frontiers | Frontiers in Sustainability

TYPE Editorial
PUBLISHED 20 February 2024
DOI 10.3389/frsus.2024.1376817

Check for updates

OPEN ACCESS

EDITED AND REVIEWED BY
Shabbir H. Gheewala,
King Mongkut's University of Technology Thonburi, Thailand

*CORRESPONDENCE
Li Li
lili@unr.edu

RECEIVED 26 January 2024
ACCEPTED 05 February 2024
PUBLISHED 20 February 2024

CITATION
Li L, Fantke P and Huang L (2024) Editorial: Sustainability assessment of chemicals in consumer products.
Front. Sustain. 5:1376817.
doi: 10.3389/frsus.2024.1376817

COPYRIGHT
© 2024 Li, Fantke and Huang. This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY). The use, distribution or reproduction in other forums is permitted, provided the original author(s) and the copyright owner(s) are credited and that the original publication in this journal is cited, in accordance with accepted academic practice. No use, distribution or reproduction is permitted which does not comply with these terms.

Editorial: Sustainability assessment of chemicals in consumer products

Li Li[1]*, Peter Fantke[2] and Lei Huang[3]

[1]School of Public Health, University of Nevada, Reno, NV, United States, [2]Quantitative Sustainability Assessment, Department of Environmental and Resource Engineering, Technical University of Denmark, Kongens Lyngby, Denmark, [3]California Department of Toxic Substances Control, Sacramento, CA, United States

KEYWORDS

consumer products, chemicals, sustainability, life cycle, product use, supply chain, recycling

Editorial on the Research Topic
Sustainability assessment of chemicals in consumer products

Chemicals are the building blocks of today's consumer products, serving varied functional performance roles in materials, products and technologies. Recent data reveal that ~350,000 chemicals and chemical mixtures have been registered globally for production and use (Wang et al., 2020). Common examples, such as plasticizers, flame retardants, and preservatives, are prevalent in various consumer products. Exposure to several chemicals has been associated with detrimental effects on human health and on ecological integrity. Consumer products can be a significant source of human exposure to their chemicals constituents due to close contact during use; they can further harm ecosystems and wildlife when they enter natural environments. Overall, chemicals in consumer products can be released from multiple life cycle stages, enter multiple environmental compartments, and expose humans and ecological receptors through multiple pathways and routes (Fantke et al., 2021; Li et al., 2021). Such a "multidimensionality" of the issue of chemicals in consumer products necessitates a thorough understanding and effective management in the context of environmental sustainability.

Research on safer and more sustainable chemical usage in consumer products is critical for improving manufacturing methods and enhancing the sustainability of consumer products throughout their life cycle. This Research Topic, titled "*Sustainability assessment of chemicals in consumer products*," seeks to examine the multidimensionality of chemicals in consumer products, focusing on their exposures and effects on human health and the environment. This Research Topic compiles diverse studies covering various stages of the consumer product life cycle (e.g., manufacturing and supply chain, use, and disposal and recycling), and highlights the need for more sustainable chemicals that pose less harm to human health and the environment throughout the product life cycle.

Meng and Zhou present an overview of the role of comparative exposure assessment (CEA) in alternatives assessment (AA) and discuss possibilities for integration of CEA into the overall AA workflow. They emphasize the importance of CEA as a crucial step in AA for selecting safer chemical alternatives in consumer products. This paper advocates for a holistic approach, connecting CEA with other AA components, such as the assessments of chemical hazards, life cycle impacts, and economic burdens. They

also highlight state-of-the-art aspects in CEA and AA, such as transparency, uncertainty, chemical mixtures, and sensitive receptors. Their approach enhances decision-making in chemical selection, ensuring that alternative chemicals are effective while posing minimal health and environmental risks. The integration of CEA into AA is particularly notable for its potential to significantly improve the safety and sustainability of chemical alternatives.

Overcash et al. assess the natural resource energy use and related carbon footprint of producing L-tryptophan, a chemical manufactured for a wide range of medicinal and dietary applications. The work highlights significant energy consumption and carbon emissions associated with its production. As a consequence, the authors emphasize the urgent need for more sustainable and energy-efficient production procedures. Notably, the authors presented the first detailed life cycle inventory for L-tryptophan, exemplifying the important role of detailed supply chain data in promoting more sustainable manufacturing of chemicals, using carbon footprint as illustrative impact category.

Sharkey and Coggins discuss the impact of chemical additives in textiles on recycling processes. They identify chemical additives that render textiles environmentally hazardous and hence non-recyclable. The authors found that presence of these chemical additives, as well as the lack of effective recycling systems, contribute to the increase in waste textiles. These challenges underline the need for transitioning to a circular economic model, focusing on sustainable waste management practices. The authors offer a perspective on textile waste management, particularly in relation to the European Union's waste policies and practices, combined with reducing consumption.

Focusing on textile industry as well, Schumacher and Forster examine the transition from a linear to a circular economy model within the U.S. textile industry, highlighting both challenges and opportunities. They emphasize the critical need for collaboration, system harmonization, and the exchange of data and information. In addition, they propose a series of necessary actions, including the development of standards, advancements in labeling, design modifications, the introduction of alternative business models for brands and retailers, the expansion of end markets for recyclers, community engagement and educational initiatives, research and development, and the influence of policy and regulation. This analysis and the suggested strategies offer a unique perspective in the field, particularly with respect to the U.S. context.

With these contributions, this Research Topic not only presents relevant research but also sets the stage for future inquiries and solutions in more sustainable chemicals management. It serves as a crucial resource for researchers, policymakers, and industry professionals seeking to understand and address the multidimensional challenges associated with the sustainability of chemicals in consumer products. The insights and methodologies developed in these contributions have the potential to guide more sustainable practices across the consumer products industry, paving the way for a future where chemical use is aligned with environmental and health considerations.

Author contributions

LL: Writing – original draft. PF: Writing – review & editing. LH: Writing – review & editing.

Funding

The author(s) declare that no financial support was received for the research, authorship, and/or publication of this article.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

The author(s) declared that they were an editorial board member of Frontiers, at the time of submission. This had no impact on the peer review process and the final decision.

The handling editor SG declared a past collaboration with the author PF.

Publisher's note

All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

References

Fantke, P., Chiu, W. A., Aylward, L., Judson, R., Huang, L., Jang, S., et al. (2021). Exposure and toxicity characterization of chemical emissions and chemicals in products: global recommendations and implementation in USEtox. *Int. J. Life Cycle Assess.* 26, 899–915. doi: 10.1007/s11367-021-01889-y

Li, L., Sangion, A., Wania, F., Armitage, J., Toose, L., Hughes, L., et al. (2021). Development and evaluation of a holistic and mechanistic modeling framework for chemical emissions, fate, exposure, and risk. *Environ. Health Perspect.* 129:127006. doi: 10.1289/EHP9372

Wang, Z., Walker, G. W., Muir, D. C. G., and Nagatani-Yoshida, K. (2020). Toward a global understanding of chemical pollution: a first comprehensive analysis of national and regional chemical inventories. *Environ. Sci. Technol.* 54, 2575–2584. doi: 10.1021/acs.est.9b06379