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SOIL POLLUTION: CAUSES, IMPACT AND RESOLUTION- A REVIEW

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ABSTRACT

Soil is the top surface on which plants can be grown. Soil is a system constituted by tiny particles of diverse sizes. This system consists of water and minerals, various microorganisms, organic and inorganic contents. Soil contamination by any means leads to soil contamination which can have harmful effects. The main factors that pollute the soil include industrial and municipal waste, incorrect agricultural practices, radioactive compounds, and many biological factors. Industrial and municipal wastes are improperly disposed of without any treatment, leading to soil degradation, leading to decreased productivity and fertility of the soil. Specifically, industrial waste is made up of heavy metals that accumulate over time and have harmful effects on plants, animals, and people. Incorrect agricultural practices include the excessive use of chemical fertilizers and pesticides. Currently more than 500 different types of pesticides are used, which not only act on target organisms, but also have negative effects on non-target organisms. The effect of the soil is not only limited to the soil, but can have negative effects on plants, animals and people; because all biological organisms are linked by the food chain. Soil contamination can be controlled through proper treatment and disposal of sewage, municipal and industrial wastes. In addition, the use of organic fertilizers and biopesticides should be encouraged instead of chemical fertilizers and pesticides, which not only increase the yield of crops for the growing population, but also reduce soil pollution. Soil is a wonderful gift of nature and the life of all living things is directly or indirectly affected by the soil in which it is found, so it is very important to protect and save it.

Keywords: soil pollution, industrial waste, pesticides, organic fertilizers

1. INTRODUCTION:

The loose, unconsolidated outer layer of the crust of the earth is known as soil, and it is naturally dusty and composed of tiny particles of different sizes. Both organic and inorganic components as well as microbial communities make up the soil environment. According to some, soil microbes serve as nature's garbage disposal system by actively breaking down solid plant and animal waste. When water, warmth, and at least some minimal nutrients are present and are not harmful, soil is the interface where plants can thrive. Substances at lower levels the composition of the soil is listed below:

2. COMPONENT %

Organic mineral matter 45
Organic matter 05
Soil water 25
Soil air 25

Soil contamination is defined as "soil contamination by human and natural activities that can have disparaging effects on living organisms". Plants, natural world, individuals, and of course the soil itself. In addition, soil contamination can always occur when the level of contaminants in the soil does not pose a risk, simply because the level of contamination in the soil exceeds the levels in the soil it occurs naturally (in the case of naturally occurring pollutants in the soil).

Soil contamination is the result of a number of factors including industry, agricultural practices, human activities, municipal waste, and many others. Soils play a fundamental role in regulating pollutants in ecosystems. The increased demand for food to support the ever-growing world population has resulted in a massive increase in agricultural and industrial activities around the world. These activities have caused great degradation of the soil environment. Soil degradation leads to a decrease in soil productivity due to adverse changes in the state of nutrients, organic matter, and concentrations of solutes and agrochemicals. The effects of soil degradation are not just limited to the soil, but have a variety of effects. When soil contamination is overcome, it has a direct impact on economic and health problems.

3. CAUSES OF SOIL POLLUTION:

The cause of soil pollution is a combination of things. These elements include agricultural practices, radioactive substances, urban waste, industrial waste, and agents of biological origin.

Industrial waste:

The primary issue with soil pollution is the disposal of industrial waste. Industries that produce industrial wastewater include those that manufacture pulp and paper, chemical fertilizers, sugar, tanneries, textiles, distilleries, iron and steel, pesticides, mineral and coal mining, pharmaceutical, glass, and industrial businesses. engineering, crude oil and cement.

Typically, these enterprises release their wastewater into local waterways, sewage systems, or adjoining agricultural lands, which causes environmental issues. Some effluent from various businesses has significantly varied chemical compositions. The type of industry and the treatment given to this trash before it leaves the factory premises will determine its quality.When industrial effluent is exposed to the elements or lands used for agriculture, it contaminates the soil with organic and heavy metal contaminants. In soils irrigated with battery and distillery effluents compared to soils irrigated with channel or pipe well water, the overall level of Pb, Ni, Cd, and Cr was greater. There is a rise in organic C. This might be because the wastewater from the distillery contains more carbon than usual (Antil et al., 1999). According to Mahata

and Antil (2004), soils irrigated with lead batteries had a lead level that was nearly 11.5 times greater. In comparison to well-irrigated soils, irrigation with effluent from the cycle industry increased the soil's level of EG, organic C, and hazardous metals (Pb, Ni, and Cd). Heavy metal concentrations of several types, including Cd, Ni, Pb, and Cr, can be very high in untreated and polluted wastewater as well as industrial effluent (Arora et al., 1985). Its ongoing disposal in agricultural soils has resulted in soil illnesses and the buildup of some hazardous metals in the soil, both of which can pose a major threat to human health (Narwal et al., 1988; Antil & Narwal, 2008).

Urban waste:
Commercial and domestic waste, which consists of sewage and dry sludge, are both included in municipal waste. trash is a general term for all municipal solid trash. The trash and waste items that make up these wastes include plastics, glasses, metal cans, fibers, paper, rubber, street litter, fuel scraps, leaves, containers, abandoned cars, and other discarded industrial products. Despite being segregated from industrial garbage, municipal waste can be toxic. This is as a result of its difficult degradation. Waste generated by households and businesses throughout the world is largely made up of plastic. Plastic garbage builds up and contributes to pollution because it is not biodegradable.

Agricultural practice:
The use of various agrochemicals is a standard practice in contemporary agriculture. Among them are pesticides, herbicides, insecticides, fungicides, and other chemicals. As agrotechnology advances, large amounts of these agrochemicals are added to increase crop yields, but these chemicals pollute the soil to a great extent. Other than these agricultural wastes, manure, slurry, debris, and soil erosion are also regarded as soil pollutants since they typically contain inorganic compounds. Pesticide residue buildup in the biosphere stresses the environment and contaminates soil, water, and food sources.

Agrochemicals such as pesticides and fertilizers, as well as industrial, household and electronic waste, have harmful effects on soil resources. A pesticide is any agent or combination of compounds used as a preventative measure to eliminate, deter, or mitigate pests or weeds. A pesticide can be categorized based on its goal, mechanism of action, duration of action, or chemical. Pesticides are employed in our environment, primarily in agriculture, in more than 500 different formulations (Azevedo, 1998). The most affordable method of weed and insect management, pesticides enable you to retain current production and hence increase profitability. Research on the environmental behavior of these substances, which can travel from treated plants to fields into the air, other soils, and bodies of water, has been prompted by concern about the environmental impact of frequent use of pesticides.

Fertilizers made of chemicals are necessary for crop cultivation since most of our high yield types respond to them. Simply using chemical fertilizers on a regular basis causes the attributes of soil to deteriorate, and farmed soils lose their natural qualities.

The pH of the soil is decreased by fertilizers including urea, ammonium chloride, and ammonium sulphate (Verma and Kumar, 2004).

Radioactive chemicals:
In nuclear testing facilities and other industrial settings, explosions produce radioactive waste from nuclear dust that seeps into the ground and builds up, contaminating the soil. These are prevalent in soil, rocks, water, air, and radionuclides of radium, thorium, and uranium, as well as potassium (K40) and carbon (C14) isotopes. The neutron and proton processes in the hydrogen and cosmic ray weapon burst result in the production of C14 from nitrogen (N15). This C14 takes part in the conversion of carbon in plants into forms that may be used by humans, animals, and other life forms. The most dangerous radionuclides found in radioactive waste include strontium90, iodine129, cesium137, and iron isotopes. Instead of calcium, strontium is deposited in bones and tissues. 4,004 nuclear reactors generate waste that includes the major nuclides Sr90 with a half-life of 28 years and Cs137 with a half-life of 30 years, as well as ruthenium 106, iodine 131, barium 140, cesium 144, and lanthanum 140 (Anushree and Jyothi, 2015). Rainwater carries Sr90 and Cs137, which are deposited on the ground, where they are retained by electrostatic forces with soil particles. All radionuclides deposited on the ground emit gamma radiation. Heavy metals are dangerous and unacceptable to the biological system.

4. EFFECT OF SOIL POLLUTION:

Soil degradation causes a decrease in soil productivity due to adverse changes in the state of nutrients, organic matter, and concentrations of solutes and agrochemicals. The effect of soil degradation is not limited to the soil, it has a variety of effects. The most serious problem facing scientists and the community is the disproportionate amount of research and regulatory action to protect the soil environment.

One of the most important factors causing soil pollution are industrial waste and sewage - industrial waste. As long as the residue has a high concentration of vital plant nutrients and a low concentration of hazardous substances, it can be used to grow plants. The physical, chemical, and biological characteristics of the soil would change over time due to use (Antil et al., 2007). Both the health of the soil and crop productivity have been adversely impacted by sewage and industrial wastewater contamination of the soil. In degraded soils in industrial areas, toxic ions of aluminium, zinc, copper, lead, cadmium, and other metals frequently build up. In addition to preventing root development, toxic ions can also result in root necrosis or death at greater concentrations (Bojarczuk, 2000). Long-term irrigation with wastewater causes toxic metals including Cd, Cr, and Ni to build up in soil and plants. In comparison to cereal, green vegetables have a higher concentration of these metals. This demonstrates the potential risk to soil and plant health and suggests the necessity of their safe usage following pre-treatment in order to safeguard soil health and lower the possibility of risks to human and animal health.

The soil became rusty and spongy due to overuse of effluent from the bicycle business, which also caused productive land to become unproductive. In addition, soil

contamination by heavy metals is one of the main environmental issues connected to the application of effluents from enterprises involved in metal processing (Antil & Narwal, 2008). This soil accumulates extremely huge levels of harmful metals. In several areas of the plant, it has been reported that soils that were irrigated with wastewater included some of the commonly found heavy metals (Ni, Cd, Cr, Pb, etc.). Radishes, squash, spinach, and cauliflower's heavy metal concentration were reported by Mitra and Gupta in 1999.Wastewater with suspended solids can cover the floor like a blanket and reduce productivity.

Chemical pesticides and herbicides used carelessly contaminate soil and groundwater, endangering the health of all living things. With increasing amounts being utilized, pesticide use has significantly improved the quantity and quality of food for the expanding global population over the past 50 years, prompting worries about their negative impacts on non-target creatures, including people (al., 1993).According to estimates, less than 0.1% of pesticides applied to plants actually reach the intended pest; the remaining portion is released into the environment for free and contaminates the soil, water, and air, poisoning or negatively affecting non-target organisms (Pimentel and Levitan, 1986). from conventional agriculture have a residue content of more than 70%.

Many pesticides can also persist in an ecosystem for a very long time; organochlorine insecticides, for instance, were still detectable in surface waters 20 years after their use was outlawed (Larson et al., 1997); additionally, once a persistent pesticide has entered the food chain, it can "bio-magnify" itself by building up in the body tissues of organisms, where it can reach concentrations many times higher than those in the environment (Brewer, 1979). Additionally, it has an impact on the soil's microbiota, which is crucial for preserving soil fertility. Numerous soil microorganisms and their activity are impacted by pesticides or their metabolites. Rhizobium, which produces bones and fixes nitrogen, Nitrosomonas, and Nitrobacter, which nitrifies the nitrogen, are all inhibited when seeds are treated with mercury-based fungicides. Numerous investigations have demonstrated that the microflora of degraded soils is altered by microbial activity and composition (Rudawskam and Leski, 1998).

Another factor contributing to soil contamination is heavy metals. They are lethal to both people and other animals. The majority of them are gradual poisons that build up in the body and result in life-threatening sickness. The five most prevalent poisonous heavy metals—mercury, lead, arsenic, chromium, and cadmium—have negative impacts on human wellness. Many bacterial infections such as actinomycosis, anthrax, botulism, ecoli, leptospirosis are spread by contact with contaminated soil.Salmonella is a foodborne illness, one of the most common ways this bacteria in vegetables passes through the soil. Many helminths such as Ascaris Lumbricoides, Necator Americanus, Ancylostoma duodenale, etc. they invade humans through contaminated soil. Poliovirus can survive in the soil environment between 80 Â° C and 96 days. Tetanus bacteria and some Hanta viruses are transmitted to humans through the excretions of infected rodents that may be in the soil.

5. CONTROL OF SOIL POLLUTION:

To prevent an excessive buildup of harmful metals in the soils and their subsequent transmission into the food chain, it is necessary to regularly monitor the sewage/industrial effluents, sludge, and soils. Both useful and hazardous components are abundant in sewage and industrial effluents. Soil serves as the appropriate sink for these effluents' disposal because some of them are a rich source of plant nutrients. However, rigorous government regulations should state that only sewage and industrial effluents that have been cleansed at sewage and effluent treatment plants may be used in fields (Brar et al., 2000). For sustainable land management, the proper disposal of industrial solid and liquid effluents should be given top priority. When industrial effluents are discharged outdoors or onto agricultural land, they contaminate the soil with organic and heavy metal contaminants.

Chemical fertilizers and insecticides used in excess seriously pollute the land. By switching to organic agricultural methods, which protect plants only with natural biopesticides, these issues can be resolved. Pest and disease problems are typically controlled with bio insecticides, bio control agents, plant extracts, etc. Instead of synthetic chemical fertilizers, organic fertilizers ought to be employed (Feigin et al., 1991). For instance, rather of discarding organic wastes in animal feces carelessly and damaging the land, they can be utilised to prepare compost manure. Chemicals and pesticides like DDT, BHC, etc. that are harmful to both plants and animals should be banned.

The primary element affecting the biological equilibrium of the soil ecosystem is the depletion of soil organic matter under intensive cropping systems. The preservation of the soil food web is crucial because it supports the population growth of all soil species, including bacteria, fungus, actinomycetes, protozoa, earthworms, and others. Increased use of organic manures, green manures, enriched vermicompost and bio composts, use of bio fertilisers, crop rotation with high and low biomass crops, and avoiding the use of chemical fertilizers are all recommended farming practices to maintain soil fertility (Joshi and Yadav, 2005).

Additionally, it should be illegal to explode nuclear weapons and dispose of radioactive material improperly. By using soil and crop management measures, which immobilize these metals in soils and decrease their uptake by plants, the entry of heavy metals into the food chain can be decreased. Heavy phosphate use as well as kaolin/zeolite applications to soils might lessen the availability of heavy metals. Utilizing organic manures helps reduce the damaging effects that toxic metals have on crops. Thus, the use of organic manures is advised in soils contaminated with significant amounts of hazardous metals to increase yield potentials and reduce metal availability to plants. To prevent harmful metals from entering the food chain, it is advised to grow hyper accumulator plants, such as mustard and trees, in soils contaminated with toxic metals (Kharche et al., 2011).

Plastic pollution can be reduced by using biodegradable or photodegradable plastic. A component vulnerable to UV radiation is included in photodegradable plastic. The element is triggered by sun radiation and snaps the polymeric chain of the photodegradable plastic. Small fragments are produced as a result, which microorganisms may digest with ease. Wastes including paper, plastic, metal, glass, organics, petroleum products, and industrial effluents should all be recycled and repurposed in order to reduce soil pollution. Industrial wastes need to be handled effectively at the source. It is important to use integrated waste treatment techniques (Bijay and Singh, 2002).

People should be made aware of the risks to their health posed by environmental education through both informal and formal public awareness campaigns. This is achievable through mass media, educational institutions, and nonprofit organizations.
People should be trained regarding sanitary habits.

6. CONCLUSION:

The continuous development of human society made it possible to invent new technologies that should improve life. The need to produce on an industrial scale resulted in cheap products and pollution. many of them with devastating effects on them and the environment as a whole. Areas contaminated with heavy metals must be renovated. Over time, natural degradation processes became increasingly detrimental to soil and plant performance, largely due to improper use of industrial fertilizers.Poor rehabilitation of former industrial sites also contributed to a prolonged period of soil contamination. Crop rotation and the use of organic fertilizers remain the simplest method of avoiding soil erosion due to industrially produced agriculture.

Soil is a gift of nature, so it is our responsibility to nature. Soil is the interface for most human activities and is strongly influenced. Soil acts as a major source of pollution and as a carrier of pollutants.Soils are a major sink for pollutants through precipitation, sorption, and immobilization reactions, and these pollutants are absorbed directly by soil biota, grazing animals, and humans. The degree of soil degradation is increasing throughout the world. It is time to remedy this and protect the wonderful gift of this nature.

REFERENCES

1. Antil, R.S. & Narwal, R.P. (2008). Influence of sewer water and industrial effluents on soil and plant health. In: *Groundwater resources: Conservation and management,* V.D. Puranik, V.K. Garg, A. Kaushik, C.P. Kaushik, S.K. Sahu, A.G. Hegde, T.V. Ramachandarn, I.V. Saradhi & P. Prathibha, (Ed.), 37-46
2. Antil, R.S.; Arora, U. & Kuhad, M.S. (1999). Leaching and transformation of urea in soils treated with sewage water and distillery effluent. *Proceedings of International Conference on Contaminants in Soil Environment in Australasia Pacific Region*, pp. 464- 466, New Delhi, India, Dec. 12-17

3. Antil, R.S.; Dinesh & Dahiya, S.S. (2007). Utilization of sewer water and its significance in INM. *Proceedings of ICAR sponsored Winter School on Integrated Nutrient Management*, pp 79-83, Department of Soil Science and Directorate of Human Resource Management, CCS Haryana Agricultural University, Hisar, India, Dec. 4-24
4. Antil, R.S.; Kumar, V., Kethpal, T.S., Narwal, R.P., Sharma, S.K., Mittal, S.B., Singh, J. & Kuhad, M.S. (2004). Extent of land degradation in different agro-climatic zones of Haryana. *Fertilizer News,* 49: 47-59.
5. Anusree Mohan, Jyothi Sajayan (2015). Soil pollution-A Momentous Crisis. ~ 45 ~ *International Journal of Herbal Medicine* 3(1): 45-47
6. Arora, B.R., Azad, A.S., Singh, B. & Sekhon, G.S. (1985). Pollution potential of municipal waste waters of Ludhiana, Punjab. *Indian Journal of Ecology,* 12: 1-7.
7. Azevedo, A.S.O.N., (1998). Assessment and simulation of atrazine as influenced by drainage and irrigation. An interface between RZWQM and ArcView GIS. Doctor Thesis. Iowa State University, Ames, Iowa.
8. Bijay and Singh (2002). Soil pollution and its control. In: F*undamentals of Soil Science, Indian Society of Soil science, 499-514,* Indian Agricultural Research Institute, New Delhi.
9. Bojarczuk K. (2000) Effect of aluminium on in vitro rooting of berch *(Betula pendula* Roth.) and poplar *(Populus tremula* L. *P.alba* L.) microcuttings. Acta Societatis Botanicorum Poloniae. 69 (4), 251
10. Brar, M.S.; Mahli, S.S., Singh, A.P., Arora, C.L. & Gill, K.S. (2000). Sewage water irrigation effects on some potentially toxic trace elements in soils and potato plants in North Western India. *Canadian Journal of Soil Science,* 80: 465-71.
11. Brewer, R., 1979. Principles of Ecology. Saunders College Publishing, Philadelphia, pp. 249–258.
12. Feigin, A.; Ravina, I. & Shalhevet, J. (1991). Irrigation with treated sewage effluent. Management for Environmental Protection. *Advanced Series in Agricultural Sciences* 17, pp 224, Springer-Verla.
13. Joshi, P.K. & Yadav, R.K. (2005). Effect of sewage on microbiological and chemical properties and crop growth in reclaimed alkali soil. *Proceedings of the International Conference on Soil, water and Environment Quality, Issues and Stratigies,* Jan. 28 – Feb. 1, 2005, New Delhi.
14. Kharche, V.K.; Desai, V.N. & Pharande, A.L. (2011). Effect of sewage irrigation on soil properties, essential nutrients and pollutant element status of soils and plants in a vegetable growing area around Ahmednagar city in Maharashtra. *Journal of Indian Society of Soil Science,* 59: 177-184.
15. Larson, S.J., Capel, P.D., Majewski, M.S., (1997). Pesticides in surface waters—distribution, trends, and governing factors. In: Gilliom, R.J.(Ed.), Series of Pesticides in Hydrologic System, vol. 3. Ann Arbor Press, Chelsea, Michigan.
16. Mahata, M.K. & Antil, R.S. (2004). Effect of organic matter and levels of organic carbon on urease activity of selected surface soil contamination with lead. *Enviornment and Ecology,* 22: 314-318.
17. Mitra, A. & Gupta, S.K. (1999). Effect of sewage water irrigation on essential plant nutrient and element status in vegetable growing areas around Calcutta. *Journal of Indian Society of Soil Science,* 47: 99-105.

18. Narwal, R.P.; Singh, M. & Gupta, A.P. (1988). Effect of different sources of irrigation on the physico-chemical properties of soil. *Indian Journal of Environment and Agriculture,* 3: 27-34.
19. Pimentel, D., Levitan, L., (1986). Pesticides: amounts applied and amounts reaching pests. *Bioscience* 36, 86–91.
20. Rao, P.S.C., Bellin, C.A., Brusseau, M. L., (1993). In Sorption and Degradation of Pesticides and Organic Chemicals in Soil. SSSA Special Publication Number 32, Wisconsin, pp. 1–26.
21. Rudawskam., Leski T (1998). Aluminium tolerance of different *Paxillus involutus* Fr. strains originating from polluted and non polluted sites. Acta Societatis Botanicorum Poloniae. 67, 115
22. Verma, K.B. & Kumar, P. (2004). Effect of agro based industrial effluents on the growth and development of wheat (*Triticum aestivum* L. var. RR21), maize (*Zea mays* L.) and mustard (*Brassica compestris* L.). *Indian Journal of Ecology*, 31: 93-96.