



Water Pollution by Detergents

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Why in News

Water **pollution caused by detergents** has become a big concern in the global context.

The **per capita (per person) detergent consumption** in **India** is around **2.7 kilogram per year**.

It is around **3.7 kg in the Philippines and Malaysia** and **10 kg in the United States of America**.

Water Pollution

- Water pollution occurs when harmful substances—**often chemicals or microorganisms—contaminate a stream, river, lake, ocean, aquifer, or other body of water**, degrading water quality and rendering it toxic to humans or the environment.
- Water is uniquely vulnerable to pollution. Known as a “**universal solvent**,” water is able to dissolve more substances than any other liquid on earth.
- Some of the **causes for water pollution** are sewage water, industrial Wastes, agricultural sources, thermal and radiation pollution, marine pollution, invasive species, underground water pollution etc.

Note:

- **Point Source:** When pollutants are **discharged from a specific location** such as a drain pipe carrying industrial effluents discharged directly into a water body it represents point source pollution.
- **Non-Point Source:** It includes **discharge of pollutants from diffuse sources or from a larger area** such as runoff from agricultural fields, grazing lands, construction sites, abandoned mines and pits, etc.

Key Points

- **Detergents:**

- A detergent is a **surfactant or mixture of surfactants** that has cleaning properties in dilute solution with water. A detergent is similar to soap.
 - **Surfactant**, also called surface-active agent, substance such as a detergent that, **when added to a liquid, reduces its surface tension**, thereby increasing its spreading and wetting properties.
 - **Surface Tension** is the property of the surface of a liquid that **allows it to resist an external force**, due to the cohesive nature of its molecules.
- They tend to be **more soluble in hard water than soap** because the sulfonate of detergent doesn't bind calcium and other ions in hard water as easily as the carboxylate in soap does.

- **Detergents & Pollution:**

- **Bioaccumulation of Nonylphenol:**

- **Nonylphenol**, a hazardous chemical present in detergents, is known to enter water bodies and the food chains. It **bio-accumulates** and can pose serious environmental and health risks.
- It has been **detected in human breast milk, blood and urine**, and is associated with reproductive and developmental effects in rodents.

- **Inhibition of Biodegradation:**

- Many laundry detergents contain approximately 35 to 75% phosphate salts. **Phosphates can cause a variety of water pollution problems.**
- For example, phosphate tends to **inhibit the biodegradation** of organic substances. **Non-biodegradable substances cannot be eliminated by public or private wastewater treatment.**

Biodegradation is the process by which organic substances are broken down into smaller compounds by living microbial organisms.

- Some phosphate-based detergents can also cause **eutrophication**. Phosphate-enrichment can cause the water body to become choked with algae and other plants.
 - **Eutrophication:** When a water body becomes overly enriched with minerals and nutrients which induce excessive growth of algae or algal bloom. It **deprives the water of available oxygen, causing the death of other organisms.**
 - In Belgium, **phosphates have been restricted for use in household detergents since 2003.**

- **Oxygen-Reducing Substances:**

Detergents also contain **oxygen-reducing substances** (ie, a chemical compound that readily transfers oxygen atoms) that may cause **severe damage to the fishes and other marine animals.**

- **Destruction of Mucus:**

Detergents are capable of destroying the **external mucus layers that protect the fish from bacteria and parasites**, causing severe damage to the gills.

Mostly fish die when detergent concentrations are near 15 parts per million (ppm); however, detergent concentrations as low as 5 ppm will kill fish eggs.

- **Makes Water Turbid:**
 - A few more harmful components of detergents which are **anthropogenic components such as herbicides, pesticides and heavy metal concentrations** (like **zinc, cadmium and lead**) can cause the water to grow dark. This **blocks out light and disrupts the growth of plants**.
 - Turbidity also **clogs the respiratory system** of some species of fishes. Pathogens from these toxic water bodies cause diseases, some fatal, in human or animal hosts diseases.
- **Hazardous for Humans:**

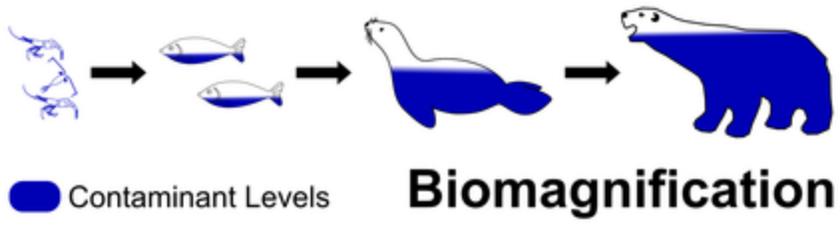
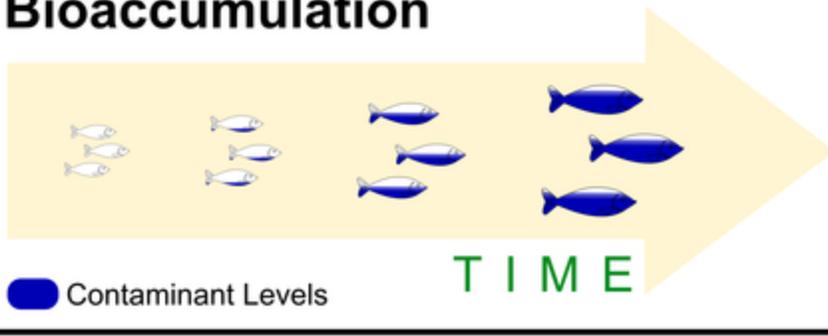
The detergents contain suspected **carcinogens**, and ingredients that do not fully biodegrade.

A **carcinogen** is an agent with the capacity to cause cancer in humans.
- **Indian Initiative:**
 - **ECOMARK Scheme:** The Government has instituted this scheme on **labeling of Environment Friendly Products**.
 - The scheme is **operating on a national basis and provides accreditation and labeling for household and other consumer products** which **meet certain environmental criteria** along with quality requirements of the Indian Standards for that product.
 - The Ecomark Scheme covers various product categories like **Soaps and Detergents, paints, food items etc.**

Bioaccumulation vs Biomagnification

- **Bioaccumulation** is when the **concentration of chemicals increases within an organism or species**. This can occur when toxic substances are ingested. These toxic substances are very difficult for organisms to excrete, therefore, **accumulate in their tissues**.
- **Biomagnification** is the process by which toxic chemicals build up within predators. This **typically occurs across an entire food chain** and affects all of the organisms but animals higher up in the chain are more impacted.

Bioaccumulation



Source: DTE