

The Hazards of Microplastics: A Legal Perspective on Unlawful Acts and Consumer Protection

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Abstract

Microplastics have emerged as a multidimensional threat, not only to environmental and public health but also to legal systems worldwide. Despite increasing scientific evidence regarding their ecological persistence and toxicity, legal responses—particularly in civil law and consumer protection—remain underdeveloped. This study examines the legal implications of microplastic pollution through the lens of unlawful acts (*onrechtmatige daad*) and consumer protection, using normative legal research methods grounded in statutory analysis, legal doctrine, and jurisprudence. The findings reveal that industrial negligence in plastic waste management may satisfy the legal elements of tort under Indonesian civil law (Article 1365 of the Civil Code), especially when microplastics harm ecosystems or pose health risks to consumers. Moreover, the absence of specific regulatory frameworks addressing microplastic content in consumer products indicates a critical normative gap that undermines the right to product safety and accurate information. This research argues that microplastic pollution constitutes not merely a technical or scientific issue but a legal crisis demanding comprehensive reform. It recommends integrating the precautionary principle into national legislation, setting enforceable safety standards, mandating microplastic content labeling, and enhancing producer accountability, drawing lessons from international instruments. The study also advocates for the establishment of independent testing bodies and robust monitoring mechanisms to support scientific evidence in environmental litigation.

Keywords : Consumer protection, microplastics, unlawful acts.

1. Introduction

In this era of intensified industrialization and mass consumption, plastic pollution has evolved into a pressing global environmental concern (Ng et al., 2023). Despite their durability (Minde, Kulkarni, Patil, & Shelake, 2024) and low production costs (Nayanathara Thathsarani Pilapitiya & Ratnayake, 2024), plastic materials have become major contributors to waste accumulation due to their persistent and non-biodegradable nature. One of the most alarming forms of plastic contamination is microplastics (Ng et al., 2023)—plastic particles less than five millimeters (< 5 mm) in size (Ng et al., 2023)—which originate from the degradation of larger plastic debris, household products, industrial waste, and personal care items. Their widespread presence poses a significant threat to ecosystem sustainability and human health.

Scientific evidence has confirmed the detection of microplastics across nearly all environmental domains, including marine, freshwater, terrestrial, and atmospheric ecosystems. Marine organisms such as fish, shellfish, and seabirds frequently ingest microplastics, either intentionally or accidentally, leading to bioaccumulation and biomagnification along the food chain. Humans, positioned at the top of this trophic hierarchy, are increasingly at risk of ingesting microplastics through contaminated food sources. Health consequences associated with microplastic exposure include endocrine disruption, organ damage, and even carcinogenic effects. These public health implications highlight that microplastic pollution is not solely an environmental issue but a multidimensional threat to human well-being.

Beyond ecological and health-related impacts, microplastic pollution also exerts severe economic pressure on key sectors such as fisheries, tourism, and maritime transport. Additionally, the financial burden of cleaning and rehabilitating environments contaminated by microplastics is substantial. Within this context, the role of legal mechanisms becomes crucial. Preventive and enforcement-oriented legal approaches are needed to ensure structured and effective control over microplastic sources and their consequences for both the environment and consumers.

Nevertheless, the enforcement of laws addressing microplastic pollution continues to face fundamental obstacles. These include ambiguous regulations, the lack of legal instruments explicitly addressing microplastics, and challenges in identifying liable parties. Many countries, including Indonesia, still lack comprehensive legal frameworks governing the production, distribution, and disposal of microplastics. Therefore, a detailed legal analysis of unlawful acts (*onrechtmatige daad*) and consumer protection becomes essential in formulating adaptive and progressive legal approaches.

This study aims to analyze the legal aspects of microplastic hazards, focusing specifically on unlawful acts and consumer protection. It seeks to fill the research gap in current literature, which largely emphasizes the scientific and technical aspects of microplastics while overlooking their legal dimensions. By integrating environmental law, civil law, and consumer protection law perspectives, this study will identify existing regulatory gaps, enforcement challenges, and evaluate the effectiveness of current legal instruments. Furthermore, the study is expected to contribute meaningfully to the development of responsive legal frameworks and reinforce legal protection for consumers against microplastic-related threats, both in Indonesia and globally.

2. Research Method

The research method employed in this study is normative legal research, which focuses on examining applicable legal norms and relevant juridical principles related

to the issues under investigation. This study relies primarily on secondary data sources, including legislation, legal doctrines, court decisions, and academic literature that inform the legal analysis of microplastic pollution, unlawful acts, and consumer protection. The data were collected through library research and analyzed systematically and critically to identify and formulate legal recommendations that may serve as the foundation for the development of more responsive and sustainable legal policies.

3. Results and Discussion

3.1 Microplastics from the Perspective of Their Hazards

Microplastics, defined as small plastic particles resulting from the degradation of plastics (Ziani et al., 2023) and measuring less than five millimeters in size (Ng et al., 2023), have become a tangible global threat to both ecosystems and human health (Ziani et al., 2023). These fragments originate from both primary and secondary plastic degradation and are widely dispersed throughout the environment via wastewater, the atmosphere, and the food chain (Cverenkárová, Valachovičová, Mackulák, Žemlička, & Bírošová, 2021). Ecotoxicological studies indicate that microplastics can be absorbed by aquatic organisms such as plankton, fish, and mollusks, which are subsequently consumed by humans (Sunny et al., 2025; Wang, Gao, Jin, Li, & Na, 2019).

According to Puspitawati et al. (2025), as presented in Table 1, plastic pollution—especially in the form of microplastics—poses a severe threat to marine biodiversity, human health, and socio-economic stability, particularly in coastal nations. Microplastics derived from degraded plastic waste can disrupt the digestive and reproductive systems of marine organisms and potentially trigger serious illnesses in humans, including cancer and immune system disorders, through trophic transfer. Beyond ecological and health impacts, plastic pollution also negatively affects key economic sectors such as fisheries, tourism, and maritime navigation, and damages infrastructure, such as water piping systems—exacerbating economic losses and increasing the vulnerability of coastal communities. Therefore, the assessment of microplastic hazards must not be confined to scientific inquiry alone but should also involve a comprehensive legal and policy-oriented approach.

Table 1: Impacts of Micro-Plastic Pollution on Ecosystems, Human Health, and Socio-Economic Sectors

Category	Impact	Details
Marine Ecosystems	Biodiversity loss	Plastics attach to marine animals, disrupting digestion and reproduction; causes disability and death.
	Microplastic contamination	Plastics degrade into microplastics (<5mm), threatening marine organisms through ingestion and bioaccumulation.

Human Health	Toxic exposure through food and water	Microplastics found in seafood and drinking water can lead to cancer, reproductive disorders, developmental issues, and immune dysfunction.
Socio-Economic Impact	Economic loss in coastal states	Coastal communities relying on fisheries, aquaculture, and tourism face disruption of livelihoods due to MPP (Newman et al., 2015).
	Navigational hazards	Discarded nets and gear entangle ship propellers and rudders, disrupting maritime operations.
	Infrastructure damage	Plastic waste clogs water pipelines and systems, causing blockages and maintenance issues.

Source: (Puspitawati et al., 2025)

Scientifically, microplastics are persistent and resistant to natural degradation, rendering their presence in the environment both accumulative and chronic (Nurika, Abidah, Wikurendra, & Ningtyias, 2023). Recent studies have shown that microplastic particles can act as carriers of toxic substances such as heavy metals, pesticides, and persistent organic pollutants, which adsorb onto their surfaces (M. Li et al., 2025; Verla, Enyoh, Verla, & Nwarnorh, 2019). When ingested by marine or terrestrial organisms, these hazardous substances may enter the human body through the food chain, thereby increasing the risks of endocrine disruption, cancer, and chronic inflammation. In this context, microplastics should not be regarded merely as passive contaminants, but rather as vector pollutants—active carriers of environmental toxins that intensify toxicological impacts on both ecosystems and human health (Pal et al., 2024).

From an international legal perspective, the hazards posed by microplastics have led to the development of global norms and agreements aimed at restricting single-use plastics and reinforcing producer responsibility (Shipton & Dauvergne, 2022). Legal instruments such as the Basel Convention Amendment and the United Nations Environment Assembly (UNEA) resolutions emphasize the importance of a life-cycle approach in managing plastics and their waste, including microplastics (Kantai, Baršauskaitė, Roy, Paterson, & Templeton, 2025). Although Indonesia has yet to implement specific regulations governing microplastics, international legal principles such as *common but differentiated responsibilities* (CBDR) and the *polluter pays* principle may serve as a normative foundation for holding industries and states accountable for transboundary microplastic pollution (Q. Xu, Zhang, & Han, 2024). Therefore, harmonizing national legal instruments with international frameworks is essential for effectively responding to the microplastic threat.

Considering its scientific complexity and legal dimensions, microplastic pollution constitutes a multidisciplinary challenge that requires an integrative response

encompassing environmental science, legal norms, and public policy. Strict regulation of the production, use, and disposal of plastic, along with the strengthening of environmental law enforcement mechanisms, is critical to curbing the escalating microplastic crisis. Furthermore, environmental litigation can serve as a legal pressure tool to promote greater accountability among industrial actors and governments. This study underscores that the dangers of microplastics can no longer be viewed merely as a technical issue; rather, they have evolved into an ecological legal crisis that demands a holistic transformation of legal systems and environmental governance.

3.2 Microplastics from the Perspective of Unlawful Acts

Under Indonesian civil law, the concept of unlawful acts (*perbuatan melawan hukum*/PMH) is normatively regulated by Article 1365 of the Indonesian Civil Code (KUHPer), which stipulates that “Every act that violates the law and causes harm to another obliges the person at fault to compensate for the loss.” According to this provision, the key elements of an unlawful act include the existence of an unlawful act, fault (*schuld*), damage (*schade*), and a causal relationship between the act and the damage (Nadiva & Kamal, 2025; Waluyo, 2022). In the context of microplastics, manufacturers or industrial actors who fail to responsibly manage plastic waste may satisfy these elements, particularly when such negligence results in environmental pollution and widespread harm to the public.

Substantively, microplastic pollution constitutes a breach of core environmental legal principles, including the duty of due diligence to prevent environmental harm. Law No. 32 of 2009 on Environmental Protection and Management (PPLH) explicitly embodies principles of responsibility and precaution (precautionary principle) (Mangkunegara, 2024), which should guide industrial activities. When producers fail to implement adequate waste control mechanisms, resulting in the release of microplastics into aquatic, terrestrial, or atmospheric environments, sufficient legal grounds may exist to conclude that an unlawful act has occurred under civil law.

Furthermore, the notion of “unlawfulness” is not confined to violations of codified law but also encompasses breaches of moral obligations, societal decency, or prevailing norms, as developed through legal doctrine and jurisprudence (Muttaqin, 2024). Consequently, industrial actors’ failure to prevent microplastic pollution may constitute a breach of legal norms in a broader sense. This interpretation is reinforced by the development of modern environmental law, which views the right to a healthy environment as part of fundamental human rights, thereby amplifying the civil liability dimension in such cases.

From a causality standpoint, microplastic pollution presents long-term effects that are increasingly traceable through scientific evidence (Hoang et al., 2025). Although proving causality under civil law poses substantial challenges—especially in

establishing a direct link between industrial conduct and specific harm suffered by individuals or communities—advances in environmental technology and scientific forensics now enable more precise analyses. When scientific evidence indicates that a factory's plastic waste significantly contributes to microplastic concentrations in a specific area, this may serve as a legal basis for an unlawful act claim, provided that damages and causality can be reasonably substantiated.

Finally, the issue of legal liability for microplastic pollution also highlights the broader role of civil law as an instrument of social control and deterrence. Tort claims not only seek restitution or compensation but also help establish legal precedents that pressure industrial actors to adopt more environmentally responsible practices. In this context, the doctrine of unlawful acts serves as a strategic accountability mechanism, filling the gaps left by often underenforced administrative or criminal environmental law. Therefore, the analysis of microplastics within the framework of unlawful acts is not merely of theoretical relevance but offers urgent practical implications in addressing the contemporary ecological crisis.

3.3 Microplastics from the Perspective of Consumer Protection

Microplastics have emerged as a significant threat to both human health and the environment (Ghosh et al., 2023; Lalrinfela, Vanlalsangi, Lalrinzuali, & Babu, 2024; Y. Li et al., 2023). However, legal consumer protection against these risks remains inadequate. Technically, microplastics can enter the human body through the food chain, drinking water, and even inhalation (Ghosh et al., 2023; J. Xu, Tang, & Xu, 2025). From the standpoint of consumer protection, safeguarding individuals from microplastic exposure should be a policy and regulatory priority (Amanu, Zahrani, Ristaatin, Ardillah, & Radianto, 2024). Legally speaking, the absence of specific regulations governing the safe limits of microplastics in consumer products—such as food and cosmetics—has created a regulatory gap that endangers consumers' right to product safety. International standards set by bodies such as the WHO and UNEP have yet to be fully integrated into the national legal frameworks of many countries, including Indonesia, leaving consumers vulnerable to health risks without a clear mechanism for redress.

Substantively, consumer protection in relation to microplastics must be approached through the lens of the precautionary principle, which is widely adopted in global consumer law. This principle obliges both states and producers to undertake preventive actions, even in the absence of fully conclusive scientific evidence regarding the harmful effects of microplastics. In the Indonesian legal context, Law No. 8 of 1999 on Consumer Protection already enshrines consumers' rights to honest information and product safety (Article 4), yet its implementation remains weak due to the lack of explicit provisions banning or limiting microplastic content. Legal

instruments such as national product standards (SNI) or mandatory "microplastic-free" labeling could serve as effective solutions if legally enforced.

From a comparative legal perspective, the European Union has taken a more progressive stance by imposing restrictions on microplastics through the REACH regulation (Registration, Evaluation, Authorisation, and Restriction of Chemicals) (Mitrano & Wohleben, 2020). This regulation mandates producers to eliminate intentionally added microplastics from products such as cosmetics and detergents. Such an approach is highly relevant for Indonesia to adopt in order to ensure producer responsibility for the impacts of their products. Moreover, the class action mechanism under the Indonesian Consumer Protection Law can be strengthened to allow consumers to collectively sue manufacturers if it can be proven that microplastic content in products has caused health-related harm.

The primary challenges in ensuring effective consumer protection from microplastics lie in information asymmetry and the difficulty of scientific-legal proof. Consumers are often unaware of their exposure due to limited public education and a lack of transparency from manufacturers. On the other hand, directly linking specific health conditions to microplastic exposure requires complex causal proof (Irfan, Irfan, Khan, Inanc, & Hasibuzzaman, 2025), which frequently poses an obstacle in litigation processes. Hence, the establishment of an independent institution authorized to test and monitor microplastic content is essential, alongside mandatory risk labeling on relevant products. Regulatory models of this nature have proven successful in addressing issues related to Bisphenol A (BPA) in plastic packaging in several countries.

In essence, microplastics constitute a pressing consumer protection issue that demands swift and comprehensive legal responses. Regulatory reform should encompass a ban on intentionally added microplastics, the standardization of product safety measures, and the establishment of robust enforcement mechanisms. Furthermore, collaborative efforts among government, academia, and industry are vital to enhancing awareness and fostering innovation in consumer-safe products. Without strong legal intervention, consumers' rights to safety and information will continue to be undermined, while the ecological and health consequences of microplastics will increasingly threaten human sustainability.

4. Conclusion

This study reveals that microplastics represent a form of environmental pollution that not only causes ecological harm but also raises significant legal concerns within the framework of unlawful acts and consumer protection. Scientifically, microplastics are persistent, toxic, and capable of entering the human body through the food chain, while legally, industrial negligence in plastic waste management may fulfill the

elements of tort under Indonesian civil law (Article 1365 of the Civil Code). Furthermore, the absence of specific regulations on microplastic content in consumer products exposes a normative gap in consumer protection, resulting in violations of the right to safety and accurate product information. Therefore, microplastics are no longer a mere technical or ecological issue but have evolved into a legal crisis requiring a comprehensive normative and institutional response.

A legal reform is urgently needed, incorporating the precautionary principle into national regulations and aligning them with international norms on microplastic restrictions. This includes setting safe thresholds for microplastic content, mandating product labeling, and establishing clear producer liability for product-related harm, as exemplified by the REACH regulation in the European Union. The government, through competent agencies, must also develop robust monitoring systems and support the establishment of independent testing bodies to facilitate scientific evidence in litigation. In the long term, tort-based litigation and the strengthening of class action mechanisms can serve as effective tools for social control over industry practices, while reinforcing the legal position of consumers in facing complex contemporary risks such as microplastics.

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