Emerging Pollutants

Introduction — In recent decades, the world has experienced adverse consequences of uncontrolled development of multiple human activities for example Industry, transport agriculture, and urbanisation. The increase in living standards and higher consumer demand have amplified pollution of the air with, for example Co_2 and other greenhouse gases Nox, So_2 and Particulate matter, of water with a variety of chemicals, nutrients leachates, oil spills, among others, and of the soil due to the disposde of hazardous wastes, spreading of pesticides, sludge as well as the use of disposable goods or non biodegradable materials and the lack of proper facilities for waste.

1) Emerging Pollutants (EPs) encompass a wide range of man made chemicals such as pesticides, cosmetics, personal and house hold care products, Pharmaceuticals etc)

2) It has been shown that between 1930 and 2000 global production of anthropogenic chemicals increased from 1 million to 400 millions tons/year.

4) It has been estimated that 70% of these chemicals ~~are~~ have a significant environmental impact.

5) Human activities has resulted in contamination of water resources with biological micropollutants such as viruses and bacteria having potential pathogenicity, biological micropollutants such as enteric bacteria, mycoplasmas, viruses and protozoa are the sources of many waterborne diseases and remain a major cause of death worldwide.

Emerging micro pollutants in the environment —

Many chemical and microbial agents that were not traditionally considered contaminants can be found in various environmental areas where they were never used, mainly due to their persistence during long distance travel, the sources and pathways of these emerging contaminants can be associated with waste and wastewaters resulting from industrial, agricultural or municipal activities.

Chemical micropollutants are often generated through degradation of organic compounds resulting in accumulation of persistent metabolites. Such as disposal of products related to pharmaceuticals in the environment. It is also related to the human demographic behaviours, changes in agricultural practices towards intensive farming and spreading of manure or sludge on agricultural fields may cause leaching to surface and groundwater, causing health problems.

Pesticides continue to be detected in surface and groundwater, although some of them are replaced by ecofriendly substitutes. pesticide metabolites in high concentration in water bodies causes toxic effects.

There are some categories of environmental contaminants, with certain chemical structure and properties which interferes with endogenous hormone systems. These contaminants are called endocrine disruptors many chemicals of personal care and household uses

Hormones, glucocorticoids analgesics such as ibuprofen estriol, additives in drugs and cosmetics such as Siloxanes and parabens, household cleaners have ~~exo~~ ecotoxicological effects. Other products like fire retardants, heavy metals (cadmium lead or mercury) industrial chemical (Bisphenol A) and some pesticides have known effect on natural endocrine system.

Sources

Industrial wastewater
Municipal (hospital, domestic, wastewaters) → Landfills
Crop / pest application
Leakage and emergencies

Categories
Industrial chemicals
Pesticides
Pharmaceuticals
Personal care products

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Receptors
Sludge
Surface water
Ground water
Soil
Sediments
~~Food~~ Food chain

Impact → chemical / biological agents which are hazardous or will become potentially dangerous in the future.
2) Ecological and health risk.
3) Pollution in water bodies and soil
4) Disruption in hormonal balance of body
5) Mixing of harmful ~~exo~~ eco toxic pharmaceutical in water bodies through human excreta and urine leading to a variety of problems in day to day life.

Treatment or Remedy —
1) Ionizing radiation — Decomposition and mineralization of antibiotics using gamma radiation

2) Membrane seperation, absorption and advanced oxidation for drinking water treatment and water reclamation for removal of emerging contaminants.

3) Photolysis / Photocatalysis - Direct Photolysis and photocatalyzed degradation process using titanium dioxide helps in decomposis and mineralization of antibiotics. The influence of operating conditions such as pH, temperature use of hydrogen Peroxide, Ozone dosage reactor setup helps in degradation of antibiotics. Implementation of treatment at point sources, such as hospitals and pharmaceutical companies can control its addition in water bodies.

4) Composting - Composing of micropollutants can also decrease their harmful effects

5) Enzymatic treatment - Auriol et al (2008) assessed the ability of two enzymes laccase plus oxygen and horseradish Peroxidase, plus hydroperoxide helps in reduction of estrogenic activity of synthetic and real waste water

6) RO → low pressure reverse osmosis helps in seperation of harmful chemicals of pharmaceutical mixed in water

Thus we can say that emerging pollutants includes Pharmaceuticals, Personal care products, endocrine disrupting chemicals which occurs in urban water cycle.

A research program is needed to combine the fate, bioavailability and ecotoxicological effect assessment of micropollutants in urban aquatic environment that supports environment friendly chemical design of these products.