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Persistent organic pollutants impact on environment and human health: A review

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Abstract
Organic compounds known as persistent organic pollutants (POPs) have a negative impact on the environment and human health all over the world. Most POPs produced in one nation can and do impact humans and wildlife far from where they are used and discharged because they can be transferred by wind and water. They can amass and spread from one species to the next through the food chain and last for a very long time in the environment. POPs numerous harmful health effects, including as endocrine disruption, immune system malfunction, neurological problems, and cancer, can be caused by exposure in people. In order to prevent the potential health impacts suggested by this article, suitable precautions should be taken when it comes to exposure to these contaminants.

Keywords: Organic pollutants impact, environment, human health

Introduction
Toxic compounds known as persistent organic pollutants (POPs) have a negative impact on both human and animal health as well as the ecosystem globally. They can amass and spread from one species to the next through the food chain and last for a very long time in the environment. Thousands of synthetic compounds were put into use in the commercial sector after World War II, which led to the widespread usage of several POPs in industrial production. Many of these chemicals are beneficial for industry, crop production, insect control, and the prevention of illness. However, these same compounds have had unanticipated consequences for both human health and the environment. Uncontrolled industrial waste discharge and the careless use of pesticides in agriculture have raised serious environmental issues. Persistent organic contaminants have spread to every aquatic ecosystem by surface runoff, river inputs, and atmospheric deposition and have gotten into the aquatic food chain (Bella *et al.* 2006) [2]. Fish and shellfish are examples of aquatic creatures that have the capacity to collect persistent residue concentrations that are several times greater than the surrounding water (Muralidharan *et al.* 2009) [8]. POPs usually mix with the sediment after entering the aquatic environment and are continuously recycled back into the water column. POPs in the water system may enter fish directly or by feeding, build up in the fatty tissues, and then become edible to humans (Campos *et al.* 2005) [5]. Some of the most well-known POPs, including PCBs, DDT, and dioxins, are well-known to a large number of individuals. POPs include a range of substances that include:

Types and classification of POPs
The Stockholm Convention on POPs, sometimes known as the "dirty dozen" or "legacy POPs," was accepted by legislators from 92 countries at the UNEP Stockholm Convention 2001 (Unep 2001) [13]. Its goal is to reduce and/or remove the release of 12 different POP chemicals. Although several other contaminants have been found, these particular 12 pose the biggest threat. Hexachlorobenzene (HCB), chlordane aldrin, endrin, DDT, dieldrin, heptachlor, mirex, toxaphene, and polychlorinated biphenyls (PCBs) are among the ten intentionally produced pollutants in the group. Polychlorinated dibenzo-p-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs), on the other hand (Ashraf *et al.* 2013). Persistent organic pollutants also include polycyclic aromatic hydrocarbons (PAHs), which are unintentionally created when organic pollutants are burned or combusted. Their existence is linked to human activity, and high-density industrial areas frequently have PAH pollution in river sediment. POPs can be categorised as being made purposefully or accidentally. Chemicals that are intentionally manufactured and are now or have previously been utilized in

manufacturing, industrial operations, disease control, or agriculture. Examples include PCBs, which have been helpful in many industrial applications (such as electrical transformers and large capacitors, as hydraulic and heat exchange fluids, and as additives to paints and lubricants), and DDT, which is still used in some developing countries to control the mosquitoes that spread malaria.

Unintentionally created compounds, including dioxins, that come from some industrial operations and combustion (such backyard burning of household and medical waste) burning of trash).

Sources of POPs

POPs are mostly produced by fire, which includes intentional, accidental, and natural burning of vegetation (Wong and Poon 2003) [14]. POPs are impossible to remove from any aspect of the environment. POPs are released into the atmosphere via a variety of industrial sources, including incinerators, power plants, and heating stations, as well as furnaces in homes, the volatilization of soil and water surfaces, the transfer of landfills, and the application of agricultural sprays. Unintentional generation from chemical facilities, incineration, other combustion processes like forest fires, and the decomposition of wastes containing PCBs are further sources of POP pollutants.

The production of cement, evaporation, the burning of animal remains, coal ignition, lixiviation of dumps and reprocessing operations, municipal incineration, therapeutic waste, organochlorine pesticide plants, industrial chlor-alkali plants, aluminium secondary plants, furnace and foundry operations, are just a few of the diverse activities that can result in this group of wastes (Thornton *et al.*, 2002) [12].

In addition to overflows from roads and fields and air deposition, waste waters from manufacturing plants or POP consumption are the source of elements, liquid fuels, oils, dirt, fats, silt, and ash in the aquatic environment. Seas and oceans are common places for POPs to gather via atmospheric deposition, river sediments, and unintentional dumping. They are deposited in sediments on the bottoms of huge lakes, seas, and oceans, where they can later be released and withdrawn into the atmosphere. (Galiulin and Galiulina 1997) [6].

Properties of POPs

Chemical behaviour in a specific context is influenced by the physical, chemical, and environmental characteristics. High toxicity, very low and high lipid solubility, and semi-volatility, which enables them to travel great distances in the atmosphere before being deposited, are the physico-chemical characteristics that allow the compounds to exist either in the vapour phase or be adsorbed by atmospheric particles (Berg *et al.*, 1998) [9]. The semi-volatility of POPs is another crucial characteristic. As a result of this feature, relatively large volumes can enter the atmosphere and travel across vast distances with a significant degree of mobility due to its moderate volatility, the material does not persist indefinitely in the atmosphere, where it would provide little direct damage to people and other living things. Therefore, these chemicals may evaporate from hot areas, but they will condense and have a tendency to stay in colder areas. A chemical with high lipophilicity will bioconcentrate from the surrounding media into the organism. Lipophilicity also leads to biomagnification across the food chain when combined with environmental persistence and a resistance to biological degradation. The top of the food chain species are exposed to substantially greater levels of radiation as a result of biomagnification.

Toxicity of POPs

POPs are a serious concern because to their frequency and severe toxicity in isolated geographic places. In recent years, hazardous ecological impacts of POPs have received the majority of scientific attention. Following recent studies, the majority of the countries restricted and outlawed the use of these POPs. In particular, they looked more closely at the hazardous effects of PCBs and (OCPs) in aquatic environments. Scientists have found a large number of organic compounds that pollute the aquatic environment. These organic contaminants have been present in the marine environment for many years since they are not biodegradable. These POPs are found in people as well as in animals and plants (Sweetman *et al.*, 2005) [11]. POPs became a public issue due to the hormonal disruptions they produce in people and their capacity to create aberrant endocrine and reproductive system functions in both humans and animals. Food and water pollutants should be removed from the atmosphere because they have been found to have a negative impact on the ecosystem. In humans and other animal species, these organic contaminants may cause cancer, birth deformities, learning difficulties, immunological, behavioural, neurological, and reproductive anomalies (Sweetman *et al.*, 2005) [11]. These dangerous compounds are also accumulated by food chain members like eagles, polar bears, killer whales, and humans. POPs are ingested by humans in large quantities, which can have harmful consequences on health. Numerous studies have shown that they can cause cancer, endocrine disruption, immunological and reproductive problems, as well as neurobehavioral disorders (Pauwels *et al.*, 2000; Katsoyiannis & Samara, 2005) [10, 15]. As a result of POP exposure, newborns and children experience immunosuppression, recurrent infections, developmental anomalies, neurobehavioral impairment, malignancy, and tumour induction or promotion. Only a few studies have shown that POPs can cause human breast cancer. These contaminants are pervasive in the aquatic environment and are heavily absorbed by aquatic species. Humans eat these aquatic species' contaminants through the food chain, storing them in their cells (Katsoyiannis & Samara, 2005) [15]. Children are found to be more vulnerable to the effects of pollutants than adults. These pollutants, particularly the persistent organic pollutants, have the potential to harm children's growing cells. A few research (Bouwman, 2003; Bolt & Degen, 2002) [3, 4] showed that those who were exposed to POPs as children had a lower IQ and were less able to block out distractions.

Conclusions

The POPs are distinguished by their persistence, semi-volatility, and lipophilicity. These qualities make these compounds more prone to long-range transit and long-term environmental persistence. Additionally, these compounds are known for their capacity to bioconcentrate and biomagnify in typical ambient settings, potentially leading to toxicologically significant concentrations. These compounds' semi-volatility makes it easier for them to be transported over great distances to the arctic and cooler parts of the planet, where there are no practical uses for them. A number of the compounds covered in this report have been linked to a variety of harmful impacts on human health and the environment, such as cancer, endocrine dysfunction, and problems with reproduction. In

many cases, the substances are considered as possible human carcinogens by the International Agency for Research on Cancer.

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