Plastic Anxiety: Is There a Cause for Alarm?

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Consider this familiar morning ritual: the use of a toothbrush with synthetic bristles, coffee in a plastic-lined paper cup, and breakfast in a polymer-based container from your favourite food vendor before heading to work – each routine silently introducing invisible particles in our daily lives. Once synonymous with convenience and modern progress, this dependence on plastics has become a source of profound unease and significant public concern on long-term health implications, as scientific scrutiny reveals the pervasive presence of microplastics - plastic particles measuring less than 5 mm - and the occurrence of plastic-associated chemicals, such as bisphenol A and phthalates (Vethaak and Legler, 2021; Tang et al., 2024). Burgeoning public apprehension can be observed in daily social interactions, where individuals decline mineral water in plastic bottles or food in polystyrene containers, signifying a shift in societal behaviour that prioritises avoidance of risks over the convenience that was previously afforded by synthetic polymers. This acute risk avoidance also extends heavily into dietary choices, where many now dread seafood consumption following the growing awareness of how polymer particles and chemical additives contaminate the marine food web. Yet, the widespread anxiety often outpaces scientific understanding, as research on toxicological mechanisms and dose-response relationships of plastic exposure remains largely incomplete (Zhao et al., 2025).

Despite these concerns, plastics remain indispensable to the modern society as their polymers have transformed patient care and public health through use in sterile medical devices, diagnostic equipment, drug delivery systems, implants and personal protective equipment (Zechel et al., 2024). This essential role is a dilemma, as complete avoidance of plastics has become neither practical nor desirable. The challenge is therefore, not whether plastics should be eliminated, but whether concerns surrounding the use of plastics are proportionate to available scientific evidence to justify the general public alarm.

In the literature, the actual magnitude of risk for the human population is largely undefined, and there are critical knowledge gaps with regard to precise concentration dependencies and threshold levels required for initiation of adverse outcomes (Vethaak & Legler, 2021). Plastic particles have been shown to induce systemic physiological disturbances, including metabolic disruptions, oxidative stress, and potential interference with gastrointestinal and immune functions. Microplastics themselves are not simply inert plastic particles, as they can adsorb environmental pollutants such as heavy metals, polycyclic aromatic hydrocarbons, persistent organic pollutants and pesticides, while also carrying plastic-associated chemicals. This creates the so-called 'Trojan horse' effect that impedes hazard identification. The complexity and remarkable diversity of microplastics in terms of size, shape and polymer composition, also make it difficult to standardise toxicological studies and establish robust human health risk assessments. This scientific uncertainty presents a challenge for regional policymakers, as the current evidence is inadequate to establish dose-response thresholds for adverse health effects induced by microplastics. Consequently, this may be the reason why regional policy frameworks such as the Malaysian Roadmap towards Zero Single-Use Plastics 2018 – 2030 (MESTECC, 2018) and the Regional Action Plan for Combating Marine Debris in the ASEAN Member States 2021 – 2025 (ASEAN Secretariat, 2021), are not yet able to incorporate evidence-based exposure thresholds in their recommendations.

An objective and robust risk management that is grounded in an evidence-based framework such as the Adverse Outcome Pathway, may be able to bridge the extreme gap between public fear and scientific fact with regard to microplastics. A multidisciplinary synergy in the deployment of such framework will be able to isolate complex toxicological mechanisms, essentially differentiating intrinsic physical hazards of weathering microparticles from the extrinsic chemical threats posed by leached additives and endocrine-disrupting

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contaminants (Vethaak & Legler 2021; Tang et al., 2024; Zhao et al., 2025). It is understandable that sensationalised claims, such as the widely publicised estimation of humans ingesting a credit card's worth of plastic weekly, effectively catalyse public awareness. However, there is the more important role of risk communicators that must counter this overwhelming friction between public health warnings and unavoidable daily exposures by providing verified and standardised safety data based on exposure levels which are realistic, rather than scientifically contested generalisations (Tang et al., 2024; Zhao et al., 2025).

The ordinary citizen is not expected to solve a global crisis through personal choices such as switching to stainless steel water bottles or cloth grocery bags and through constant consumer vigilance. While individual habits matter, personal lifestyle adjustments are only a small piece of the puzzle. They would have to be backed with institutional, top-down changes such as legal caps on raw plastic manufacturing, safer and eco-friendly product redesigns and equitable and inclusive regional waste strategies. This is an ethical calling for all professionals, as well as advocates across public health and governance. Instead of allowing the public to carry the weight of risk reduction, leadership must synthesise early and alarming toxicity data into enforceable public policies and environmental protections to stop the plastic crisis and pollution directly where it begins. Ultimately, this shift from individual burden to systemic accountability will truly allay public anxiety, transforming the climate of fear into a collective, institutional security.

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