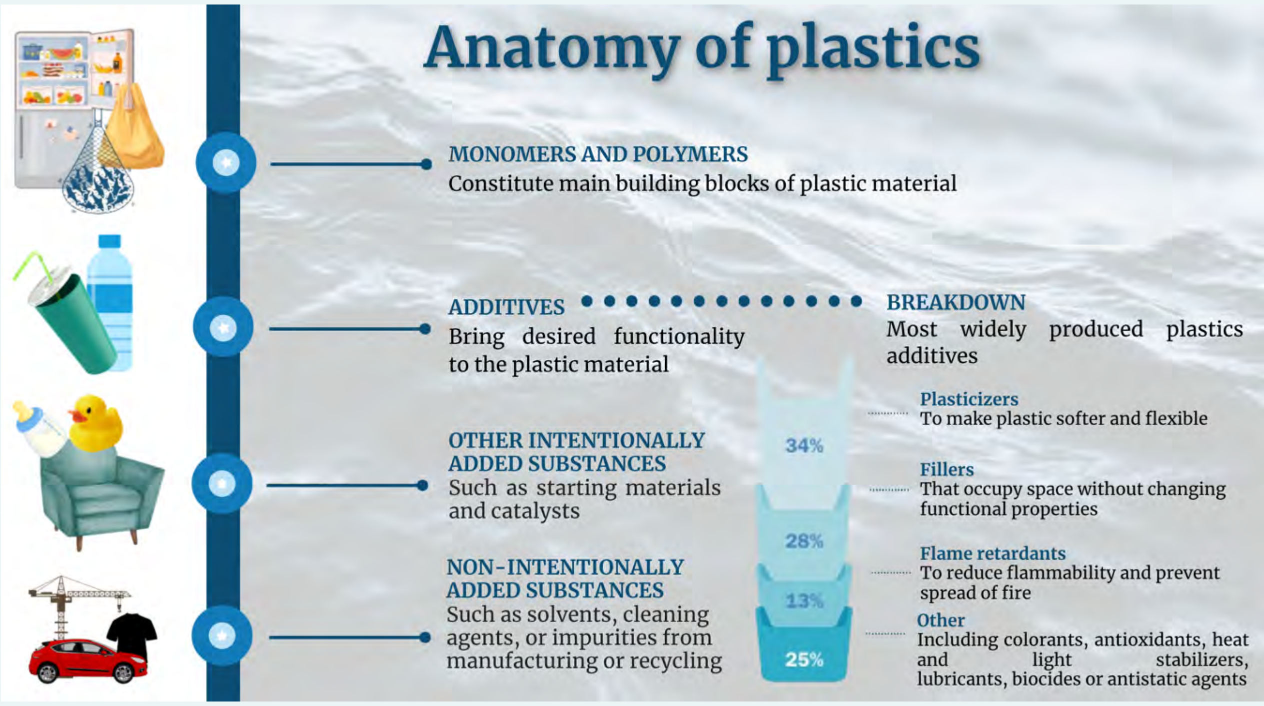
- **Establish Rigorous Additive Safety Assessments:** Require thorough evaluations of all additives used in plastics to confirm their safety for all ecosystems, including assessments for substances like trace metals and SVHCs. Compostable plastics, currently promoted for agricultural use, are designed to remain in the soil, as seen with certain mulch films. Therefore, requirements ensuring the absence of environmental toxicity to all components of biological communities in both aquatic and terrestrial ecosystems should be reinforced.

- **Expand Environmental Considerations:** Develop standards that encompass a broader range of environments, including freshwater, marine, landfill, and anaerobic settings, to address the full spectrum of potential plastic pollution impacts. Studies should focus on the bioavailability of the contaminants and not only on their occurrence in the environment, to determine their ecotoxicological impacts more accurately.

- **Prioritize Reduction and Systemic Change:** Emphasize reducing plastic usage and implementing systemic changes to transition towards a circular economy. Strengthen extended producer responsibility (EPR) programs to ensure manufacturers take accountability for the additives used in their products. Regulatory actions should ensure compliance across the plastic supply chain including the safety of imported plastic products in the EU.

- **Promote Behavioural Change from manufacturers to consumers:** Encourage industries to adopt the digital product passports (DPP), eco-labelling and certification schemes to provide accessible and comprehensive information that fully discloses the product's chemical content. Increase funding for research and encourage collaboration between industry and scientists to develop safer, environmentally friendly alternatives to hazardous additives. Decisions on alternative additives should use a priori Environmental and Human Health Risk Assessments to prioritize safety.

- **Enhance Public Awareness and Promote Responsible Consumption of Plastic Additives:** Improve public understanding of the issues surrounding plastic additives and encourage responsible consumption choices through education and awareness campaigns.



Source: Modified from UNEP (2023)

Sources

1 UNEP (2023). Chemicals in plastics: a technical report. Geneva, Switzerland: United Nations Environment Programme and Secretariat of the Basel, Rotterdam and Stockholm Conventions. 144 p.

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POLICY BRIEF

Guidelines for Analytical Methods of Plastics

Summary

Plastics contamination in environmental and biological matrices is a growing concern due to its potential ecological and human health impacts. The reliability and comparability of analytical results depend on standardized sampling techniques (*e.g.* spatial and temporal resolution) and analytical and handling methods that define key parameters such as limits of detection (LoD) and analytical blanks. This policy brief outlines key challenges in establishing harmonized analytical protocols and provides recommendations to improve the reliability of plastic sampling and analysis.

Description of the Problem

Plastics (macro, micro and nanoplastics[1]) are found everywhere in the environment – in water, soil, air, and biological tissues. Each matrix presents unique challenges for extraction and analysis, necessitating tailored methodologies. For instance, the presence of organic matter in soil or biota can interfere with detection techniques, requiring additional sample preparation steps. The use of different analytical methods has led to significant variability in reported concentrations and composition. Factors such as background contamination, instrumental sensitivity, and laboratory-specific procedures impact data quality. **Establishing clear guidelines to overcome common sampling and analytical challenges** is critical to ensure the accuracy and comparability of results across different studies and regulatory frameworks.

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Relevance to Legislation

- *European Chemicals Agency (ECHA), Restriction Proposal on Microplastics (2023).* Establishes regulatory measures for microplastic release, emphasizing the need for harmonized detection methods.
▷https://trade.ec.europa.eu/access-to-markets/en/news/restriction-microplastics-eu-17-october-2023

- *EU Marine Strategy Framework Directive (2008/56/EC).* Requires standardized monitoring of marine litter, including plastics, necessitating reliable analytical techniques.
▷https://eur-lex.europa.eu/eli/dir/2008/56/oj/eng

- *US EPA Method 3510C (Solid-Phase Extraction of Organic Analytes from Aqueous Samples).* Includes considerations for LoD and contamination control relevant to plastic analysis.
▷https://www.epa.gov/sites/default/files/2015-12/documents/3510c.pdf

- *UNEP Global Plastics Treaty (Upcoming).* Aims to regulate plastic pollution with a focus on establishing science-based monitoring and assessment protocols.
▷https://www.unep.org/inc-plastic-pollution

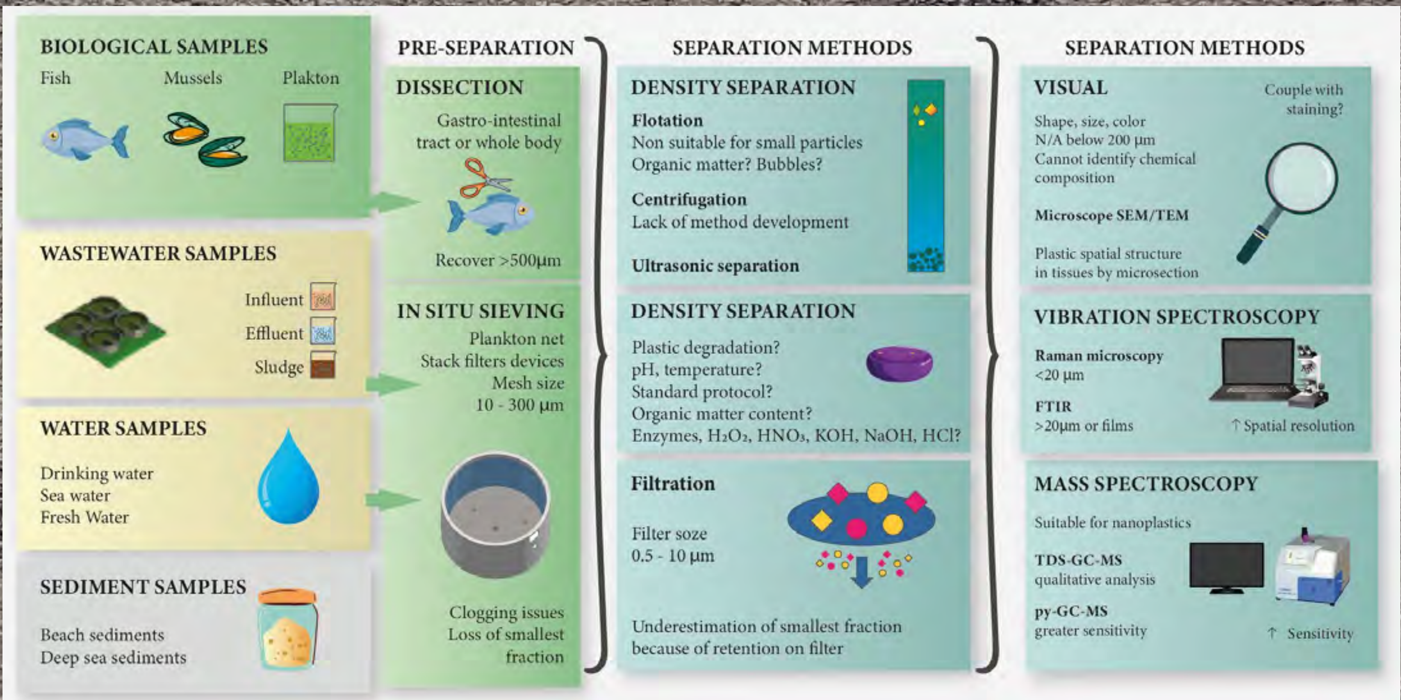
Policy Challenges

- **Lack of Standardization for Data:** The absence of guidelines and best practices, harmonised and adaptable, with some critical parameters to be considered for sampling, identifying, and quantifying microplastics leads to inconsistencies across studies. Variations in sample collection, preparation, and analysis hinder the comparability of data and the establishment of global baselines [1]. This lack of standardization complicates efforts to assess the true extent of plastic contamination and to develop effective mitigation strategies. Establishing harmonized protocols and quality assurance measures is critical to producing reliable and comparable data.

- **Background Contamination:** Analytical procedures -for micro and nano plastics- are highly susceptible to contamination from ambient microplastics present in laboratory environments. Airborne particles, equipment, and even clothing can introduce extraneous plastics into samples and analytical blanks, leading to false positives or inflated concentration, readings affecting the reliability of measurements [2].

- **Diversity of analytical techniques:** Different analytical techniques (e.g., spectroscopy, chromatography, and microscopy) use varying detection limits and quantification approaches, leading to a lack of comparability in reported data. For example, detecting and characterizing nano-plastics require in particular highly sensitive instrumentation capable of identifying particles at the nanoscale. The diversity of analytical tools with different sensitivities and detection limits results in the underreporting of smaller plastic particles. Advancements in technologies such as thermal extraction-desorption gas chromatography/mass spectrometry (TED-GC/MS) are being explored to enhance detection capabilities [3], however, variability in instrument sensitivity influences the LoD, requiring harmonized criteria to ensure comparability of results.

- **Regulatory Gaps:** Existing European environmental regulations do not fully address recommended protocols for plastic analysis, leading to difficulties in compliance and enforcement.



General workflow for microplastics analysis. Adapted from Sarkar, S., et al. (2023). Microplastic Pollution: Chemical Characterization and Impact on Wildlife. *Int. J. Environ. Res. Public Health*, *20* (3), 1745.

The development of **a sampling strategy for plastics** in the environment is **critical for plastic governance** as it provides the scientific basis for informed decision-making, regulatory frameworks, and policy development.

The LABPLAS Project has developed a plastics sampling strategy for Water samples, Sediment, Atmospheric deposition and Biota which intends the harmonisation of sampling methods to ensure comparable techniques across plastic sampling.

An example of a unified approach for assessing plastic pollution in a specific environment

The LABPLAS Project has collected samples for small microplastics (10-1000 micron) from the North Sea, including the Elbe and Thames rivers basins, as well as from the Mero-Barcés river basin. In freshwater, samples were collected from 2-3 distinct environments (▷ rural, urban, and estuarine), ensuring good spatial coverage of the North Sea (▷ from the Thames estuary to the Elbe estuary). All samples were collected using a standardized method, employing the same sampling tool (▷ pump equipped with a 10-micron filter). Sampling across all locations was conducted almost simultaneously (▷ month-wise). Sampling containers were prepared uniformly. Samples were processed and prepared for analysis utilizing the same analytical technique to identify and characterise microplastics.

More information: LABPLAS deliverable

D2.1 Harmonisation of Sampling Methods

Policy Recommendations

- **Harmonize Sampling and Analytical Protocols:** Develop internationally recognized guidelines for the identification and quantification of plastics in different matrices, integrating best practices from existing analytical methods. Establish a minimum threshold for the detection and quantification of plastics in different matrices, considering method-specific capabilities and environmental relevance.

- **Promote Interlaboratory Comparisons and Development of Reference Materials:** Encourage proficiency testing and collaborative studies to evaluate the performance of different methodologies and improve result consistency. Interlaboratory comparisons for validating analytical methods require a standardized reference material with a uniform matrix, therefore, the development of matrix reference materials for plastic analysis should be supported.

- **Strengthen Regulatory Frameworks:** Update environmental monitoring and risk assessment legislation with the scientific community's latest recommendations for plastic analysis, ensuring regulatory alignment and effective policymaking.

Sources

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2 Hale, R.C. (2017). Analytical challenges associated with the determination of microplastics in the environment. Analytical Methods 9(9), 1326–1327.

3 Kusch, P. (2022). Challenges in the Analysis of Micro- and Nanoplastics. In: Rocha-Santos, T., Costa, M.F., Mouneyrac, C. (eds) Handbook of Microplastics in the Environment. Springer, Cham. pp 477–501.

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