Soil Pollution in India: Causes, Effects and Solution

Dr.Kuldeep Kumar[1] , Dr.Dinesh Kumar[2]

[12]University College of Agriculture
[12]Guru Kashi University, Talwandi Sabo

ABSTRACT

The presence of xenobiotic (human-made) compounds or other changes in the natural soil environment produce soil pollution. Soil contamination is defined as the unfavourable change of soil by the addition or removal of chemicals and variables that reduce soil productivity, plant quality, and groundwater quality. Pesticides, herbicides, and fumigants, as well as chemical fertilisers and air pollutants brought down from the atmosphere by rain, all contribute to soil contamination. It decreases soil fertility, nitrogen fixation, erodibility, soil fauna and flora imbalance, ecological imbalance, pollutant gas emission, increased salinity, drain obstruction, public health issues, and contamination of drinking water sources. In addition, the pollutants will alter the composition of the soil as well as the sorts of microorganisms that reside there. If certain organisms die off in the area, the larger predator animals will also have to move away or die because they've lost their food supply. soil pollution can be cured by recycling, reforesting and solid waste management.

Keywords: Soil pollution, Pesticides, Ecological Imbalance, Reforesting, Recycling

I. INTRODUCTION

In our ordinary and day-to-day lives, the word pollution has become a common occurrence. This phrase has been ingrained in our lives, not just in schools and colleges, but also in newspapers and magazines, which are awash in stories about environmental contamination. So it becomes mandatory to know what exactly is it? Pollution occurs when pollutants from various sources contaminate our natural surroundings, thereby, affecting our normal lifestyles adversely due to the changes which these pollutants bring. So these pollutants are the key elements of pollution which are found as waste material of different forms. This pollution causes an imbalance in our environment and ecosystem, which is our most important life support system. Modernization and development, which were formerly seen as boons to contemporary civilization, have now become a chronic affliction for the modern man. Along with progress, pollution has infiltrated our lives, bringing with it global warming and a slew of human diseases.

Pollution has many forms and may arise in a variety of ways. Some of these are - air, water, soil, radioactive, noise, heat/ thermal and light. There are two types of pollution sources: point sources and non-point sources. It is easy to identify, monitor and control the point source,whereas, the non point sources are always hard to control. The current article will go over the causes of soil contamination, as well as the harmful impacts it has and the methods that may be used to avoid it.

II. SOIL POLLUTION

Soil pollution as found by Wikipedia is caused by the presence of xenobiotic (human-made) chemicals or other alteration in the natural soil environment. Soil contamination is defined as an unfavourable change in soil caused by the addition or removal of chemicals and variables that reduce soil productivity, plant quality, and groundwater.

Various industrial operations, chemicals used in agricultural activities, or inappropriate waste disposal are the most common causes. Petroleum hydrocarbons, polynuclear aromatic hydrocarbons (such as naphthalene and benzo (a) (Pyrene), solvents, insecticides, lead, and other heavy metals are the most prevalent and harmful compounds utilised. Contamination is correlated with the degree to which industrializationtakes place and the intensity to which chemicals are used.

Negative Soil Pollution

Overuse of soil and erosion are examples of negative soil pollution. The two variables that cause soil erosion are water and air. Water erosion takes place near the hills where high speed rivulets and flood removes and washes away the top soil. High-speed winds can also cause soil erosion by transporting sand particles from a parched

desert. Fertile land is also being converted into barren areas by unplanned urbanization, building of road, houses or industrial complexes. Rubbish, empty cans, rubbish, broken furniture, empty bottles, building material, sludge, ash, and other waste are thrown on open grounds outside of settlements, making the surrounding lands desolate as well. It's also known as "third pollution" or "landscape pollution."

Positive Soil Pollution

It is pollution caused by (i) pesticides, herbicides, and fumigants (ii) chemical fertilizers and

(iii) Air pollutants washed down from atmosphere through rain.

Agricultural Practices

To a considerable extent, modern farming techniques contaminate the land. Huge amounts of fertilisers, insecticides, herbicides, and weedicides are applied to boost crop yields as agro-technology advances. Apart from these farm wastes, soil contamination is said to be caused by manure, slurry, debris, and soil erosion containing predominantly inorganic compounds. Some of these practises must be addressed in further depth.

Pesticides and Weedicides

A number of chemicals have been developed to kill insects (insecticides), fungi (fungicides), algal blooms (algaecides), rodents (rodenticides), weeds (weedicides or herbicides) in order to improve agriculture, forestry, horticulture and water reservoirs. Insecticides are the most extensively utilised of them. The majority of these insecticides or pesticides are broad-spectrum, which means they may harm other animals, humans, and even plants. They are, hence, also called biocides.

(i) Chlorinated Hydrocarbons

DDT, DDE, Chlordane, Aldrin, Dieldrin, Endrin, Heptachlor, BHC (benzene hexa-chloride), and other pesticides are among them. Chlorinated hydrocarbons are extremely dangerous. When swallowed, dieldrin is 5 times more toxic than DDT, and when absorbed, it is 40 times more lethal. Among the chlorinated hydrocarbons, Endriri is the most poisonous. These herbicides are persistent and mobile in the environment, in addition to being poisonous (over dust particles- in air, over organic matter in water). Because chlorinated hydrocarbons are fat soluble, they tend to build up inside living organisms.

Due to the phenomena of biological amplification, their concentration per unit weight of the organisms increases as the tropic level rises. DDT and other chlorinated hydrocarbons impact the central nervous system, causing brain softness, cerebral haemorrhage, liver cirrhosis, hypertension, cancer, thinning of egg shells in birds, and sex hormone abnormality, among other things. As a result, ecological amplification of chlorohydrocarbons is lethal to higher trophic level species, particularly fish and birds.

Excessive usage of harsh biocides can lead to a prey-predator population imbalance. Due to DDT usage, the population of the predator Lady Bird beetle (Novius cardinalis) in Australia has decreased while that of its victim, the scale insect (kerya purchasi), has grown (Rudd, 1971). Only after the DDT spraying was discontinued was the equilibrium restored. DDT has an effect on plant photosynthetic activity, particularly in phytoplankton.

(ii) Organo-Pesticides

Malathion, parathion, diazonin, triothin, ethion, tetraethyl pyrophosphate or TEPP are examples of organophosphorus compounds, as are carbamates. Organo-pesticides are biodegradable, but because they are dangerous, they cause perspiration, salivation, nausea, vomiting, diarrhoea, and muscle tremors in those who handle them.

(iii) Inorganic Pesticides

Arsenic and sulphur are commonly found in insecticides. Because pesticides are persistent, their continuing use is toxic to both plants and animals.

(iv) Weedicides (Herbicides)

The chemicals are used for weed control in agriculture, horticulture, and forest management, as well as removing areas of woods for new residential or industrial colonies, highways, rail-roads, and weed control in agriculture, horticulture, and forest management. Weedicides and herbicides are metabolic inhibitors that prevent photosynthesis and other metabolic functions in plants, killing them. Some weedicides kill plants by causing phloem cell multiplication, preventing organic food from being transported. Weedicides were used to manage weeds near the Aswan Dam in Egypt. It had an impact not only on the agricultural areas that were watered by that water, but also on marine fish productivity in the sea where it was discharged. The phenomena

of substances or activities causing negative ecological repercussions in the future is known as ecological boomerang or blowback.

III. URBAN WASTES

Commercial and domestic wastes, such as dry sludge and sewage, are included in urban wastes. Refuse is the general term for all urban solid wastes. Components of urban waste: Plastics, glasses, metallic cans, fibres, paper, rubbers, street sweepings, fuel residues, leaves, containers, abandoned automobiles, and other discarded produced items are among the waste and junk elements found in this refuse. Even if household garbage is separated from industrial waste, it can still be hazardous. This occurs because they are difficult to decay.

VI. BIOLOGICAL AGENTS

Soil absorbs a considerable quantity of human, animal, and avian excrement, which is a primary source of biological agent contamination. Manures and digested sludge applied in large quantities can harm plants in a few of years.

VII. FERTILIZERS

Chemical fertilisers applied to soils infiltrate agricultural plants and drain into the water table, eventually becoming part of subterranean water. Spinach, Mustard, and Lettuce, for example, create deadly levels of nitrate or nitrite in their leaves and fruits as a result of nitrogen fertiliser. Nitrate-containing canned food corrodes the can's tin liner, raises the tin content of the food, and emits nitrous oxide (N_2O) gas. If there are enough nitrates in the drinking water, the toxicity rises.

Bacterial activity in the alimentary canal converts nitrates to nitrites. Methaeinoglobin is formed when the latter enters the bloodstream and combines with haemoglobin. As a result, the amount of oxygen transported is decreased. Methaemoglobinaemia is an illness caused by it (presence of methaemoglobin in the circulating blood). It causes cyanosis in neonates (blue babies due to bluish tint of skin). Adults have shortness of breath as a result of it. Nitrate poisoning in babies can be lethal unless methylene blue is administered promptly.

Excessive use of chemical fertilisers degrades soil by reducing natural bacterial populations (nitrogen fixing, nitrification, and sulphofying) and destroying crumb structure. With continued fertiliser application, the salt content of the soil will inevitably rise.

VIII. OTHER SOIL POLLUTANTS

Many contaminants from the air and water end up in the soil. Toxic compounds are also released into the soil as a result of the weathering of some rocks. A large portion of the lead released by automotive exhaust lands on the roadside and becomes a part of it. The similar thing happens throughout the food chain. Fluorides flow into pumped water and the food chain in the same way. Fluorides in Isn plants react chemically with Mg^{2+} in chlorophyll, inhibiting photosynthesis, causing leaf and fruit abscission, and destroying vegetation. In the case of fluoride contamination, maize is a sensitive indicator.

The mottling of teeth is a common indication of excess fluorine or fluorosis in humans. Fluorosis of the bones develops later. The latter is characterised by weak bones, a boat-shaped posture, and knee banging. Animals who graze on fluoride-rich vegetation show signs of ill health, including brittle teeth, brittle bones, and swelling of the knee bones.

IX. SALINATION OF SOIL

Salination is defined as an increase in the content of soluble salts in the soil. The following variables influence the origin or development of salty soil.

(i) Poor Drainage of Soil

Because of insufficient drainage, salts dissolved in irrigation water build on the soil surface, especially during floods.

(ii) Quality of Irrigation Water:

The ground water in arid (dry, barren areas with insufficient rainfall to sustain vegetation) areas is typically salty. Irrigation water may be high in soluble water, contributing to soil salinity.

(iii) Capillary Action:

During the summer, salts from the bottom layers migrate up by capillary action and are deposited on the soil's surface.

(vi) Excessive Use of Basic Fertilizers:

Excessive use of alkaline fertilisers such as sodium nitrate, basic slag, and other alkaline fertilisers can cause soil alkalinity.

(v) Salts Blown by Wind:
A lot of salt is blown by the wind and deposited on the plains in dry places near the sea.

(vi) Saline Nature of Parent Rock Materials:
Soil would be saline if it developed from the saline character of parent rock minerals. There are about six million hectares of salty land in India. Every year, around 6,000-8,000 hectares of farmland in Punjab become unsuitable for cultivation.

X. EFFECTS OF SOIL POLLUTION

Agricultural
• Reduced soil fertility
• Reduced nitrogen fixation
• Increased erodibility
• Larger loss of soil and nutrients
• Deposition of silt in tanks and reservoirs
• Reduced crop yield
• Imbalance in soil fauna and flora

Industrial
• Dangerous chemicals entering underground water
• Ecological imbalance
• Release of pollutant gases
• Release of radioactive rays causing health problems
• Increased salinity
• Reduced vegetation

Urban
• Clogging of drains
• Inundation of areas
• Public health problems
• Pollution of drinking water sources
• Foul smell and release of gases
• Waste management problems

XI. ENVIRONMENTAL LONG TERM EFFECTS OF SOIL POLLUTION
The cost of polluted soil is considerably higher when it comes to the ecosystem. Contaminated soil should no longer be used to grow food, as the chemicals can leach into the food and damage those who consume it.

When polluted soil is utilised to grow food, the yields are generally lower than if the soil was not contaminated. This, in turn, can exacerbate the problem since a lack of plants on the soil causes additional erosion, transferring toxins to territory that was previously uncontaminated.

Furthermore, the pollutants will alter the composition of the soil as well as the sorts of microorganisms that reside there. If specific species die off in the region, larger predator animals will be forced to flee or perish as a result of a lack of food. As a result, soil contamination has the potential to alter entire ecosystems.

XII. EFFECTS OF SOIL POLLUTION IN BRIEF
• polluted soil may pass pollutants on to consumers
• polluted soil may no longer grow crops and fodder
• soil structure is damaged (clay ionic structure impaired)
• corrosion of foundations and pipelines
• impairs soil stability
• may release vapours and hydrocarbons into buildings and cellars
• may create toxic dusts
• may poison children playing ionised water

XIII. CONTROL OF SOIL POLLUTION

Reusing of materials

Glass containers, plastic bags, paper, fabric, and other materials can be reused at home rather than disposed of, minimising solid waste pollution.

Recycling and recovery of materials

This is a practical approach of reduce soil contamination. Paper, various types of plastics, and glass can all be recycled, and they are. This reduces the amount of waste generated and aids in the conservation of natural resources. One tonne of recovered paper, for example, may save 17 trees.

Reforesting

Land loss and soil erosion can be slowed by restoring forest and grass cover, which helps to prevent wastelands, soil erosion, and floods. Crop rotation or mixed cropping can help to increase soil fertility.

Solid waste treatment

The proper strategies for managing solid waste disposal should be used. Physically, chemically, and biologically, industrial pollutants can be handled until they are no longer harmful. Acidic and alkaline wastes should be neutralised first, and insoluble materials should be allowed to breakdown under controlled circumstances before disposal.

To reduce the spread of mine dust, considerable improvements in mining operations and transportation of mined minerals should be made. It's not a good idea to leave the place desolate and arid. Instead, as soon as it is possible, afforestation should be carried out. As a last option, new places for hazardous waste storage, such as deep well injection and more secure landfills, should be examined. The simplest and most generally utilised method of solid waste management is burying rubbish in sites distant from residential areas. Before deciding on dumping locations, environmental and aesthetic issues must be taken into account. Incineration of other wastes is costly, leaves a large residue, and pollutes the air.

Pyrolysis is the process of burning a substance in the absence of oxygen or in a controlled environment of oxygen. It's a better option than incineration. The resulting gas and liquid can be utilised as fuel. Carbonaceous wastes such as firewood, coconut, palm waste, corn combs, cashew shell, rice husk paddy straw, and saw dust are pyrolyzed to produce charcoal, as well as tar, methyl alcohol, acetic acid, acetone, and a fuel gas.

REFERENCES

- Mashhood Ahmad."Environmental Pollution: Its Effects On Life And Its Remedies."Researchers World Journal of Arts, Science and Commerce.Vol-II Issue- 2, April 2011
   http://www.researchersworld.com/vol2/iss ue2/Paper_23.pdf/

- Khan Lakshmana, C.M. "Dynamics Of Urban Growth, Resource Degradation And Environmental Pollution In Million Plus Cities In India." Environment and Urbanisation ASIA 5(1) 49-61 SAGE Publication,New Delhi. <http;//eva.sagepub.com>

- livingston, James V, ed.Agriculture and Soilpollution: New Research London: NovaPublishers, 2005

- Huppert, H. E. & Sparks, R. S. J... ExtremeNatural Hazards: Population Growth, Globalisation and Environmental Change, Philosophical. Transactions of the Royal Society, 364(1845), pp. 1875-s1888(2006).