

Chlorofluorocarbons and its Effect on Ozone Layer and Ultimately on Human Health

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Abstract

At the University of California, Irvine, F. Sherwood Ronald and Mario J. Molina discovered that chlorofluorocarbons (CFCs) could deplete earth atmospheric ozone layer; the layer which blocks sun ultraviolet damaging rays. When the scientist reported their findings in 1974, CFCs were in a wide use in refrigeration, air conditioning and aerosol spray cans. CFCs are group of colorless, non-combustible and high volatile liquids also known as ferons. Because they are highly volatile substances, they can easily release into the air during production and use. The chemical breakdown of CFCs in the stratosphere release Cl and Br atoms that destroy ozone molecules in catalytic cycles. Due to ozone layer destruction, the damaging Ultraviolet rays of sun pass through it and may be cause serious problems such as sun burn, skin damaging, skin cataracts, DNA damage and lungs diseases, effect on food shortage in human population, effect on human immunity and skin cancer in human. We should decrease the use of CFCs or replace its use by use of hydrochlorofluorocarbons (HCFCs) and hydrofluorocarbons (HFCs) which decrease ozone layer with much lesser extent than CFCs.

Keywords: Hydrochlorofluorocarbons; Stratosphere; Ozone layer

Introduction

CFCs

Chlorofluorocarbons or CFCs also called ferons are non-dangerous, non-combustible, and non-cancer-causing. They essentially contain fluorine particles, carbon molecules, and chlorine atoms. The five primary CFCs are: CFC-11(trichlorofluoromethane- CFCl_3), CFC-12(dichloro-difluoroethane- $\text{C}_2\text{F}_2\text{Cl}_2$), CFC-113(trichlorotrifluoroethane- $\text{C}_2\text{F}_3\text{Cl}_3$), CFC-114(dichloro-tetrafluoroethane- $\text{C}_2\text{F}_4\text{Cl}_2$) and CFC-115(choropentafluoroethane- $\text{C}_2\text{F}_5\text{Cl}$) [1]. The lifetime of CFCs in the climate is around 20 to 100 years [2].

Uses of CFCs

Because of its unique attributes, for example, non-combustible and non-lethality, CFCs have extraordinary significance. Its creation and use are progressively normal especially in created nations, after the 1960's. The present day way of life has been made conceivable by the utilization of CFCs. The most well-known uses of CFCs are: refrigerants for refrigerators, automobiles and air-conditioners, cleaning agents for semiconductors and precision parts, foaming agents for insulating materials and packing cushions and propellant for aerosols sprays [3,4].

Emission of CFCs in atmosphere

CFC are extremely volatile substances means they can easily evaporate and poorly soluble in water. During production and its use they evaporate in air. CFCs released to surface water will be evaporating within a few days. Because CFCs are not bond strongly to soil, they can easily leach to ground water. CFCs degrade slowly in ground water [5].

Depletion of ozone layer

Ozone is available in stratosphere in the locale of air from 6 to 31 miles. Ozone assimilates conceivably harming bright (UV) radiations [6,7]. The thickness of ozone layer changes among elevation and occasional variation [8,9]. Most of the ozone is framed at equator where there is greatest daylight however with wind it moves at high height and get gathered at stratosphere [10]. Ozone depletion is influencing the human wellbeing and condition adversely, as it enables the infiltration of UV radiations to arrive at the Earth. These radiations can cause

extreme maladies in people, for example, skin disease, eye harm and hereditary transformations and so forth [11,12]. Moreover, the ozone exhaustion is influencing the oceanic life, biogeochemical cycles, air quality and furthermore contributing in An Earth-wide temperature boost yet in this review paper our primary spotlight is on the impacts of ozone consumption on human wellbeing [13].

Sunburn

Unreasonable presentation to UVR may cause burn from the sun also called erythema. It might be mellow or extreme. If you had severe sunburn, you'll remember it for lifetime. Its causes are marked by bright pink or scarlet- colored skin, swelling, blistering and pain. An extremely severe cause nausea, fever or chills and tachycardia. Sunburn also causes dehydration due to loss of water from skin [14].

Effect on skin

Presentation to UV radiations can cause skin malignant growth. UV radiations adjust the structure of biomolecules and in this manner lead to various infections [15-18] Skin is the frequently uncovered piece of body to UV radiations there are two kinds of skin malignant growth, Melanoma and Non-melanoma. Melanoma is most genuine type of malignancy and is frequently deadly, while non-melanoma is most regular sort and less lethal. Exhaustion of ozone layer prompts both Sun consume and skin malignant growth [19]. UV radiations are additionally liable for bosom malignant growth and leukemia [20]. Epidemiological investigations of Melanoma show that the rate of melanoma is expanding in those nations having high proportion of cases [21,22]. As UV radiations can enter, the more effectively in

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slight skin so there is more noteworthy number of rates is found in touchy individuals. It is discovered that the rate of Melanoma is more in kids than grown-ups. The possibility of frequency of melanoma is corresponded with UV introduction besides the endurance possibility of melanoma is less in young men when contrasted with young ladies [23]. As the power of radiation increments in summer so the danger of melanoma in touchy individuals is expanded in summer and it is more in females when contrasted with guys as their skin is more slender than guys [24,25]. There is extensive connection between melanoma hazard and irregular sun introduction and burn from the sun history [26]. There is likewise an immediate connection between air voyaging and melanoma occurrence [27]. Anyway, the examinations uncovered that hereditary variables contribute more for having melanoma ailment than conduct angles [28]. The epidemiological investigations of non-melanoma skin carcinoma (NMSC) shows that its hazard is more in youthful females in lower appendages [29,30] and sunbathing builds its hazard multiple times in trunk locale.

Cataracts

The major cause of blindness in this world is cataracts. There would be 0.3% - 0.6% increase in risk of cataract if there will be 1% decrease in Ozone level [United Nations environment programme, 1994]. Eye lens can be damaged by oxidative agents. Oxidative oxygen produced by UV radiation can severely damage eye lens and cornea of eye is also badly damaged by UV radiation [31,32]. Photokeratitis, cataract, blindness all are caused due to UV rays [33].

Effect on human immunity

Exposure to UV radiations can likewise bring about concealment of resistant reaction to skin malignant growth, irresistible sicknesses and different antigens [34]. The resistant framework concealment is because of changes in skin photoreceptors and antigen displaying cells that are brought by UV radiations [United Countries Condition Program, 2006]. More increment in consumption of ozone brings about more reduction in invulnerable framework [35].

Effect of food shortage on human population

Consumption of ozone layer is likewise making the issue of nourishment lack people. UV radiations are upsetting formative and physiological procedures which is diminishing the efficiency of yields. As people are intensely reliant on crops for nourishment so there is an extraordinary possibility if exhaustion of ozone layer isn't checked it might cause genuinely deficiency of nourishment to people [36]. Investigates likewise show that UV radiations can likewise be utilized to upgrade yield of harvests by the utilization and use of phytohormones.

DNA damage and lung diseases

Short introduction to UV-B radiations can cause the DNA harm since UV radiations can upset biomolecules, for example, lipids, proteins and nucleic acids. Because of UV-B radiations there would be secretive transposable components which may lead towards the transformations which is more perilous than the prompt DNA harm [37]. Over the top UV-B radiation presentation results in the basal and squamous cells carcinomas. These sorts of tumors are actuated due to transcriptional mistakes during DNA replication which are brought about by changes in pyrimidine bases. A definitive reason for this entire instrument is seen as the delayed introduction to UV radiations. It is evaluated that there is increment of 2% of occurrence of these diseases by 1% consumption of ozone layer. Introduction to UV radiations similarly influences lungs. Bronchitis, deterrent of lungs, Emphysema, asthma all can be come about because of UV radiations presentation.

Measuring stratospheric ozone

Ozone in the stratosphere can be estimated by using instruments on aircrafts, rockets, and—particularly balloons. Most generally utilized instruments are Dobson spectrophotometer, Brewer ozonomete and sensors on satellite.

Stratospheric ozone cycles

Superimposed on the everyday ozone cycle close to the ground are seasonal changes in the measure of stratospheric ozone. In the northern side of the equator, the aggregate sum of ozone is most minimal during winter. The measure of ozone starts to rise quickly during spring and bit by bit decreases in the midyear and fall. This slow seasonal variety in ozone is set apart by sharp spikes and plunges related with climate frameworks [37].

Ozone hole

Ozone hole is made in the areas where ozone layer has been exhausted. The expression “Ozone hole” is applied when the exhaustion level is beneath 200 Dobson Unit (D.U). Ozone gaps are first found in Antarctica in 1970. Scarcely any years back ozone holes are likewise found in ice area. Since 2000 pace of ozone consumption is expanding 0.5 percent every year [38]. Because of consumption of Ozone UV beams are infiltrating in troposphere and prompting more ozone arrangement in troposphere which is causing harmful consequences for our wellbeing as ozone is dangerous for our body [39].

Actions

The impact of CFCs emanation is all around the globe independent to where it produces. In 1987, 56 nations concurred under what becomes Montreal Convention to slice CFCs creations and use down the middle. In consequent years, the convention was reinforced to require an inevitable overall eliminate of the generation of CFCs and other ozone draining synthetics [40]. While trying to give substitutes having execution properties like those of CFCs just as low toxicities, industry has been concentrating on the advancement and evaluation of hydrochlorofluorocarbons (HCFCs) and hydrofluorocarbons (HFCs). HCFCs have a lot of diminished ozone consumption possibilities (ODPs), and HFCs have zero (ODP) contrasted with CFCs. Protection and nonfluorine-containing substitutions are expected to lessen utilization in the coming years, however certain applications will require the utilization of HCFCs and HFCs. The HCFCs would serve incidentally until reasonable HFC substitutes are distinguished.

Conclusion and Recommendations

Ozone layer is constantly draining which is profoundly disturbing circumstance of today. Chlorofluorocarbons are significant reason for ozone consumption. These substances ought to be prohibited or we should utilize their other options so that in future we can shield ourselves from the destructive impacts of UV radiation. We should buy air-conditioning and refrigeration equipment that do not use HCFCs as refrigerant. We should buy aerosol products that do not use HCFCs or CFCs as propellants. We should conduct regular inspection and maintenance of air-conditioning and refrigeration appliances to prevent and minimize refrigerant leakage. For existing air-conditioning and refrigeration appliances that operate on HCFCs or CFCs, the refrigerant should be recovered or recycled whenever an overhaul of equipment is to be carried out. Replacing or retrofitting such equipment to operate on non-HCFCs refrigerant should also be considered. When motor vehicle air-conditioners need servicing, make

sure that the refrigerants are properly recovered and recycled instead of being vented to the atmosphere. Human eye and skin are the most uncovered piece of the body to these radiations. So, there is high level of frequency of visual deficiency and skin malignancy ailment expanding step by step with the exhaustion of ozone layer, so we should utilize shades and full body garments particularly in summer when there is high force of daylight, so we can shield our body from destructive UV radiations.

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