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Styrene in plastic materials and articles intended to come into contact with food

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Details of the Deep Dive

Topic: Styrene as food contact material
Thematic area(s): Food ingredients and packaging
Keyword(s): Food contact material; FCM
Query: styrene OR thermocol OR vinylbenzene OR styrol AND food
Timeframe: 2023-present

A. Deep dive general introduction

Styrene, a chemical that is extensively employed in the production of plastics and polymers, is a common ingredient in consumer products, particularly in materials that come into contact with food. The extensive use of styrene requires a thorough assessment of its safety, particularly in relation to its potential migration into food products. This consideration is consistent with the European Food Safety Authority's (EFSA) objectives to guarantee consumer safety and preserve rigorous public health standards.

This deep dive aims to explore the potential concerns and issues related to styrene in plastic materials and articles intended to come into contact with food, with a focus on the contributions and insights from EFSA's partners and stakeholders. By examining pertinent research and data from January 2023 to September 2024, the review places particular emphasis on the perspectives of stakeholders, alongside regulatory advancements, and their implications for consumer safety.

B. Distilled information

B.1 Key actors position as identified by EFSA

Regulatory frameworks: A multidisciplinary approach to manage public health risks is underscored by a comprehensive evaluation of regulatory frameworks and research findings. This represents a response to the ongoing reassessment of the risks posed by styrene in plastic materials and articles intended for food contact. It is estimated that between 70,000 and 400,000 types of polymers are in use. Discussions on the extensive use of polymers across the EU began in 2006, highlighting a significant lack of public information regarding their identity, usage, and potential hazards, calling for stronger regulations (CHEM Trust Europe, 2023).

In particular, the Commission Regulation (EU) No 10/2011 established rigorous standards for the use of styrene and other monomers in the production of polymers for food contact materials. This regulation guarantees safety by setting up precise conditions regarding the permissible levels of monomers, additives, and production aids, as noted by the **BfR** (German Federal Institute for Risk Assessment, a) (German Federal Institute for Risk Assessment, b).

As a result of their low-risk profile under specific conditions, **ANSES** reports that certain materials, including styrene-butadiene block copolymers, are exempt from more extensive regulations (French Agency for Food, 2023). In addition, ongoing safety assessments guarantee that materials such as paper and paperboard utilised in food contact environments adhere to the most recent standards, which are based on the most recent scientific data, in order to reduce any negative health consequences (German Federal Institute for Risk Assessment, c).

The use of specific polymers and monomers in food contact materials is regulated also for rubbers and latices, ensuring that only approved substances are allowed. This regulation also applies to polymer dispersions used in

food coatings, reflecting a strong effort to ensure these coatings do not compromise food safety (German Federal Institute for Risk Assessment, d) (German Federal Institute for Risk Assessment, e).

Migration in food and public exposure: Research on the migration of microplastics into the food chain and their presence in the environment has raised significant concerns. **FOD/SPF** and **FAO** emphasize that microplastics are known to bioaccumulate and can cross critical barriers, such as the placental and blood-brain barriers, highlighting the need for stringent regulatory measures and continued research to understand and mitigate the associated health risks (Federal Public Service, s.d.) (Food and Agriculture Organization, 2024 a).

The transport and packaging sectors are also affected by concerns, as the handling of substances such as styrene monomer necessitates stringent controls to mitigate environmental impact and prevent contamination risk during transport (Food and Agriculture Organization, 2024 b).

Furthermore, it is noted by the **US EPA** and **WUR** that there is a clear need for better research methodologies to more effectively manage public exposure and deepen the understanding of the health impacts of styrene exposure from environmental sources, such as nano- and microplastics (The United States Environmental Protection Agency, 2024) (Wageningen University & Research , 2023).

B.2 Additional position of non-key actors

EU Regulatory Changes: The European Commission's Farm to Fork Strategy, which is designed to guarantee a safe, healthy, and environmentally favourable food system, has been a significant influence on the ongoing adjustments in EU legislation, as evidenced by the recent amendments to Regulation (EU) No 10/2011. Regulation (EU) 2022/1616 focusses on recycled plastic materials intended for food contact as part of these modifications, thereby improving environmental sustainability and consumer safety. The legislation has undergone numerous modifications, including the implementation of the 16th amendment in July 2023, which introduced new substances to the positive list and modified specific migration limits. In addition, ongoing discussions indicate that upcoming amendments may include stricter migration limits for styrene, which is indicative of apprehensions regarding its safety in food contact materials. The legislative process anticipates additional amendments to address multilayer objects and biocides, demonstrating a progressive refinement of food contact material regulations (AIMPLAS, 2023) (Packmedia webmagazine, 2023) (Knoell, 2023a) (Merieux Nutri Sciences, 2023) (Alfred Olthof Consulting, 2023) (AkzoNobel, 2023).

United States Legislative Initiatives: Parallel to the EU, the United States is advancing its regulatory framework for food contact materials. The proposed "No Toxics in Food Packaging Act of 2023" aims to limit the use of hazardous chemicals in food packaging, including ortho-phthalates, PFAS, bisphenol A, styrene, and antimony trioxide, due to their potential to cause cancer and disrupt hormones (US FDA, 2023). This act is an attempt to harmonise federal standards with the growing number of state regulations, thereby emphasising a unified strategy for minimising toxic exposures from food contact materials (SGS, 2023) (SupplySide, 2023) (Breast Cancer Prevention Partners, 2023) (CIRS, 2023a) (CIRS, 2023b) (AkzoNobel, 2023) (PROMAG, 2024) (Patek Packaging, 2024). The "Farewell to Foam Act" that has been proposed by U.S. legislators is designed to prohibit the use of single-use expanded polystyrene (EPS) food packaging products by 2026 as a result of environmental and health concerns. This national initiative expands upon the existing prohibitions in states and cities, indicating a substantial paradigm shift towards the improvement of public health protections and the reduction of plastic pollution (EHN, 2024a) (EHN, 2024b).

Japan's regulatory environment: It is currently in the process of transitioning to a comprehensive positive list system for food contact substances, with a deadline of May 2025. The objective of this system is to improve transparency and compliance within the supply chain by compiling a comprehensive inventory of all approved polymeric resins and additives that are employed in food contact plastics. Companies are obligated to conduct self-assessments to confirm compliance during the transition period and may obtain a Certificate of Compliance from the Japan Institute for Chemical Research and Evaluation (Knoell, 2023a) (Knoell, 2023b) (Enhesa, 2024).

Recycling Innovations: INEOS Styrolution is a pioneer in the development of polystyrene (PS) recycling innovations in Europe, and it operates a substantial mechanical recycling facility in Krefeld, Germany. This facility is dedicated to the production of food-contact approved recycled PS (R-PS), which involves overcoming historical obstacles such as the requirement to source high-quality feedstock and navigate the rigorous approval procedures

of the EFSA under the new EU regulations (ICIS - Independent Commodity Intelligence Services, 2024) (S&P Global, 2023). The demand for recycled PS is expected to experience significant growth as the industry transitions from virgin polymers, as a result of legislative changes such as the EU Packaging and Packaging Waste Regulation (PPWR), which is anticipated to mandate recycled content in plastic packaging by 2030. Nevertheless, the challenge of guaranteeing the safety of recycled materials in food contact applications persists. In order to establish safety and obtain regulatory approvals, it is imperative to conduct rigorous testing and acquire comprehensive data (S&P Global, 2023) (ICIS - Independent Commodity Intelligence Services, 2024) (Food Contact Center, 2023). Research has highlighted concerns regarding the potential for chemical contamination from recycled plastics. Substances such as styrene, benzene, and bisphenol A have been observed to migrate into food products, thereby presenting substantial health risks. These results underscore the necessity of rigorous quality controls to reduce contamination risks and the intricate nature of the recycling processes (EHN, 2024a) (The Guardian, 2023) (Future Waste, 2023). The dynamics of the market for recycled plastics are complicated, with price volatility and supply chain issues that must be addressed. The stability and growth of the recycled polymer markets can be influenced by the significant costs associated with procuring and processing recycled materials, as well as the economic pressures that the recycling industry faces resulting from fluctuating demand (ICIS - Independent Commodity Intelligence Services, 2024). The industry's dedication to innovation and adaptation is exemplified by technological advancements, such as the development of ABA structures in PS recycling. These technologies are intended to satisfy regulatory requirements and consumer safety standards, thereby facilitating the more sustainable assimilation of recycled plastics into the food packaging sector (S&P Global, 2023) (CISION, 2023).

C. Monitoring timelines

The time period covered by the following deepening is from 1 January 2023 to 25 September 2024.

D. Key actors and roles

Organization	Number of documents cited	Item type
CHEM Trust Europe	1	Report
French Agency for Food, Environmental and Occupational Health & Safety	1	Review
German Federal Institute for Risk Assessment	5	Reports
Federal Public Service (FPS) Health, Food Chain Safety and Environment	1	Review
Food and Agriculture Organization of the United Nations	2	Reviews
Health Canada	2	Papers
The United States Environmental Protection Agency	1	Paper
The United States Food and Drug Administration	1	Alert
Wageningen University & Research	1	Paper

E. Key insights and recommendations

Insights:

- The global regulatory frameworks for food contact materials are being refined in several economic areas:
  - EU: the Farm to Fork Strategy is in accordance with the amendments to regulations, such as Regulation (EU) 2022/1616 on recycled plastics.
  - US: the "No Toxics in Food Packaging Act of 2023" is a legislative proposition that seeks to prohibit the use of substances such as styrene and PFAS.
  - Japan: the implementation of a positive list system guarantees that only substances that have been approved for use in food contact materials are employed.
- Focus on styrene: the EU is currently contemplating the establishment of migration limits for styrene, which suggests that there is a greater emphasis on individual substances in order to create safer food contact materials.

- Market dynamics and safety concerns: the demand for recycled PS is expected to increase due to anticipated regulatory changes. However, challenges remain in managing the market's volatility and supply chain complexities, as well as ensuring material safety.
- Health risks from microplastics: microplastics in the environment pose substantial health risks due to their potential for bioaccumulation and ability to migrate across biological barriers.
- Contamination in transport and packaging: handling of substances like styrene monomer in transport and packaging involves significant environmental and contamination risks.

Recommendations:

- Strengthen regulatory frameworks: regulations must be enhanced to address existing gaps, ensuring strict safety standards for polymers in food contact materials.
- Maintain rigorous safety assessments: safety assessments of food contact materials must be updated frequently to align with the latest scientific data.
- Increase research on microplastics: a boost in research and regulatory efforts can bring to a better understanding and mitigation of the health risks associated with microplastics.
- Companies must remain informed and adapt to regulatory changes in all markets to ensure compliance and maintain market access.
- The participation in regulatory discussions and investments in the enhancement of analytical testing methods will influence industry outcomes in response to new regulations.
- A shift towards safer and more sustainable materials in product development must be adopted to satisfy both regulatory requirements and consumer expectations.
- Innovation in recycling technologies must be continuously pursued to comply with safety standards and facilitate the integration of recycled plastics into the food packaging sector.

F. Document analytics

The distribution and classification of articles used in the deep dive are significantly clarified by the graphical representations included.

The documents are categorised by actor's relevance tier in Figure 1. It is important to note that 10 of the articles are classified as Critical, emphasising their important role in supporting the fundamental arguments or discoveries of this report.

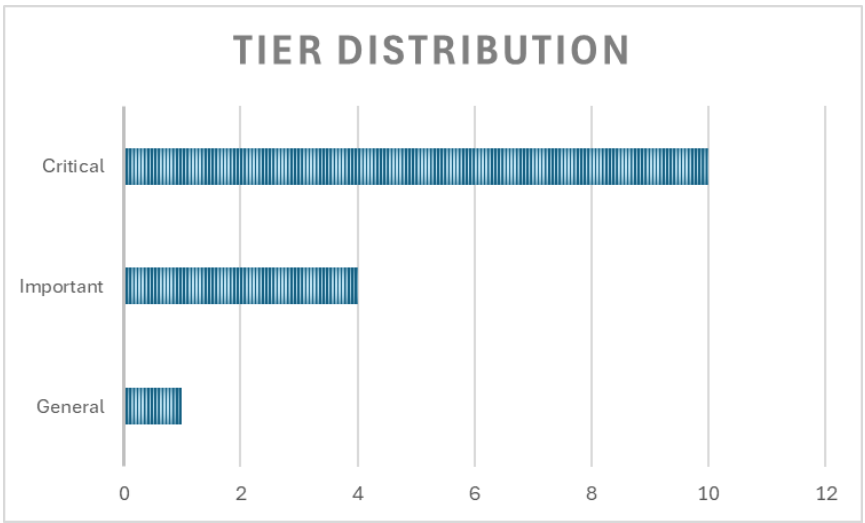

Figure 1. Tier distribution based on actor.

Figure 2 shows the distribution of the type of document analysed and cited from the actors' sources.

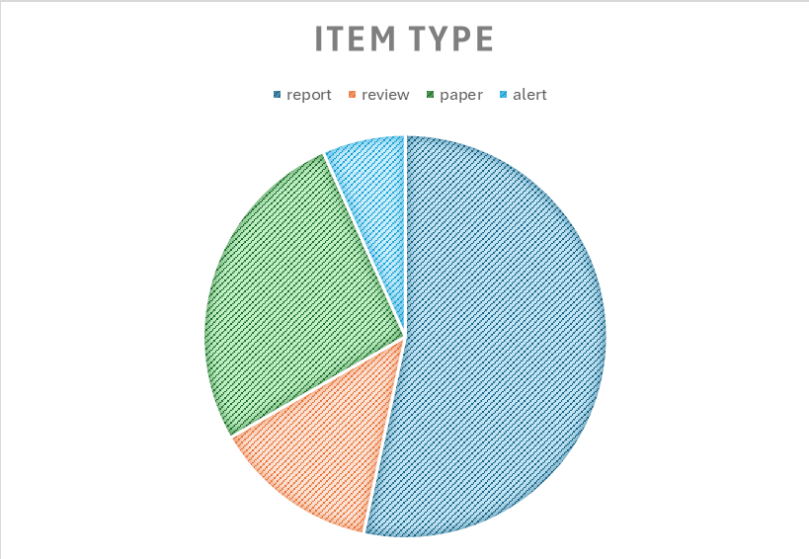

Figure 2. Item type distribution

G. Concise summary

This deep dive encompasses research and data from January 2023 to September 2024 and underscores the necessity of comprehensive regulatory frameworks to mitigate the public health hazards associated with the use of styrene in food contact materials. The EU has been confronted with a substantial information gap regarding polymer identity, utilisation, and hazards, which has been the subject of discussions since 2006. This has underscored the need for more comprehensive regulations. The Commission Regulation (EU) No 10/2011 established stringent standards for the use of styrene and other monomers, thereby guaranteeing safety by defining the permissible concentrations of substances in polymers. The report also addresses the environmental and health concerns raised by the migration of microplastics into the food chain, promoting the implementation of stringent measures and the pursuit of additional research to comprehend and mitigate the associated health risks. The necessity for stringent controls to prevent contamination and environmental impact is underscored by concerns in the transport and packaging sectors regarding styrene monomer. Finally, there is a pressing need for enhanced research methodologies to gain a more comprehensive understanding of the health consequences of styrene exposure from environmental sources such as nano- and microplastics.

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