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# Persistent organic pollutants-its tale and fate in times of COVID -19

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## Abstract

Preserving the nature in its fullest beauty and purity is the ever faced challenges faced by the world. The developments which facilitate the improved life and betterment of society resulted in bringing up adverse effects on biota. This paper focuses on the Persistent Organic pollutants (POPs), its sources and adverse effect imposed by them on humans, plants and animals. In the context of COVID-19, the lock down also could not help in controlling the POPs released to the environment.

**Key words:** Pandemic, organic pollutants, Environment, Contaminants

## Introduction

COVID -19 Pandemic which has turned out to be the greatest global health crisis of our time is now the major challenge facing by the whole mankind all over the world. The World Health Organization, Government and health authorities has suggested to strictly follow precautionary measures to control the widespread of this pandemic. One among the major control measures that was implemented is lockdown so that social distancing is well achieved and worked out which helped to control the community transmission of the disease. In association with lock down humans get confined themselves within their homes, industries remained closed for long time, travel ban restricted vehicles over road and air, reduced waste disposal in water, landfills etc pollution in air, land and water were also drastically reduced. Thus pandemic has resulted in contrasting consequence on mankind, in the sense that, on one side it has executed world wide destruction of human lives and adversely affected the industry and economy but at the same time created a positive impact by providing signs of healing the nature <sup>1</sup>. But a still major

concern is the use of Persistent organic pollutants as disinfectants.

Persistent Organic Pollutants (POPs) are a group of toxic chemicals that are of global concern due to their potential for long range transport, persistence in the environment and possibility to bioaccumulate in fat tissues of humans and get biomagnified in food chains thus creating harm to the environment. As per mentioned in Tox Town reports "The Stockholm Convention on Persistent Organic Pollutants is an international treaty to protect human health and the environment from POPs. In 2001, it originally covered the 12 POPs of greatest concern, called the "dirty dozen or legacy POPs," aldrin, chlordane, DDT, dieldrin, dioxins, endrin, furans, heptachlor, hexachlorobenzene, mirex, PCBs, and toxaphene. Along with that 10 more organic pollutants were added in 2009 and 2012<sup>2</sup>. POPs are highly toxic even at low concentration as they resist photolytic, chemical and biological degradation <sup>3,4</sup>. Another 16 additional chemicals were added to the treaty in 2017". In this paper the main objective is to discuss about sources, types and impact of POPs in humans and environment in context of COVID -19.

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## 2. Sources of POPs

As reported by World Health Organization<sup>5</sup> “The most commonly encountered POPs are organo-chlorine pesticides, such as DDT, industrial chemicals, most notably polychlorinated biphenyls (PCB), as well as unintentional by-products of many industrial processes, especially polychlorinated dibenzo-p-dioxins (PCDD) and dibenzofurans (PCDF), commonly known as ‘dioxins’”. Persistent Organic Pollutants may enter the food-chain in variety of ways as intentional and unintentional products which are the consequences of human careless acts on disposing wastes (Fig 1).

But some POPs have been added to improve product characteristics or even to disinfecting agents to irradiate microorganisms. Although most developed nations have put restrictions upon the use of POPs in industrial products or in places of humanitarian concern, a great number of developing nations are still using it for agricultural purposes etc and have only fairly begun the initiatives to control its production and usage. POPs are generated during the incineration at industrial plants, household furnaces and combustion process such as forest fires, municipal waste incineration, the burning of animal remains, coal ignition etc<sup>6,7</sup>. It is common practice nowadays to use waste incinerators in most institutions especially in context of COVID -19 pandemic. As the wastes include mix of hazardous substances including plastics, the incineration will evolve annex A POPs to a certain extent. Hence recycling of materials is

in general to be preferred over incineration with energy recovery.

## 3. Intentionally produced POPs

Intentionally produced POPs include Chemicals produced in industries and Chlorine containing pesticides. The core 10 intentionally produced pollutants identified are: aldrin, endrin, chlordane, DDT, dieldrin, heptachlor, mirex, toxaphene, hexachlorobenzene (HCB), and polychlorinated biphenyls (PCBs). Dairy products and animal meat serves as the major source of Aldrin. Studies in India indicate that a person intake daily an average of 19 micrograms of Aldrin. In the case of Chlordane which is carcinogenic in nature humans were affected normally when exposed to air and may affect the human immune system. DDT was widely used against diseases spread by insects. DDT continued to be used to control disease, and it was sprayed on a variety of agricultural crops. Dieldrin another intentionally produced pollutant is highly toxic to fish and other aquatic animals, particularly frogs even with exposure to low levels. These POP residues have been found in air, water, soil, fish, birds, and mammals, including humans.

The primary source of exposure to the general population happens through intake of food and other dairy and agricultural products. “For example, dieldrin was the second most common pesticide detected in a US survey of pasteurized milk.” This insecticide is sprayed on the leaves of crops



Fig 1: Waste Disposal –a major source of POPs

to prevent pests. Heptachlor is also considered as a possible human carcinogen. Most other POPs are toxic to plants, aquatic animals and humans<sup>8</sup>.

#### 4. Unintentionally produced POPs

Polycyclic aromatic hydrocarbons (PAHs), part of polychlorinated biphenyls, polychlorinated dibenzofurans (PCDFs) and polychlorinated dibenzo-p-dioxins (PCDDs) are categorized as unintentionally generated persistent organic pollutants<sup>9</sup>. Along with that combustion and burning of organic contaminants, plastics etc creates dioxins unintentionally. Their existence is associated with man-made activities and is common in high-density industrial zones. These POPs accumulate in the food chain due to their high lipophilicity, high stability and lower vapor pressure. They are not easily metabolized and hence cause bioaccumulation in humans and animals<sup>10</sup>. It will cause cancer, birth defects, induce genetic damage, cause miscarriage, or otherwise interfere with the reproductive process. These groups of highly hazardous chemicals persist for long time when released into the environmental media and may cause a real threat to man and the environment. These persistent organic pollutants (POPs) are controlled by international conventions and agreements such as Stockholm, Basil, and Rotterdam.

##### 4.1 Polychlorinated dibenzo-p-dioxins (PCDD)

These chemicals are released accidentally because of incomplete combustion and thermal method involving Chlorine and organic matter furthermore during the manufacture of pesticides and chlorinated substances for terminating pests in agricultural fields. PCDD are also released as a results of bound activities that involves burning of hospital, municipal and waste material waste that are currently at peak level within the context of dumping materials used by people infected by COVID-19 at hospitals and during quarantine period. In addition to that industrial activities like cement kilns firing dangerous waste, production of chemicals generating elemental Chlorine, thermal process in metallurgical industry etc additionally causes

hefty environmental pollution by the emission of POPs collectively in between the processes. In addition to the emission from vehicles and automobiles, burning of landfill sites, firing of fossil fuels, wood, other biomass and industrial boilers<sup>11</sup> also contribute in generating POPs.

##### 4.2 Polychlorinated dibenzofurans (PCDF)

Furans being structurally similar to dioxins possess many toxic features in common. Like dioxins they are also carcinogenic and get retained in environment for prolonged period without any degradation causing harmful effects in biota. In most cases these compounds are produced unintentionally conjointly from many of the same processes that produce dioxins, and also during the production of PCBs. Furans have also been detected in infants born to women who had been exposed to PCBs. Low birth weight was also reported for infants of POP affected mothers<sup>12</sup>.

#### 5. Impact of POPs on health and environment

POPs have stable structure and hence can persist in the environment for decades. It is highly toxic to animals and humans and causes illness by inhalation, contact through skin and intake of food contaminated by those disinfectants, drinking water where waste from industries has been polluted by POPs. Long term exposure of these contaminants may impart harmful effects on respiratory system, immune system, neurological system, reproductive system etc<sup>13,14</sup>. Thus the POPs are really silent killers which imposes adverse affects on society, wild life and plants. Similar to the case with many environmental pollutants, it is very difficult to establish that a specific symptoms or illness is attributed to any specific POPs. They enter into cyclic in nature, accumulating in the bigger animals as they consume smaller ones and get into the food chain<sup>15</sup>.

Marine mammals are greatly affected and increased mortality is reported to be due to immune dysfunction. In plants effects include disruption of photosynthesis in microscopic plants. "The toddler spends much time on the floor may

be exposed to contaminated soil thorough skin or because of ingestion”<sup>16</sup>. Epidemiologic studies and reports show a trend towards increased risk of hormone-related cancers (e.g. breast, prostate, testicular). Some POPs are considered as Endocrine disrupting chemicals which interfere with the endocrine system. Thus it is difficult to distinguish between the direct and indirect effects of POPs and its impact on living and non-living things <sup>17,18</sup>. Because of the increasing risk of community spread due to corona virus ,infectious clinical waste are disposed after one time use and are incinerated. The studies showed that it is better to avoid deposition of persistant organic pollutants in landfills and measures have to be taken to reduce the evolution of POPs from incinerators<sup>19</sup> by gas cleaning technologies.

## 6. Conclusion

Persistent organic pollutants put their footprints in air, water, soil and biota in the industrialized

and non industrialized regions. Due to the adverse effects posed by POPs, their production and usage has been banned by various nations. But due to the lack of alternative substitutes some farmers are forced to use it even nowadays to prevent their crops from pests. Due to lock down even though the nature get purified the hospital waste and urban waste got dumped ever increasingly than before which proportionally boosted up POP concentration in air soil and water. COVID-19 resulted in creating negative impact by increasing the percentage of POPs generation. Thus POPs continues to contaminate the environment and threaten human health. Let us hope that studies will pave way to irradiate use of POPs and could replace materials that generate POPs with other harmless substitutes through the process of bioremediation. This can offer a green technology solution to the problem of environmental pollution.

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