Plastics and Toxicity Scan - Chemistry Industry Association of Canada

Title	Abstract	Link
1. Toward the Development and Application of an Environmental Risk Assessment Framework for Microplastic	Emissions of plastic waste to the environment and the subsequent degradation into microplastic particles that have the potential to interact with biological organisms represent a concern for global society. Current understanding of the potential impacts on aquatic and terrestrial population stability and ecosystem structure and function associated with emissions of microplastic particles is limited and insufficient to fully assess environmental risks. Multistakeholder discussions can provide an important element in helping to identify and prioritize key knowledge gaps in assessing potential risks. In the present review, we summarize multistakeholder discussions from a 1-d International Council of Chemical Associations–sponsored symposium, which involved 39 scientists from 8 countries with representatives from academia, industry, and government. Participants were asked to consider the following: discuss the scientific merits and limitations of applying a proposed conceptual environmental risk assessment (ERA) framework for microplastic particles and identify and prioritize major research needs in applying ERA tools for microplastic particles. Multistakeholder consensus was obtained with respect to the interpretation of the current state of the science related to effects and exposure to microplastic particles, which implies that it is unlikely that the presence of microplastic in the environment currently represents a risk. However, the quality and quantity of existing data require substantial improvement before conclusions regarding the potential risks and impacts of microplastic particles can be fully assessed. Research that directly addresses the development and application of methods that strengthen the quality of data should thus be given the highest priority. Activities aimed at supporting the development of and access to standardized reference material were identified as a key research need.	https://setac.onlinelibrary.wiley.com/doi/full/10.1002/etc.4529
2. Microplastics in waters and soils: Occurrence, analytical methods and ecotoxicological effects	Microplastics (MPs) are ubiquitous in the environment and more abundant in the marine environment. Consequently, increasing focus has been put on MPs in oceans and seas, while little importance has been attached to their presence in freshwaters and soils. Therefore, this paper aimed to provide a comprehensive review of the occurrence, analysis and ecotoxicology of MPs. The abundance and distribution of MPs in several typical freshwater systems of China were summarized. It suggested that the surface water of Poyang Lake contained the highest concentration of 34 items/L MPs among all the 8 freshwater systems, and the content of MPs in sediments were higher than that of the surface water. Net-based zooplankton sampling methods are the most frequently utilized sampling methods for MPs, and density separation, elutriation and digestion are three major pretreatment methods. Fourier transform infrared spectroscopy, Raman spectroscopy and pyrolysis-gas chromatography coupled to mass spectrometry are often used to identify the polymer types of MPs. Besides, MPs might damage the digestive tract of various organisms and negatively inhibit their growth, feeding and reproduction. The ways of human exposure to MPs are by ingestion, inhalation and dermal exposure, digestive and respiratory system might be adversely influenced. **However, potential health risks of MPs to humans are remained insufficiently researched**. Overall, by showing the presence of MPs in freshwaters and soils as well as possible ecotoxicological effects on the environment and humans, this paper provided a framework for future research in this field.	https://www.sciencedirect.com/science/article/pii/S0147651320307491
3. Microplastic regulation should be	The presence of plastic in the environment has sparked discussion amongst scientists, regulators and the general public as to how industrialization and consumerism is shaping our world. Here we discuss restrictions on the intentional use of primary microplastics: small solid polymer particles in applications ranging from agriculture to cosmetics. Microplastic	https://www.nature.com/articles/s414

more precise to incentivize both innovation and environmental safety	hazards are uncertain, and actions are not similarly prioritized by all actors. In some instances, replacement is technically simple and easily justified, but in others substitutions may come with more uncertainty, performance questions and costs. Scientific impact assessment of primary microplastics compared to their alternatives relies on a number of factors, such as microplastic harm, existence of replacement materials and the quality, cost and hazards of alternative materials. Regulations need a precise focus and must be enforceable by these measurements. Policymakers must carefully evaluate under which contexts incentives to replace certain microplastics can stimulate innovation of new, more competitive and environmentally conscious materials. **Quote:** However, while there are a number of ways to use governance to reduce or shift plastic consumption, use, and disposal practices, for the case of microplastics, it is not clear to us if technical bans are the route to significant reductions of microplastics in the environment. In our view, a major part of the issue can and must be prevented by proper (macroplastic) waste collection, ideally as part of the transition towards a circular economy. (pg. 7)	67-020-19069-1.pdf?origin=ppub
4. Quality Criteria for Microplastic Effect Studies in the Context of Risk Assessment: A Critical Review	In the literature, there **is widespread consensus that methods in plastic research need improvement**. Current limitations in quality assurance and harmonization prevent progress in our understanding of the true effects of microplastic in the environment. Following the recent development of quality assessment methods for studies reporting concentrations in biota and water samples, we propose a method to assess the quality of microplastic effect studies. We reviewed 105 microplastic effect studies with aquatic biota, provided a systematic overview of their characteristics, developed 20 quality criteria in four main criteria categories (particle characterization, experimental design, applicability in risk assessment, and ecological relevance), propose a protocol for future effect studies with particles, and, finally, used all the information to define the weight of evidence with respect to demonstrated effect mechanisms. On average, studies scored 44.6% (range 20−77.5%) of the maximum score. No study scored positively on all criteria, reconfirming the urgent need for better quality assurance. Most urgent recommendations for improvement relate to avoiding and verifying background contamination, and to improving the environmental relevance of exposure conditions. The majority of the studies (86.7%) evaluated on particle characteristics properly, nonetheless it should be underlined that by failing to provide characteristics of the particles, an entire experiment can become irreproducible. Studies addressed environmentally realistic polymer types fairly well; however, there was a mismatch between sizes tested and those targeted when analyzing microplastic in environmental samples. **In far too many instances, studies suggest and speculate mechanisms that are poorly supported by the design and reporting of data in the study. This represents a problem for decision-makers and needs to be minimized in future research.** In their papers, authors frame 10 effects mechanisms as “suggested”, whereas 7 of them are framed as “demonstrated”. When accounting for the quality of the studies according to our assessment, three of these mechanisms remained. These are inhibition of food assimilation and/or decreased nutritional value of food, internal physical damage, and external physical damage. We recommend that risk assessment addresses these mechanisms with higher priority	https://pubs.acs.org/doi/pdf/10.1021/acs.est.0c03057

5. Dealing with Microplastic Pollution In The Netherlands: Human Health Risk Assessment And Policy Making Approaches	Microplastics (MPs), the so-called plastic particles under 5mm in size, are recent ubiquitous pollution in the environment. Recently, concerns about implications in human health regarding these particles have arisen interest in the scientific community and governments. Scientific literature in recent years presents evidence that MPs can be a potential threat to human health. This research aims to analyse the situation of Microplastics in the Netherlands by conducting a Health Risk Assessment in combination with the analysis of measures implemented, which helps to assess MPs in the country adequately. The research methodology contemplated in-depth desk research with scientific literature, reports from ministry, NGO´s, and in-depth interviews with experts in the topic. Moreover, the combination of both research methods led to recommendations to all stakeholders involved in Microplastics pollution. Findings showed that there is a significant lack of data regarding MPs testing methods, exposure, and concentration rates in humans. **Experts said that this lack of information made it impossible to assess a MPs risk assessment fully.** In the Netherlands, since 2014, measures to address MPs pollution were implemented and improved over time. Finally, this research concludes that MPs pollution is a complex issue in which actions should involve human health and its environmental consequences, which also concerns all countries involving producers, policy makers, product designers and consumers.	http://essay.utwente.nl/82792/1/Ruiz%20de%20Somocurcio%20Chavez%20Quiroz_MA_BMS-pdfa.pdf
6. Proceed with caution: The need to raise the publication bar for microplastics research	Plastic is a ubiquitous contaminant of the Anthropocene. The highly diverse nature of microplastic pollution means it is not a single contaminant, but a suite of chemicals that include a range of polymers, particle sizes, colors, morphologies, and associated contaminants. Microplastics research has rapidly expanded in recent years and has led to an overwhelming consideration in the peer-reviewed literature. While there have been multiple calls for standardization and harmonization of the research methods used to study microplastics in the environment, the complexities of this emerging field have led to an exploration of many methods and tools. While different research questions require different methods, making standardization often impractical, it remains import to harmonize the outputs of these various methodologies. **We argue here that in addition to harmonized methods and quality assurance practices, journals, editors and reviewers must also be more proactive in ensuring that scientific papers have clear, repeatable methods, and contribute to a constructive and factual discourse on plastic pollution.** This includes carefully considering the quality of the manuscript submissions and how they fit into the larger field of research. While comparability and reproducibility is critical in all fields, we argue that this is of utmost importance in microplastics research as policy around plastic pollution is being developed in real time alongside this evolving scientific field, necessitating the need for rigorous examination of the science being published.	https://www.sciencedirect.com/science/article/abs/pii/S004896972034955X
7. Five Misperceptions Surrounding the Environmental Impacts of Single-Use Plastic	This article explores five commonly held perceptions that do not correspond with current scientific knowledge surrounding the environmental impacts of single-use plastic. These misperceptions include: (1) plastic packaging is the largest contributor to the environmental impact of a product; (2) plastic has the most environmental impact of all packaging materials; (3) reusable products are always better than single-use plastics; (4) recycling and composting should be the highest priority; (5) “zero waste” efforts that eliminate single-use plastics minimize the environmental impacts of an event. This paper highlights the need for environmental scientists and engineers to put the complex environmental challenges of plastic waste into better context, integrating a holistic, life cycle perspective into research efforts and discussions that shape public policy.	https://pubs.acs.org/doi/pdf/10.1021/acs.est.0c05295

	Quote: Improved recycling, circular economy, and zero waste events are necessary steps toward sustainability. Efforts to reduce plastic waste through circular economy principles are part of a suite of interventions to help initiate broader conversations to create a more informed public and leverage public interest in single-use plastic reduction for greater environmental improvement and reduced overall consumption.	
8. Sustainability Assessment of a Single-Use Plastics Ban	Abstract: Governments around the world are introducing single-use plastics bans to alleviate plastic marine pollution. This paper investigates whether banning single-use plastic items is an appropriate strategy to protect the environment. Product life cycle assessment was conducted for single-use plastic and single-use non-plastic alternatives. The life cycle impacts of the two product categories were compared and scaled according to EU consumption of 2016. The results show that a single-use plastics ban would decrease plastic marine pollution in the EU by 5.5% which equates to a 0.06% decrease globally. However, such a ban would increase emissions contributing to marine aquatic toxicity in the EU by 1.4%. This paper concludes that single-use items are harmful to the environment regardless of their material. **Therefore, banning or imposing a premium price on single-use items in general and not only single-use plastic items is a more effective method of reducing consumption and thereby pollution. The plastics ban only leads to a small reduction of global plastic marine pollution and thus provides only a partial solution to the problem it intends to solve.** Quote: Alternatives to a single-use plastics ban exist, such as banning or imposing a premium price on single-use items regardless of their material composition, to reduce consumption and thereby pollution. Another promising strategy to reduce plastic marine pollution is to refrain from plastic waste exports into countries with high rates of mismanaged waste. An improvement of the single-use plastics ban would be a stronger emphasis on awareness raising to avoid inappropriate disposal in the EU and a requirement for paper and wood products to be certified to come from sustainable forestry sources. (pg. 14)	https://www.mdpi.com/2071-1050/12/9/3746
9. When plastic packaging should be preferred: Life cycle analysis of packages for fruit and vegetable distribution in the Spanish peninsular market	Food packaging is an important industrial sector that has great influence on food loss and waste. The search of optimal conditions to minimize the negative impacts of food packaging on the environment must promote the selection of the best available packages. This work has evaluated the environmental impact of the distribution of fruit and vegetables in the Spanish peninsular context using reusable plastic crates and single-use cardboard boxes. Discussion and decision at each phase and step of the methodology were provided, being an example to follow for similar studies in the future. For the analysis, five different impact categories were considered: global warming potential, acidification potential, eutrophication potential, ozone depletion potential and photochemical oxidant creation potential. In addition, energy and water consumption were taken into account. According to the results of the analysis, the use of reusable plastic crates should be selected, since the values of all impact categories and energy consumption indicators were higher in the case of single-use cardboard boxes. The sensitivity analysis revealed a robust preference for plastic crates in comparison with cardboard boxes even in alternative scenarios, and only the hypothetic reduction of the quality of the cardboard resulted in significant lower impacts for cardboard boxes in comparison to plastic crates in photochemical oxidant creation	https://www.sciencedirect.com/science/article/abs/pii/S0921344919305725?via%3Dihub

	potential, acidification potential, and energy consumption. **This work demonstrates that plastic packaging should not be totally excluded or banned, since it can be the most environmentally friendly option in certain applications.** **Quote:** The results showed that reusable plastic crates implied significantly lower environmental impacts than the single-use cardboard boxes. (pg.12) Therefore, we advocate for a case by case analysis of the appropriateness of using plastics for packaging, acknowledging the situations in which it will be the preferred option over other materials, but also identifying those supply chains in which its use multiples the environmental burdens that may arise. (pg. 14)	
10. Food Packaging and Circular Economy in the Netherlands: Challenges and Policy Solutions	This thesis examines how circular economy can be integrated into food packaging practices. **Moreover, it studies the challenges of such an integration focusing on the Dutch context of food packaging. It also analyses the relevant policy frameworks suggested by the European and Dutch policymakers that aim to overcome the identified challenges and enable and/or accelerate the Circular transition of the sector.** The aforementioned research objectives are studied through desk research and semi-structured interviews with food packaging experts. The most predominant challenges in the Dutch context are categorized into informational, technological, behavioural, regulatory, and societal challenges. Next to this, relevant policy solutions provided by the European Commission and the Dutch government to address these challenges are illustrated. The results of these findings are further discussed and interpreted before conclusions are drawn. Lastly, recommendations regarding the inadequately addressed challenges are presented along with directions for future research.	http://essay.utwente.nl/82993/1/CHANIOTAKI_2_MA_BMS.pdf
11. Rethinking and optimising plastic waste management under COVID-19 pandemic: Policy solutions based on redesign and reduction of single-use plastics and personal protective equipment	Plastics have been on top of the political agenda in Europe and across the world to reduce plastic leakage and pollution. However, the COVID-19 pandemic has severely disrupted plastic reduction policies at the regional and national levels and induced significant changes in plastic waste management with potential for negative impacts in the environment and human health. This paper provides an overview of plastic policies and discusses the readjustments of these policies during the COVID-19 pandemic along with their potential environmental implications. The sudden increase in plastic waste and composition due to the COVID-19 pandemic underlines the crucial need to reinforce plastic reduction policies (and to implement them into action without delays), to scale up in innovation for sustainable and green plastics solutions, and to develop dynamic and responsive waste management systems immediately. Policy recommendations and future research directions are discussed. **Quote:** The replacement of the plastics value chain from fuel-based raw materials and energy is already being prioritised as part of international agreements to entail a green and circular economy. Such transition and the decoupling from fossil fuel-based resources needs to be prioritised in a shorter-term, by developing a more supportive legislative landscape and a clear direction. (pg.5) During COVID-19, the use of SUPs and PPE increased significantly; thus, the need of rethinking and redesigning plastics (i.e., development of eco-friendly and bio-based solutions at an affordable price), along with the improvement of recycling streams to ensure proper end-of-life for those products (during pandemic scenarios), should be at the highest priority. (pg. 6)	https://digital.csic.es/bitstream/10261/216015/1/Rethinking%20and%20optimising%20plastic%20waste%20management.pdf

12. It's the product not the polymer: Rethinking plastic pollution	Mismanaged plastic waste poses a complex threat to the environments that it contaminates, generating considerable concern from academia, industry, politicians, and the general public. This concern has driven global action that presents a unique opportunity for widespread environmental engagement beyond the immediate problem of the persistence of plastic in the environment. But for such an opportunity to be realized, it is vital that the realities of plastic waste are not misrepresented or exaggerated. Hotspots of plastic pollution, which are often international in their source, present complex environmental problems in certain parts of the world. Here we argue, however, that the current discourse on plastic waste overshadows greater threats to the environment and society at a global scale. Antiplastic sentiments have been exploited by politicians and industry, where reducing consumers' plastic footprints are often confused by the seldom-challenged veil of environmental consumerism, or "greenwashing." Plastic is integral to much of modern day life, and regularly represents the greener facilitator of society's consumption. We conclude that it is the product, not the polymer that is driving the issue of plastic waste. Contemporary consumption and disposal practices are the root of much of the anthropogenic waste in the environment, plastic, or not. Effective environmental action to minimize plastic in the environment should be motivated by changes in consumption practices, policies, and product design, and should be informed by objective science and legislation. Quote: there has also been a huge public worry and a "dash from plastic" that is partly driven by scientific findings that are inconclusive at best. It is therefore vital that academic research and policy do not undermine this unique opportunity to exploit further positive environmental progress. (pg. 8)	https://onlinelibrary.wiley.com/doi/full/10.1002/wat2.1490
13. Plastics and Microplastics: Impacts in the Marine Environment	Accumulation of plastics and, more recently, microplastics, in the marine environment has become a global concern. Plastics are highly durable materials and this persistence coupled with increasing emissions to the environment has resulted in a wide-scale accumulation from shallow waters to the deep sea. However, it is important to recognise that plastic debris is a highly heterogeneous mix of different polymer types, sizes, shapes and sources, and all of these factors influence the type and probability of impact. A small proportion of these items is sufficiently large and they can be visualised by satellites from space, but it is now recognised that the most abundant size category are microplastics. Indeed, many scientists consider there will be even greater accumulations of plastic particles in the nano size range, but such particles are currently beyond the limit of analytical detection. There is clear evidence of impacts on wildlife, as well as economic harm, and there is growing concern about the potential for effects on human well-being. Over 700 species of marine organism are known to encounter plastics in the environment with clear evidence of physical harm from entanglement and ingestion. In addition, there is concern that plastics may present a toxicological hazard because they can transfer chemicals to organisms if ingested. However, there is currently little evidence that plastics provide an important vector for chemicals to wildlife compared to other pathways. There is also emerging evidence that plastic debris could have impacts on assemblages of organisms altering ecosystem processes. Despite this clear evidence of harm it is also clear that plastics as materials bring numerous societal benefits; however, unlike many of the challenges currently facing the ocean, the benefits of plastics could largely be achieved without emissions to the environment. In our view the	https://link.springer.com/chapter/10.1007/978-3-030-38945-1_3

	solutions to this global environmental problem require a more responsible approach to the way we design, produce, use and dispose of plastics, so that we can realise the benefits of plastics without current levels of harm.	
14. The Case for a Plastic Tax: A Review of Its Benefits and Disadvantages Within a Circular Economy 15 June 2020	In 2017, global plastic production reached 348 million tonnes. Despite growing concerns about the environmental challenges associated with both plastic production and plastic waste, recent estimates suggest that plastic production and subsequent waste is expected to double by the year 2035 (European Commission, 2018). To help reduce the amount of plastic waste that litters the oceans and damages the environment, the European Union has recently commissioned a study about the feasibility of levying a tax on plastic products (New Economic Foundation for the Rethink Plastic Alliance, 2018). However, very few academic articles currently exist that critically examine the arguments for or against a plastic tax and thereby enlighten government and regulators on the subject. **This chapter investigates whether plastic taxes can be used as an economic disincentive for plastic products and explores its advantages and disadvantages within a circular economy.** It explores whether a plastic tax is the right economic instrument to limit the use of plastics, generate design and technical innovations for bio-based materials and degradable/recyclable plastics, create other economic incentives to optimize the value of plastic and its waste collection, and increase public awareness and responsibility. **We find that a plastic tax may be a suitable solution as it is likely to influence the design, production, consumption, and waste sectors if designed properly. Yet, the tax should be carefully implemented and combined with other instruments to obtain the desired outcomes and reduce the occurrence of unfavorable side effects.**	https://www.emerald.com/insight/content/doi/10.1108/S2514-175920200000004010/full/html?utm_source=TrendMD&utm_medium=cpc&utm_campaign=Business_and_Society_360_TrendMD_1
15. Breaking the Plastic Wave Last updated Oct. 23, 2020	"Breaking the Plastic Wave" follows two reports from the Ellen MacArthur Foundation that established the vision of a **circular economy, aimed at eliminating waste and encouraging the continual use of resources by reusing, redesigning, and recycling.** This concept has garnered unprecedented support across the global plastics system. By highlighting the systemic link between better plastic design, reuse, improved recycling economics, and increased collection incentives, these reports provided a central theme for the challenge addressed in "Breaking the Plastic Wave": how to apply the concept of a circular economy—along with increased reduction and substitution of plastics, and better waste management—in a way that urgently addresses this serious environmental challenge. Quote: **SYSTEM INTERVENTION 3** Design products and packaging for recycling to expand the share of economically recyclable plastic from an estimated 21 per cent to 54 per cent by 2040 **SYSTEM INTERVENTION 5** Double mechanical recycling capacity globally to 86 million metric tons per year by 2040	https://www.pewtrusts.org/-/media/assets/2020/07/breakingtheplasticwave_report.pdf

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