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Soil pollution is the reduction in the productivity of soil due to the presence of soil pollutants. Soil pollutants have an adverse effect on the physical chemical and biological properties of the soil and reduce its productivity. Pesticides, fertilizers, organic manure, chemicals, radioactive wastes, discarded food, clothes, leather goods, plastics, paper, bottles, tins-cans and carcasses- all contribute towards causing soil pollution. Chemicals like iron lead mercury, copper, zinc, cadmium, aluminium, cyanides, acids and alkalies etc. are present in industrial wastes and reach the soil either directly with water or indirectly through air. (e.g. through acid rain).

The improper and continuous use of herbicides, pesticides and fungicides to protect the crops from pests, fungi etc. alter the basic composition of the soils and make the soil toxic for plant growth. Organic insecticides like DDT, aldrin, benzene hex chloride etc. are used against soil borne pests. They accumulate in the soil as they degrade very slowly by soil and water bacteria. Consequently, they have a very deleterious effect on the plant growth stunting their growth and reducing the yield and size of fruit. Their degradation products may be absorbed by the plants from where they reach the animals and man through the food chains.

Radioactive wastes from mining and nuclear processes may reach the soil via water or as ‘fall-out’. From the soil they reach the plants and then into the grazing animals (livestock) from where ultimately reach man through milk and meat etc. resulting in retarded and abnormal growth of man. Human and animal excreta used as organic manure to promote crop yield,

pollute the soil by contaminating the soil and vegetable crops with the pathogens that may be present in the excreta. Nitrification, which is the process of forming soluble nitrates from the elemental atmospheric nitrogen or from originally harmless organic materials actually contribute towards water pollution when the nitrates leach out of the soil and accumulate to toxic levels in the water supply. Therefore, intensification of agricultural production by practices of irrigation (causes salination), excessive fertilisers, pesticides, insecticides etc. have created the problems of soil pollution.

Soil pollution can be checked by restricting the use of soil pollutants, resorting to organic farming, adopting better agriculture practices etc. Soil pollution comprises the pollution of soils with materials, mostly chemicals that are out of place or are present at concentrations higher than normal which may have adverse effects on humans or other organisms. It is difficult to define soil pollution exactly because different opinions exist on how to characterize a pollutant; while some consider the use of pesticides acceptable if their effect does not exceed the intended result, others do not consider any use of pesticides or even chemical fertilizers acceptable. However, soil pollution is also caused by means other than the direct addition of xenobiotic.

The most common decontamination method for polluted soils is to remove the soil and deposit it in landfills or to incinerate it. These methods, however, often exchange one problem for another: landfilling merely confines the polluted soil while doing little to decontaminate it, and incineration removes toxic organic chemicals from the soil, but subsequently releases them into the air, in the process causing air pollution. For the removal and recovery of heavy metals various soil washing techniques have been developed including physical methods, such as attrition scrubbing and wet-screening, and chemical methods consisting of treatments with organic and inorganic acids, bases, salts and chelating agents. For example, chemicals used to extract radionuclides and toxic metals include hydrochloric, nitric, phosphoric and citric acids, sodium carbonate and sodium hydroxide and the chelating agents EDTA and DTPA. The problem with these methods, however, is again that they generate secondary waste products that may require additional hazardous waste treatments.

A number of environmental, chemical, and management factors affect the biodegradation of soil pollutants, including moisture content, pH, temperature, the microbial community that is present, and the availability of nutrients. Biodegradation is facilitated by aerobic soil conditions and soil pH in the neutral range (between pH 5.5 to 8.0), with an

optimum reading occurring at approximately pH 7, and a temperature in the range of 20 to 30°C. These physical parameters can be influenced, thereby promoting the microorganisms' ability to degrade chemical contaminants. Of all the decontamination methods bioremediation appears to be the least damaging and most environmentally acceptable technique. The upper layer of the unsaturated zone of earth is the soil.

Soil is the natural body made of mineral and organic constituents. It is produced by solid material recycling and complex processes of solid crust modifications. Soil offers shelter, habitat for numerous organisms and is the living medium for plants. Soil is the basis for agriculture. All vegetation for human food and animal feed depends upon soil. Enormous quantities of waste from manmade products are being released into the soil causing soil pollution. Polluted water also causes soil pollution. Soil pollution is caused due to unhygienic habits, agricultural practices and inappropriate methods of disposal of solid and liquid wastes.

Soil pollution is also caused as a result of atmospheric pollution. In industrialized countries, soil pollution is a result of use of chemicals in agriculture, dumping of waste materials, mining, smelting of metals and also dumping of domestic refuse and solids, untreated sewage and industrial wastes.

Types of Soil Pollution

Soil pollution may be any chemicals or contaminants that harm living organisms. Pollutants decrease soil quality and also disturb the soil's natural composition and also lead to erosion of soil. Types of soil pollution can be distinguished by the source of the contaminant and its effects of the ecosystem. Types of soil pollution may be agricultural pollution, Industrial wastes and urban activities.

Agricultural Pollution

• Agricultural processes contribute to soil pollution. • Fertilizers increase crop yield and also cause pollution that impacts soil quality. • Pesticides also harm plants and animals by contaminating the soil. • These chemicals get deep inside the soil and poison the ground water system. • Runoff of these chemicals by rain and irrigation also contaminate the local water system and is deposited at other locations.

Industrial Waste

• About 90% of oil pollution is caused by industrial waste products. • Improper disposal of waste contaminates the soil with harmful chemicals. • These pollutants affect plant and animal species and local water supplies and drinking water. • Toxic fumes from the regulated landfills contain chemicals that can fall back to the earth in the form of acid rain and can damage the soil profile

Urban Activities

• Human activities can lead to soil pollution directly and indirectly. • Improper drainage and increase run-off contaminate the nearby land areas or streams. • Improper disposal of trash breaks down into the soil and it deposits in a number of chemical and pollutants into the soil. These may again seep into groundwater or wash away in local water system. • Excess waste deposition increases the presence of bacteria in the soil. • Decomposition by bacteria generates methane gas contributing to global warming and poor air quality. It also creates foul odours and can impact quality of life.

Causes of Soil Pollution

Soil Pollution is a result of many activities by mankind which contaminate the soil. Soil pollution is often associated with indiscriminate use of farming chemicals, such as pesticides, fertilizers, etc. Pesticides applied to plants can also leak into the ground, leaving long-lasting effects. In turn, some of the harmful chemicals found in the fertilizers (e.g. cadmium) may accumulate above their toxic levels, ironically leading to the poisoning of crops. Heavy metals can enter the soil through the use of polluted water in watering crops, or through the use of mineral fertilizers. Faulty landfills, bursting of underground bins and seepage from faulty sewage systems could cause the leakage of toxins into the surrounding soil. Acid rains caused by industrial fumes mixing in rain falls on the land, and could dissolve away some of the important nutrients found in soil, as such change the structure of the soil.

Industrial wastes are one of the biggest soil-pollution factors. Iron, steel, power and chemical manufacturing plants which irresponsibly use the Earth as a dumping ground often leave behind lasting effects for years to come. Fuel leakages from automobiles, which get washed by rain, can seep into the nearby soil, polluting it. Deforestation is a major cause for soil erosion, where soil particles are dislodged and carried away by water or wind. As a result, the soil loses it structure as well as important nutrients found in the soil. Some the causes of soil pollution can be as follows:

• Industrial effluents like harmful gases and chemicals. • Use of chemicals in agriculture like pesticides, fertilizers and insecticides. • Improper or ineffective soil management system. • Unfavourable irrigation practices. • Improper management and maintenance of septic system. • Sanitary waste leakage. • Toxic fumes from industries get mixed with rains causing acid rains. • Leakages of fuel from automobiles are washed off due to rains and are deposited in the nearby soil. • Unhealthy waste management techniques release sewage into dumping grounds and nearby water bodies. • Use of pesticides in agriculture retains chemicals in the environment for a long time. These chemicals also effect beneficial organisms like earthworm in the soil and lead to poor soil quality. • Absence of proper garbage disposal system leads to scattered garbage in the soil.

Effects of soil pollution

The main reason for soil contamination is due to the presence of anthropogenic activities. These waste products are made of chemicals that are not originally found in nature and hence lead to soil pollution. Soil pollution is typically caused by industrial activity, chemicals used in agriculture and improper disposal of waste. Soil contamination leads to health risks due to direct and indirect contact with contaminated soil. Soil pollution causes huge disturbances in the ecological balance and the health of the organisms is under risk. The effects of pollution on soil are quite disturbing and can result in huge disturbances in the ecological balance and health of living beings on earth. Normally crops cannot grow and flourish in a polluted soil. However, if some crops manage to grow, then these crops might have absorbed the toxic chemicals in the soil and might cause serious health problems in people consuming them. Sometimes the soil pollution is in the form of increased salinity of the soil.

Long term effects of soil pollution

The long-term effects of soil pollution are many and can be difficult to deal with, depending on the nature of the contamination. How Soil Gets Polluted Soil is a sort of ecosystem unto itself, and it is relatively sensitive to foreign matter being applied to it. That's good for us in the case of wanting to add soil amendments, fertilizer and compost to make the soil healthier, but not so good when it comes to soil pollution.

There are many different ways that soil can become polluted, such as:

• Seepage from a landfill • Discharge of industrial waste into the soil • Percolation of contaminated water into the soil • Rupture of underground storage tanks • Excess application of pesticides, herbicides or fertilizer • Solid waste seepage

The most common chemicals involved in causing soil pollution are: • Petroleum hydrocarbons • Heavy metals • Pesticides • Solvents

Control of soil Pollution

A number of ways have been suggested to curb the pollution rate. Attempts to clean up the environment require plenty of time and resources. Some the steps to reduce soil pollution are:

• Ban on use of plastic bags below 20 microns thickness. • Recycling of plastic wastes. • Ban on deforestation. • Encouraging plantation programmes. • Encouraging social and agro forestry programmes. • Undertaking awareness programmes. • Reducing the use of chemical fertilizer and pesticides. • Recycling paper, plastics and other materials. • Ban on use of plastic bags, which are a major cause of pollution. • Reusing materials. • Avoiding deforestation and promoting forestation. • Suitable and safe disposal of including nuclear wastes. • Chemical fertilizers and pesticides should be replaced by organic fertilizers and pesticides. • Encouraging social and agro forestry programs. • Undertaking many pollution awareness programs.

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