Challenges of Plastic Degradation

Why in news?

Microplastics and nanoplastics are an emerging threat to cardiovascular health

How plastics are degraded?

- Plastics are everywhere, from our oceans to the air we breathe. They've infiltrated every corner of our planet due to their widespread use.
- Plastics can contaminate the environment through ocean currents, atmospheric winds, and terrestrial processes, leading to their widespread dispersion.
- Once released into nature, plastics undergo degradation, resulting in the formation of
    - Microplastics (particles smaller than 5 millimetres) and
    - Nanoplastics (particles smaller than 1,000 nanometres).
- **Process-**It can be categorized into photodegradation (UV light from the Sun), thermal degradation, chemical degradation, and biodegradation.
- Both microplastics and nano plastics (MNP) induce various toxic effects.

What are the challenges of MNP?

- **Detection**- MNPs range from visible particles to those on the nanoscale, making detection and quantification difficult.
- **Slow degradation-** MNPs persist in in the environment due to their slow degradation rates, thier long lasting presence poses risks to ecosystems and living organisms.
- **Diverse sources-** Both originate from various sources, including plastic waste, fragmentation of larger plastics and unintentional release during production and use.
- **Biological effects-** Both can harm etabolic, morphological, physiological, and behavioral processes in organisms, their impacts occurs at both cellular and ecosystem levels.
- **Lack of standardization-** Assessing the risks of NPs for human health is challenging due to the lack of a comprehensive framework.
- **Ecosystem disruption-** Accumulatio of MPs and NPs affect ecosytem

functions including nutrient cycling, food webs and biodiversity, their presence disrupts natural processes.

- **Lack of awareness-** Consumers may lack awareness of MNP-containing products and their potential health and environmental implications, highlighting the need for transparent labeling practices.

What are the impacts of MNP?

- **Ingestion by marine organisms-** MNP is ingested by a wide range of marine organisms, from tiny plankton to large fish and mammals.
- **Chemical toxicity-** It can adsorb and concentrate harmful chemicals from the water, such as pesticides, heavy metals, and persistent organic pollutants (POPs), which then can be ingested by marine organisms.
- **Biomagnification-** The accumulation of MNPs in smaller organisms can lead to biomagnification, where higher concentrations of MNPs and associated toxins are found in larger predators up the food chain, including humans.
- **Soil health-** It can alter soil structure and function, affecting water retention, nutrient availability, and soil microbial communities.
- **Wildlife exposure**- Terrestrial animals, including insects, birds, and mammals, can ingest MNPs through contaminated soil, water, and food sources, leading to similar health issues as observed in marine life.
- Human health- It can enter the human body via ingestion, inhalation, and skin contact which result in cardiovascular dysfunction, gut health issues, hormonal interference etc.,

What lies ahead?

- As plastics continue to infiltrate our environment, mitigating their impact on human health must become a top priority.
- Addressing the global challenge of MNPs requires international cooperation and coordination among governments, industry, academia, and civil society.
- Harmonizing standards, sharing data and best practices, and promoting collaboration are essential for effective MNP management.

Reference

Down To Earth- MNPs are emerging as a major threat to CVDs



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