



# Polystyrene, Disposable Food Containers, and Contaminated Food

## Polystyrene

Polystyrene is used to make inexpensive disposable food containers like plates, cups, and school lunch trays, this material can come in many different forms including a lightweight foam often called “styrofoam” or “expanded polystyrene foam” (EPS) as well as rigid plastics but all forms will show a resin code #6 at the bottom. They are convenient single-use containers because they can be used to hold both hot and cold food and beverages. Many of these containers can be identified easily because they are labeled with the #6 “chasing arrows” logo.

Polystyrene is made by joining together large numbers of styrene molecules, and typically after manufacturing, some unbound styrene remains in the finished polystyrene product. This styrene can move into food from polystyrene food containers when they are used. This contamination has been documented by both government<sup>5</sup> and academic<sup>6,7</sup> studies.

This makes polystyrene a potential hazard because exposure to styrene has well documented impacts to human health including cancer<sup>1-3</sup> disruption of hormones<sup>4</sup>, and reproductive harm<sup>4</sup>.



## Styrene Hazards

The International Agency for Research on Cancer, the National Institutes of Health, and California all identify styrene as a chemical that may cause cancer<sup>1-3</sup>. The National Institute for Occupational Safety and Health also identified 36 studies conducted between 1978 and 2009 showing that styrene causes genetic damage in humans or laboratory animals<sup>4</sup>, which could be the way it causes cancer.

Styrene can also disrupt the normal activity of our hormones. According to a database from the National Institute for Occupational Safety and Health, styrene damages a gland called the adrenal cortex where stress and sex hormones are produced. It also causes changes in several other hormones, including luteinizing hormone which is important in menstrual cycles and sperm production<sup>4</sup>.

The National Institute for Occupational Safety and Health also identified 11 studies that found that styrene exposure was linked to reproductive harm including sperm damage, reduced fertility, miscarriages, stillbirth, and birth defects<sup>4</sup>.

## Styrene in Polystyrene

Styrene is frequently found in polystyrene food containers because not all styrene is formed into polystyrene during the manufacturing process. A 2014 study by the U.S. Food and Drug Administration found styrene in all 24 polystyrene products tested<sup>5</sup>. CEH’s 2019 testing has consistently found styrene in polystyrene foam lunch trays.

### Styrene Contamination of Food

The free styrene in polystyrene containers can contaminate food stored in the containers.<sup>8</sup> The U.S. Food and Drug Administration study mentioned above measured styrene contamination in eight foods stored in polystyrene, including yogurt, soup, and cookies. All of the foods tested were contaminated with styrene.<sup>5</sup>

An additional study from 2021 also found that styrene could contaminate food simulants that were put in polystyrene cups, trays, and plates further indicating that styrene can contaminate food in EPS containers.<sup>6</sup> A similar 2023 study found that styrene and microplastics leached out of polystyrene food containers.<sup>8</sup> A systematic review of studies that assessed styrene contamination of food found that the fat content of foods had a direct effect on the amount of styrene that leached into them from polystyrene containers.<sup>9</sup>

### Environmental Harm

Estimated use of polystyrene in food containers in the U.S. based on data from 2012 is 2600 million pounds per year<sup>10</sup>. This generates a massive amount of waste and many local governments no longer accept expanded polystyrene in curbside recycling as this material is not easily recyclable and waste haulers struggle with it contaminating their recycling stream.

All types of polystyrene food containers at the end of their use should be sent to landfills, but oftentimes they end up littered across cities, polluting soil and waterways or breaking down into microplastics in our oceans<sup>11</sup>. Animals regularly ingest macro, micro and nano plastic particles including polystyrene and this can have an adverse impact on animal health. Research in polystyrene nanoplastic ingestion in whiteleg shrimp indicates that even in low concentrations, there can be dramatic impacts including immune disruption.<sup>12</sup>

In fish, polystyrene ingestion can affect immunological responses and slow growth rate, while in algae exposure impacts the amount of pigment in the body and a decrease in photosynthesis.<sup>13</sup> Polystyrene nanoparticles can bioaccumulate<sup>14</sup>, meaning that these particles can build up in the bodies of animals higher up in the food chain as they consume smaller animals with polystyrene in their bodies. This can ultimately expose humans to polystyrene if the animals they consume have previously ingested this material.

### Conclusion

Based on the studies summarized above, polystyrene is not a healthy material to use in food containers. The presence of unbound styrene in the containers, the ability of this styrene to contaminate food, and the documented hazards of styrene exposure provide compelling reasons to use other materials.

### References

1. [IARC Monographs, 2018](#)
2. [NTP 15th Report on Carcinogens: Styrene, 2021](#)
3. [California OEHHA, 2016](#)
4. [CDC, 2018](#)
5. [Genualdi et al., 2014](#)
6. [Ajaj et al, 2021](#)
7. [Wang et al, 2019](#)
8. [Pilevar et al, 2019](#)
9. [Sadhigara et al, 2022](#)
10. [El-Ziney et al, 2016](#)
11. [UN Environment Programme, 2018](#)
12. [Environmental Technology & Innovation, 2023](#)
13. [Frontiers in Toxicology, 2023](#)
14. [Environmental Advances, 2022](#)