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Chemical Interactions

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Science: Paige Buchholz Design: Zoë Sharp

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Abstract

How the different chemical structure of plastics affect the environment differently.

Chemical Interactions

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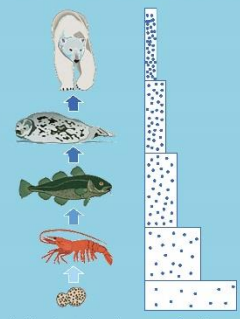
crystalline

amorphous

A crystalline structure is uniform. It leaves little space between molecules. An amorphous structure is irregular, leaving open spaced of various sizes.



A food chain showing how pollutants are transferred from one organism to the next. As you can see with the dot representation on the right the pollutant becomes increasingly concentrated as it is passed up the food chain.

Structure and absorption

Plastics are uniquely good at absorbing molecules from the environment. The irregular structures of plastic polymers that make them malleable and easy for us to transform are a major part of the problem. Think about the various types of plastic you use on a daily basis. Some are hard like PVC piping and others are really soft like grocery bags. The softer plastics have increasingly irregular structures, which means more space between molecules for other things, like pollutants, to make their way in.

Pollutants

Not only are plastics really good at absorbing things but many pollutants are attracted to plastic. Often time's pollutants are hydrophobic, which means they "fear water"; because of this fear they want to get as far away from water molecules as possible. In order to do so they will attach themselves to other particles such as sediment or plastic. Plastic is a perfect get away with all of its little nooks and crannies provided by its irregular structure.

Common pollutants in the Great Lakes

- Pesticides
- Pharmaceuticals
  Ibuprofen, Naproxen, estrogens, caffeine
- Flame retardants
- Heavy metals
  Mercury, lead, copper, chromium, aluminum
- Polycyclic aromatic hydrocarbons (PAHs)
  Carcinogenic and mutagenic rings of carbon formed by the burning of carbon based materials such as coal, petroleum, and wood.
- Polychlorinated biphenyls (PCBs)
  A now banned group of manmade chemicals that do not biodegrade well and remain a prominent contaminant. Used to be used in coolant and heat transfer fluids.

Common plastics listed from softest to hardest:

1. Low Density Polyethylene: Grocery bags, film packaging, tubing
2. High Density Polyethylene: Milk jugs, yogurt cups, cereal box liners
3. Polypropelene: Ropes, insulation for electrical cables, bottle tops, folders
4. Polyethylene Terephthalate: Bottles, synthetic fibers
5. Polyvinyl Chloride: Piping, signage, artificial leather

Why is absorption a problem?

The concentration of pollutants will typically become higher in plastics than in water, and as many of us have seen through anti-plastic advocacy, organisms eat plastic. Plastic is often mistaken for food such as zooplankton, which are eat by fish; or jellyfish, which are eaten by turtles, fish, and sharks. Once the plastic is consumed by the organisms it has entered the food chain and the absorbed pollutants will then be passed on to the predators of the original plastic consumer. Pollutant absorption by plastic also means that the pollutants will remain suspended in the water column for a longer period of time, because most plastic floats, and they will take longer to biodegrade.