

Chemical Pollution and One Health – from Reactivity to Proactivity October 2023

The health and environmental challenges of recycling chemicals in the sustainable management of plastics

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Background

Plastic products, integral to various industries, consist of myriad chemicals, including intentional additives like plasticizers and unintentional by-products, making plastic compositions complex. The circular process of plastic management faces a monumental challenge due to the unknown composition of chemicals in recycled plastics, in conflict with the goal of sustainability. Hazard identification of chemicals relies on fulfilling specific criteria, but many chemicals lack comprehensive evaluations, posing a challenge for subsequent legislation. The issue of legacy substances in recycled raw materials arises due to the time lag between substance restrictions and product end-of-life, emphasizing the need for preventive measures.

The unpredictability and variability of plastic waste streams complicate the future use of recycled plastics, especially in applications demanding traceability, such as food packaging or medical use. Decontamination technology and advanced analytical approaches become crucial in ensuring the safety of recycled materials. Demand and production of plastic are expected to double in the next two decades, prompting the exploration of recycling and biobased plastics as strategies to reduce fossil material use. However, the environmental impact of biobased plastics is not necessarily superior, and they still contain chemical additives.

Assessing chemical hazards in plastics faces challenges because it primarily relies on a targeted, one-chemical-at-a-time approach that may miss unexpected or unknown chemicals. The need for cost-efficient, non-targeted analytical methods and effect-based monitoring is apparent in relation to comprehensive screening for hazardous chemicals.

In summary, there are intricate challenges associated with chemicals in plastics, emphasizing their critical role in modern society while acknowledging the potential threats they pose to human health and the environment.

Approach

The objectives of the workshop were to discuss the roadmap for future management of plastics and recycling of plastics, from a human and environmental health perspective, focusing on proactivity related to chemicals in plastics. The workshop addressed current knowledge on the identity and effects of plastic-related chemicals, and methodologies used to assess plastic-related chemicals, but also the main uncertainties regarding plastic-related chemicals and their fate in recycling. To give an overview of the current state of play, Dr Jane Munke, managing director and chief scientific officer of the Food Packaging Forum, started the workshop with a presentation on the latest facts on the benefits and drawbacks of plastic recycling. A group of just over 20 participants from seven countries representing academia, government agencies and different organizations then worked with urgent questions related to conflicts in management for the safe recycling of plastics. Four main topics were addressed by the participants in group discussions: 1) what are the main challenges associated with chemicals in plastic recycling, and for being proactive, 2) what makes circularity of plastic safe, 3) what are the needed solutions or responses to the identified challenges, and 4) which actors are responsible for and/or can influence a safe circularity? The outcome of the discussions was later combined to identify the proposed recommendations below.

Recommendations

Challenges with safe recycling

The challenges related to hazardous chemicals in plastics can be categorized in relation to societal, environmental, human health, and technical aspects. Societal challenges involve understanding the necessity of these chemicals in plastics and educating people about their toxicity. Environmental concerns include biomagnification in food chains, persistence of chemicals, and difficulties in detecting and analysing chemical

mixtures in plastics. Regarding human health, characterizing and assessing the numerous chemicals, detection limitations, and potential hazards of substituting unknowns are all major challenges. On the technical front, analytical limitations, questioning the vast number of chemicals, and the need for targeted methods in hazard assessment were highlighted.

PROPOSED ACTIONS:

- Increase public awareness of the necessity of chemicals in plastics and explore alternative materials.
- Educate the public about the toxicity of chemicals in plastics to enhance understanding and support for hazard mitigation efforts.
- Investigate and implement measures to address biomagnification of plastic chemicals in food chains.
- Develop strategies to prevent plastics from acting as vectors for chemicals and pathogens.
- Enhance characterization of chemicals in plastics, especially persistence, and assess the potential dangers of substituting unknowns.
- Explore grouping methods for assessing and categorizing the vast number of chemicals in plastics.
- Invest in research to improve the detection of hazardous chemicals in plastics, considering analytical limitations.
- Investigate the impact of chemical mixtures and develop methods to analyse all possible combinations in plastics.
- Explore computational methods and in chemico approaches for hazard assessment.

Proactive measures face hurdles, especially in developing countries with technical difficulties and lack of awareness. Other challenges concern the recycling itself. There are misconceptions regarding the recycling process due to lack of transparency, and a risk that new contaminants will be introduced through recycled plastics of different origins, e.g., ocean plastics. Market demand for recycling was identified as an important driver, which highlights the need for better education on recycling.

PROPOSED ACTIONS:

- Support is required for hazard detection and assessment in developing countries, considering their specific challenges.
- Implement educational programmes to raise awareness about the toxicity of chemicals in plastics, especially in regions with a low level of technical expertise.

What makes circularity of plastic safe?

Characteristics of safe plastics involve reducing the toxicity as well as increasing the transparency, traceability, and understanding of the content of materials. Biobased plastics are suggested as a way forward, but challenges include market dynamics affecting feedstock profitability. The responsibility for addressing these challenges lies with industry, society, and regulators, and knowledge is concentrated in the hands of industry and scientists.

PROPOSED ACTIONS:

- Evaluate the need to reduce plastics recycling and explore alternatives like circularity.
- Define characteristics of safe plastics, including reduction, reuse, transparency, understanding, and traceability.
- Stimulate the development of polymers that do not bind chemicals and explore biobased plastics.

What are the needed solutions or responses?

Various groups propose solutions such as funding for developing countries, requirements of transparency and traceability, bridging policy gaps, increasing knowledge and awareness, encouraging sustainable shifts through insurance and market investments, and advocating for scientist-led initiatives to demonstrate the consequences of current practices.

PROPOSED ACTIONS:

- Engage different actors in the recycling value chain to address industry dominance and market demand.
- Discuss raw material issues and consider criticality for different types of materials.
- Increase basic literacy in the population, with a focus on knowledge for consumer companies.
- Advocate for funding for developing countries, transparency, and traceability to ensure industry accountability.
- Identify and bridge policy gaps inhibiting a non-toxic circular economy and implement precautionary principles.
- Promote knowledge and problem awareness, improve education, and prioritize banning certain products over recycling.
- Explore insurance solutions and encourage market investments in sustainable shifts and safe product design.
- Empower scientists to develop scenarios illustrating the consequences of business-as-usual practices, emphasizing the hazards of certain chemicals and the need to ban plastics.

Which actors are responsible for and/or can influence a safe circularity?

In conclusion, the challenges associated with group hazardous chemicals in plastics are complex and multifaceted, requiring collaboration among different stakeholders and the implementation of various solutions to address the societal, environmental, and technical aspects of the problem. The responsibility for the actions lies with several actors, which also needs to be better clarified.

PROPOSED ACTIONS:

- Emphasize industry and societal responsibility in addressing plastic-related challenges.
- Promote transparency in knowledge sharing among industry, scientists, and regulators.
- Analyse and address the influence of consumers, non-profit organizations, and social media in shaping market behaviour.
- Improve communication strategies to convey the



IMAGE CREDIT: GETTY IMAGES

complexity of chemical issues in plastics and emphasize potential risks.

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