CY-1018: Environmental Chemistry Theory

Know our environment (chemistry of lithosphere, energy balance, sustainability and recycle), Know about global warming (infrared absorption, molecular vibration, atmospheric window, residence time of greenhouse gases, evidences and effects of global warming), Deeper analysis of atmospheric pollution (Chemistry of CO, NOx, VOCs, SO_2, Industrial smog, photochemical smog), Ozone depletion (production, catalytic destruction), **Organic Chemicals in the Environment, Insecticides, Pesticides, Herbicides and Insect Control, Soaps, Synthetic Surfactants, Polymers, and Haloorganics. Fate of organic/inorganic chemicals in natural and engineered systems (fate of polymers after use, detergents, synthetic surfactants insecticides, pesticides etc. after use),** Aspects of transformations in atmosphere (microbial degradation of organics-environmental degradation of polymers, atmospheric lifetime, toxicity). Green Chemistry and Industrial Ecology. Future challenges (CO_2 sequestering, Nuclear energy). A project on environment related topic.

Reference: Principles of Environmental Chemistry By James E. Girard, Third Edition

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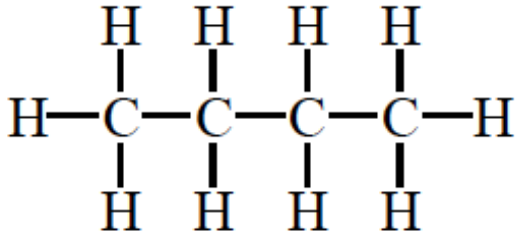
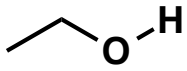
Organic Chemicals in the Environment

Organic compounds: Compounds that mainly contain Carbon and Hydrogen atoms

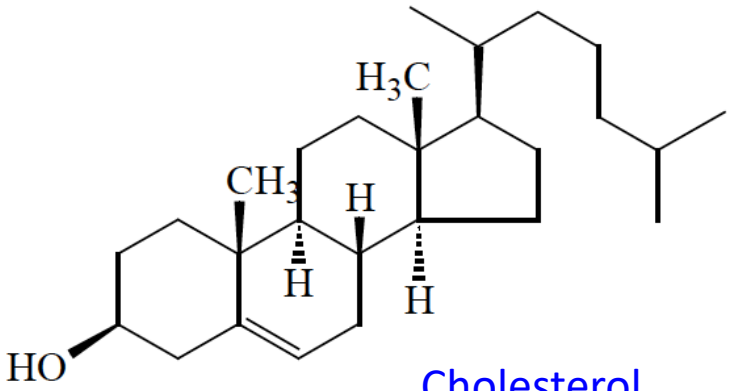
Ex.



n-butane



Ethanol



Cholesterol

Glucose: $C_6H_{12}O$

DNA

Amino acids

Proteins

Medicines

Plastics

Pesticides

Organic Chemicals in the Environment

- Thousands of different organic chemicals are synthesized each year for use as cosmetics, insecticides, detergents, and plastics
- Some of them are not adequately tested for toxicity before being put on the market
- Many of these chemicals persist in the environment for long periods of time

Persistent organic pollutants (POPs)

	Half-Life of Chemical		
Media	**Not Persistent**	**Persistent**	**Highly Persistent**
Water	< 2 months	≥ 2 months	> 6 months
Soil	< 2 months	≥ 2 months	> 6 months
Air	≤ 2 days		> 2 days
Sediment	< 2 months	≥ 2 months	> 6 months

Organic Chemicals in the Environment

Persistent organic pollutants (POPs)

- POPs can enter into water and food chains and can cause serious health and environmental problems
- POPs can go from one place to other via wind and water
- POPs generated in one country can affect the people and wildlife in other countries even though they are very far from each other
- Some POPs evaporate from water or land surfaces into the air, then return to Earth in snow, rain, or mist

Organic Chemicals in the Environment

Insecticides: Substances used to kill insects

Pesticides: Substances used to kill pests including weeds

Herbicides: Pesticide used to kill unwanted plants

Fungicides: Substances used to kill fungus

Approximately 80,000 synthetic chemicals are on the market today and most of them have never been tested for toxicity

Organic Chemicals in the Environment

- POPs contamination is also found in arctic regions, which are thousands of miles from anywhere the POPs are manufactured or used

Stockholm Convention

In 2001 **"dirty dozen" POPs**

- Out of 12 chemicals, 10 were intentionally produced by industry
- 9 were produced as **insecticides or fungicides**
- Two are are unintentionally produced in combustion processes