What are Polyfluorinated Alkyl Substances-Why Should You Care?

Guest Author: Allen Misa

Food safety issues and environmental contamination concerns are treated much differently based on the laws that govern them. Government agencies such as, the Food and Drug Administration (FDA), United States Department of Agriculture (USDA), and Environmental Protection Agency (EPA), administer these laws that are created at various times and purposes. These agencies are separately staffed and don’t even talk to each other most of the time.

However, in the physical world, food and environment are intimately connected. Food is grown in soil, nourished by water, exposed to pesticides, processed in a factory, wrapped in plastic, and finally consumed in individual environmental settings. Although this compartmentalization of food and environmental issues may make it easy on the regulators, it makes it difficult to holistically assess common threats to both domains. What we breathe, drink, eat, and touch equally impact our healthy existence. Our well-being is strongly impacted by chemistry than by choice of regulatory agency. Let’s examine how regulatory compartmentalization is trumped by chemistry by examining a remarkable class of chemical compounds: Polyfluorinated Alkyl Substances, or PFASs, for short.
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**What are PFASs?**

Polyfluorinated Alkyl Substances are a large group of compounds characterized by a linear aliphatic backbone (commonly octyl), a high degree of fluorination (usually per-fluorinated) and often featuring a carboxylic- or sulfonic- acid functionality. These chemical characteristics make PFASs highly resistant to heat, oil and water. As a result, for many years these remarkable materials have found a multitude of uses in everything from carpeting and clothing to firefighting foams.

However, owing to these same useful chemical properties, PFASs are unfortunately extremely resistant to degradation in the environment and also strongly bioaccumulate. A result of their widespread use and persistence, PFASs compounds are globally distributed at trace levels. Because of their strong tendency to bioaccumulate, PFASs compounds are widely found at trace levels in the blood and fatty tissue of both humans and animals in the developed world. These same chemical properties also raise concerns about potential adverse health effects.

The EPA eloquently puts it: “At high concentrations, certain PFASs have been linked to adverse health effects in laboratory animals that may reflect associations between exposure to these chemicals and some health problems such as low birth weight, delayed puberty onset, elevated cholesterol levels, and reduced immunologic responses to vaccination” (Source).

Although humans are not generally exposed to PFASs at high concentrations, PFASs persistence and high bio accumulation raises concerns about the effect of low-level lifetime exposure through increased body burden. The potential impact on certain vulnerable classes (e.g., infants) is also worrisome.
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Consequently, PFASs have become an environmental pollutant of emerging concern and the EPA has started to increase the degree of scrutiny placed on these compounds. However, due to the higher level of observation, many excellent analytical methods have been developed to measure PFASs in environmental samples. One recent example is the analysis of PFASs in drinking water (link) by direct inject UHPLC-MS/MS: PFAS Drinking Water Analysis (pdf)

It’s Everywhere!

Talking about the environment is all well and good, but what does all this have to do with food? Although PFASs were originally identified as an “environmental pollutant”, the same unique chemical properties make them a food pollution concern as well. The resistance to oil and heat make PFASs a very effective coating for grease resistant paper, used in consumer products such as microwave popcorn bags, fast food wrappers, and pizza boxes. In all such applications, there exists the potential for traces of PFASs to migrate from the packaging to the food. Similar PFASs food contact opportunities abound in commercial food processing operations as well.

Another potential source of bioaccumulated PFASs comes from the food itself since bioaccumulation is magnified at higher levels of the food chain. Therefore, fish and meat could exhibit advanced points of PFASs contamination than the environment in which they were raised. Therefore, exposure of livestock to elevated PFASs levels could represent an additional exposure route for the human population.

Finally, although not strictly a food-born source, the widespread occurrence of PFASs in carpet, upholstery, and clothing adds to the human body burden primarily through ingestion. Your mother always told you to wash your hands before you eat; now you know
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why. In conclusion, although many sources of PFASs exposure have been greatly reduced over the last 15 years, it has been concluded that: “Food contaminated with low levels of PFASs is the most likely source of exposure for general populations in industrialized nations” (Source)

So, the saga continues as the concern of PFASs rises so will the study of the compounds. More and more applications will occur and become available. Hopefully the more PFASs are studied, the more light that is shed on the subject.

For a more in depth look into PFASs, check out our webinar: Modern Approaches for PFAS LC/MS/MS Analysis in Aqueous Matrices Using SPE or Large Volume Injection by HPLC and UHPLC

Also see our application technical notes analyzing PFAS:
PFAS Analysis in Water Samples using LC/MS/MS Large-Volume Direct Injection
Rapid Analysis of 23 PFASs by UHPLC-MS/MS using Luna Omega 1.6 µm PS C18

Questions about Polyfluorinated Alkyl Substances PFASs? Connect with our nearly 24/7 Technical Experts at www.phenomenex.com/chat. We look forward to hearing from you!

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### Summary

**Article Name**
What are Polyfluorinated Alkyl Substances (PFASs)-Why Should You Care?

**Description**
Allen Misa explores polyfluorinated alkyl substances (PFASs) and if they can be potentially harmful to the mass public based on method development studies.

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