

EWCE 131
Ecology and Environmental Pollution

Lecture 12

Instructor

Maj Dr. Kazi Shamima Akter, Engrs

Department of EWCE, MIST

Lecture outline

Pollutants and Pollution

Topics

- ❖ **Chemical pollution by –**
- **detergents**
- **dyes**
- **pharmaceuticals**



INCREASED INDUSTRIALISATION

Increase in Population



Increase demand for goods





More Industrialisation

Let's look around us .....

Clothes we wear – dyes and bleaches

Paper, paper, paper everywhere

Leather bags and shoes

Batteries

Metal plating

Paints

Plastics

Pharmaceuticals









All these industries are highly water polluting

Pollution by Chemicals

Soaps & Detergents



- Collectively called surfactants because they are surface tension reducing agents

- Mainly two components

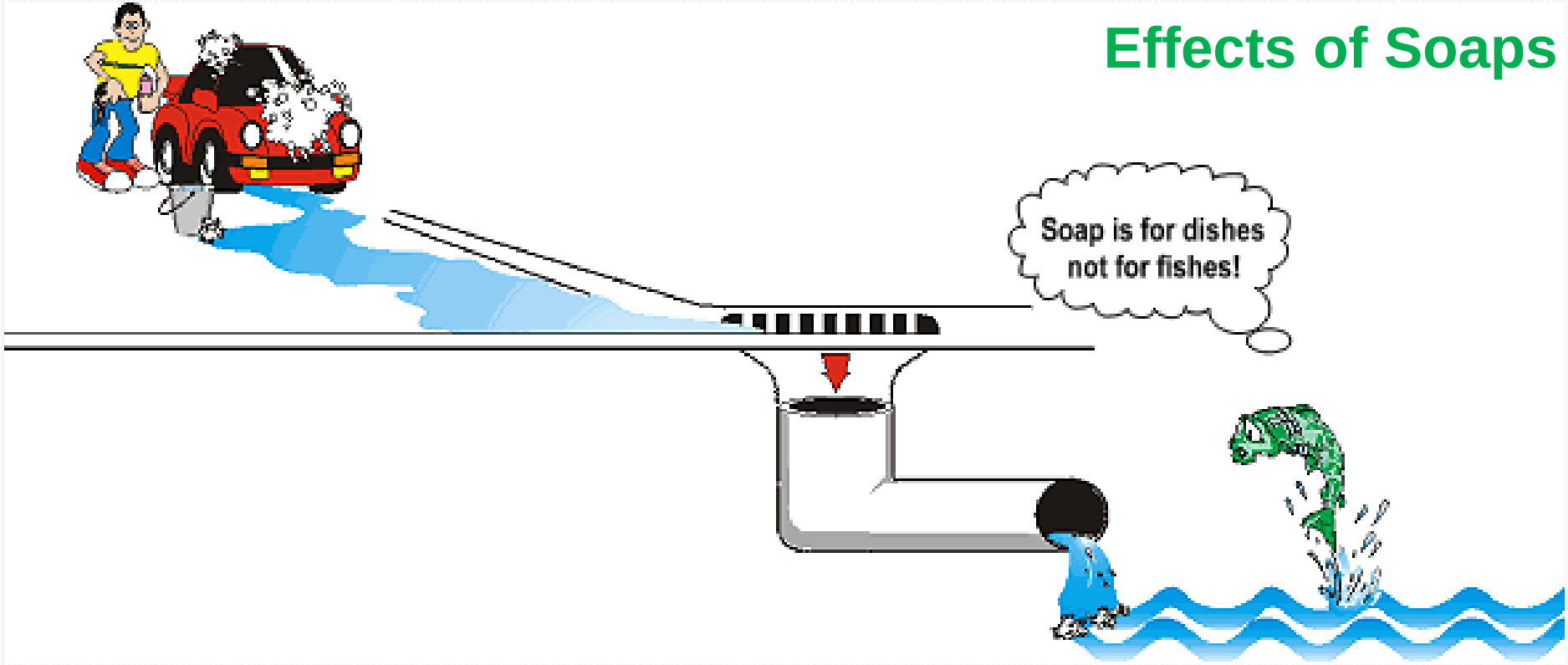
  ✓ Lyophilic :- merges with the solvents

  ✓ Lyophobic:- merges with the oily dirt.



- Detergents mainly of 3 types:- anionic, cationic and non-ionic.

Pollution by Chemicals - **Soaps**



- Soaps are made from chemical found in animals and plants. i.e., biodegradable, hence they can be decomposed by the action of bacteria.

- Soap discharged to water body depletes DO.

Pollution by Chemicals - **Detergents**

Effects of Detergents

- Most detergents have branched hydrocarbon chains and are non-biodegradable, that is, they cannot be decomposed by bacteria. As a result, non-biodegradable detergents cause water pollution.

- Phosphates in detergents act as fertilizers and promote the excessive growth of water plants and algae (eutrophication). When the plants die and decay, they will use up the DO in water. This will decrease the oxygen content in water and kill fishes and other aquatic lives.





Pollution by Chemicals - **Detergents**

Effects of Detergents

- Detergents produce a lot of foam in water. The layer of foam that covers the water surface will prevents oxygen from dissolving in water. This condition will cause fish and other aquatic life to die from oxygen starvation.

- Additives such as sodium hydrochlorite (bleaching agents) releases chlorine gas in water that is acidic. Chlorine gas is highly toxic and kills aquatic life.

Pollution by Chemicals -**Detergents**

Effects of Detergents

- Destroy the external mucus layer which protects the fish from bacteria & parasites and hence cause fish killing.

- Laundry detergents can also damage indoor air quality. Traces of many organic compounds, including carcinogens such as acetaldehyde and benzene was found in dryer vent exhaust gas.

Pollution by Chemicals

Textile Dyes

- Textile wet processing plants of Bangladesh may be classed as - (i) Knit dyeing units, (ii) Woven dyeing units, (iii) Denim plants, (iv) Printing units, and (v) Garments washing units.

- Knit dyeing industries are one of the most highly environment polluting textile industries in Bangladesh.





Pollution by Chemicals – **Textile Dyeing**

Pollutants from typical textile dyeing effluent

- Various unfixed dyes (5-40%)
- Salts
- Color, BOD, high COD
- Dissolved solids, cationic materials
- Low suspended solids
- Heavy metals
- Alkalies, oxidizing and reducing agents
- Organic acids
- Na_2S
- $Na_2S_2O_2$
- Soap, detergents etc

Pollution by Chemicals – **Textile Dyeing**

Impacts of textile dyeing effluent

- Generally, the textile dyeing industries release a large amount (volume) of effluents.



- Effluent contain toxic and hazardous pollutants which degrades the environment very badly.

- Textile industrial effluents show toxic effects on aquatic macrophytes and algae, as it is noticed that, aquatic macrophytes could hardly survive 2 days on textile effluent.

Pollution by Chemicals – **Textile Dyeing**

Pollutants from typical textile dyeing emission

- VOCs
- Sulphides – cause odor

Impacts of textile dyeing effluent





Pollution by Chemicals



Pharmaceutical Pollutants

- Pharmaceutical pollutants consist of any prescription drug that is released into the environment.

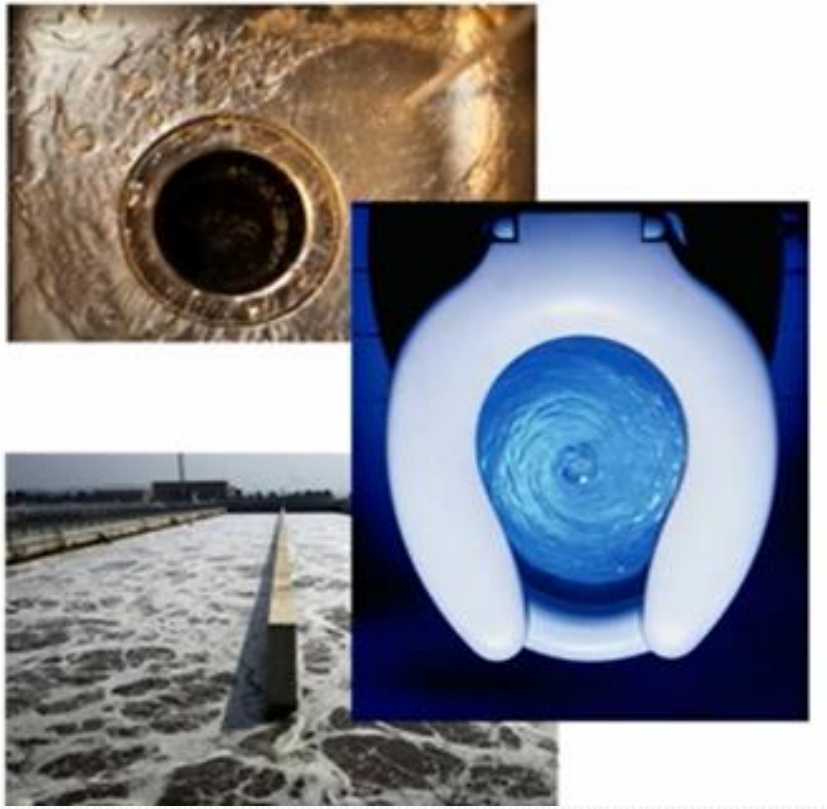
- Pharmaceutical drugs are designed to resist the effects of stomach acids, which makes them long-lasting. Because of this, they remain in the environment for long periods of time (persistent).

- The amount of prescription drugs in the environment has increased drastically as more people can afford healthcare and prescription medication.

Pollution by Chemicals - **Pharmaceuticals**

How released to environment?

- They are excreted from humans and animals, mainly through urine and are released either directly or indirectly through waste treatment plants into the environment.
- Unused medicines are dumped down drains and toilets and make their way into water supplies.
- Manufacturers of prescription medication might release unused medication into the environment.



Pollution by Chemicals - **Pharmaceuticals**

Effects on environment

- After discharging to water body from wastewater treatment plants, though there may not high levels of drugs in water, the drug accumulate in fish.

- When the tertiary consumers eat these contaminated fish, they are getting three times the amount of the prescription pollutants.



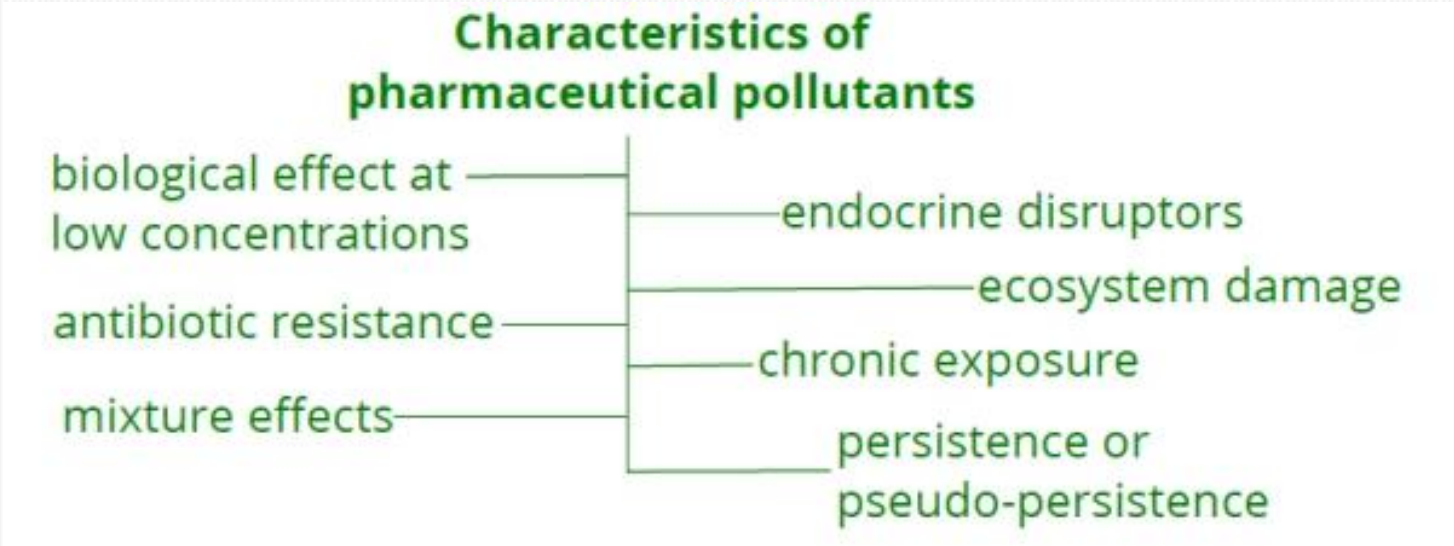
- Research has uncovered popular antidepressant medication concentrated in the brain of the fishes from water waste treatment plants

Pollution by Chemicals - **Pharmaceuticals**

Effects on environment

- Estrogen-like chemicals cause genetic deflects in human beings, including hormonal, developmental and physical defects.

- May cause complete extinction of species in an environment, leading to the destabilization of certain ecosystems.



Pollution by Chemicals - **Pharmaceuticals**

Pharmaceutical pollutants factsheet

NTN NATIONAL TOXICS NETWORK

up to >70%

Amount of pharmaceutical dose excreted in urine

Wastewater treatment plants ***are not designed to remove or degrade pharmaceuticals***
Pharmaceuticals are ***released into the environment*** in treated wastewater and sewage sludge

>200 Number of different pharmaceuticals detected in aquatic environments globally

Types of pharmaceuticals that have been detected in sewage sludge and treated wastewater

- antidepressants
- antibiotics
- non-steroidal anti-inflammatory drugs
- lipid regulators
- anti-epileptics
- beta blockers

Source: Report on “National Toxics Network and titled Pharmaceutical Pollution in the Environment: Issues for Australia, New Zealand and Pacific Island countries”, October 2015 [http://www.ecoinvestor.com.au/Stories/Features-Opinion/Pharmaceuticals-in-the-Environment.htm]

Pollution by Chemicals - **Pharmaceuticals**

Effects of specific drugs found in water

Synthetic Hormones

- Estrogen leads to feminization in male fish.
- Hormonal changes have also found in other aquatic reptiles and amphibians.

Antibiotics

- Antibiotics in water sources can lead to microbes that are immune to the antibiotic's effects.

Pollution by Chemicals - **Pharmaceuticals**

Effects of specific drugs found in water

Anti-Depressants

- Anti-depressants can affect the activity levels in some fish and shellfish.
- Can cause the same kinds of effects in fish as it does to humans.
- The accumulation of these drugs in fish can be harmful to who consume it.

Pollution by Chemicals - **Pharmaceuticals**

Reducing Pharmaceutical Footprint

Limiting bulk purchase

- Big bottle of unused pills creates opportunity for medications to end up in the water

Using drug take back programs

- Some of the federal drug enforcement agencies in the developed country organize national drug-take-back days.

Do not flush unused medicines or pour them down

- Use drug-take-back program (if available), or find other safe disposal methods
  - (described later).



Pollution by Chemicals - **Pharmaceuticals**

Reducing Pharmaceutical Footprint

Be careful about how you throw medication into the trash



- If you put them in the trash remove them from the packaging,
- crash them and seal them in a plastic bag with some water
- add some sawdust, cat litter, coffee grounds or some other unappealing materials to the bag to cut down the contents.

Pollution by Chemicals - **Pharmaceuticals**

Safe disposal

- For pharmaceutical products, the most environmentally safe disposal method is to take advantage of a community drug take-back programs that collect drugs at a central location for proper disposal .

- Another method used is biodegradation, and through this method microorganisms, such as bacteria, feed or break down these pollutants thus eliminating them from the contaminated media.