Ways to prevent soil pollution

Following are the ways to prevent soil pollution problem

1. Government regulations

In order to reduce the problem of soil pollutions, governments around the world must take measures and introduce strict regulations. This means a strict control on the operation of landfills to make sure that the soil is not contaminated.

2. Reforestation

Another measure to mitigate the soil pollution problem is reforestation. On the one hand, an increase in trees means that more harmful gases can be filtered and thus the air gets cleaner which also results in less acid rain and therefore in less soil pollution.

3. Reduction in consumption

Every one of us can mitigate the soil pollution problem in our daily life through a reduction in consumption. To produce material goods, precious metals and other elements have to be extracted from the ground. Often, the extraction process of these elements includes the use of toxic elements which contaminate the soil.

4. Recycling

Recycling prevents the depletion of resources and therefore indirectly contributes to a reduction in soil contamination.

5. Reduction in the use of fertilizers and pesticides

Pesticides and fertilizers contain harmful elements which contribute to soil pollution. Farmers can contribute to a reduction in soil pollution if they get aware of the problem and thus reduce the use of these substances.

6. Switch from conventional to organic products

Through the excessive use of pesticides, the level of contamination with harmful substances is usually much higher in conventional products than in organic products. With the switch from conventional to organic products, we can contribute to less soil pollution since in organic agriculture, much less harmful substances are allowed.

7. Avoid the use of fossil fuels

Fossil fuels are used by industries as well as in our daily life, for example using our cars. Fossil fuels contribute to soil pollution since the burning of these fuels causes harmful gases which lead to acid rain. This rain contaminates the soil and makes it more acid, thus harming the whole ecosystem. We can thus mitigate the soil contamination problem by avoiding the consumption of fossil fuels in our daily life.

8. Organic gardening

A further step to mitigate soil pollution can be accomplished by organic gardening. If you have a garden or a balcony, you could plant part of your food in an organic way instead of buying conventional food from the store. Thus, you can contribute to a lower level of total fertilizer and pesticides used and therefore to less soil pollution.

9. Proper waste disposal

We have to also assure that our waste is disposed properly. This means we should separate garbage in our daily life. Moreover, it has to be assured that industries have proper waste disposal processes and do not dump their trash in nearby rivers, lakes or other storage spaces in nature.

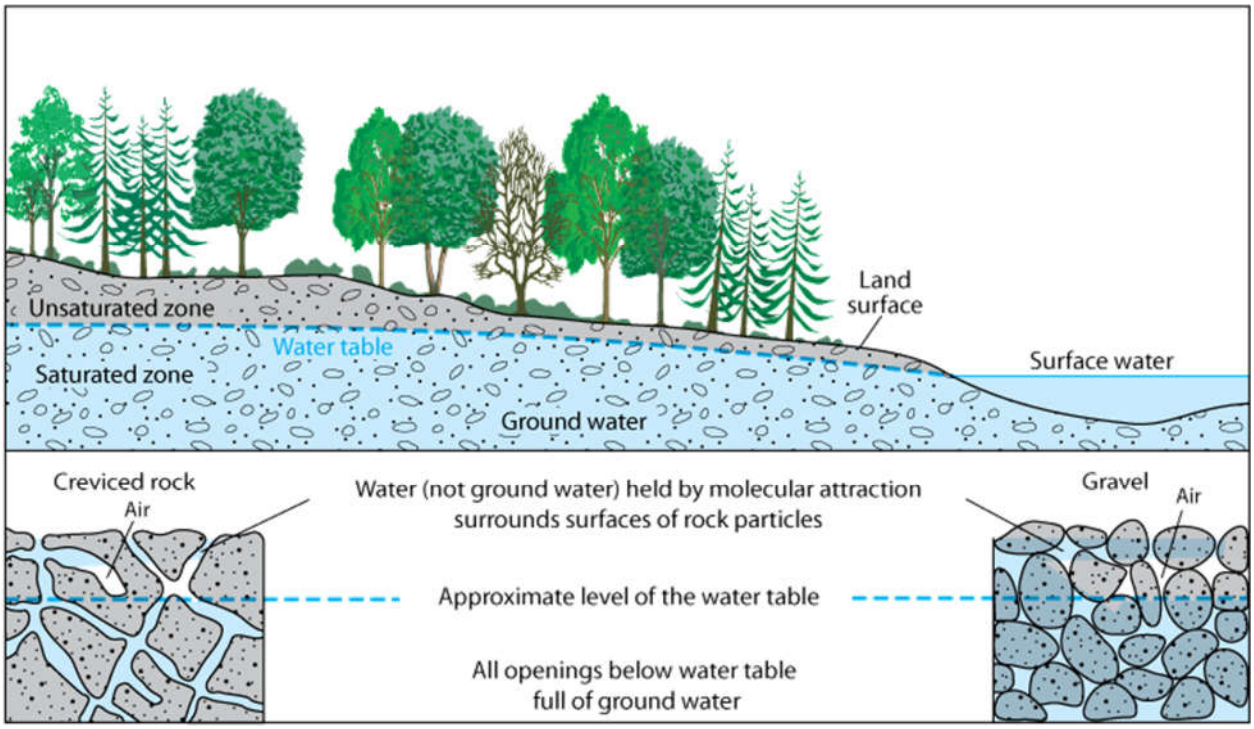
10. Physical, chemical and biological techniques for remediation of contaminated soil

10.1. Physical techniques

Physical techniques include the following

10.1.1. Soil vapor extraction

Soil vapor extraction (SVE) is a physical treatment process for in situ remediation of volatile contaminants in vadose zone (unsaturated) soils. The vadose zone, also termed the unsaturated zone is the region of aeration above the water table.



Typical contaminants that soil vapor extraction is applicable for are volatile organic compounds. Volatile organic compounds (VOCs) are compounds that have a low boiling point and a high vapor pressure. This low boiling point causes the molecules within the compound to evaporate from the liquid and enter into the air.

10.1.2. Thermal Desorption

Thermal desorption is a technology of physical separation based on heating the contaminated soil to volatilize water and organic contaminants. Thermal desorption separates contaminants from soil. Soil is heated in a chamber in which water, organic contaminants and certain metals are vaporized. The design of a system aims to volatize contaminants, while attempting not to oxidize them.

10.1.3. Incineration

Incineration has been successfully used to treat soils contaminated with chlorinated hydrocarbons, dioxins, polychlorinated biphenyls (PCBs), and petroleum products. The main goal of incineration is to heat the contaminated media to temperatures between 870 and 1,200 °C, volatilizing and burning halogenated organic compounds and other compounds that are difficult to remove. Contaminated soils can be incinerated onsite or the excavated soil can be transported to an incinerator offsite.

10.2. Chemical techniques

10.2.1. Stabilization/Solidification (S/S)

Stabilization/Solidification (S/S) is typically a process that involves the mixing of waste with binders to reduce the volume of contaminant leachability by means of physical and chemical characteristics to convert waste in the environment that goes to landfill or others possibly channels.

Stabilization is the general term for a process that transforms contaminants into a less mobile or toxic form, while solidification is a more specific process that treats material to increase its solidity and structural integrity. Solidification does not remove nor degrade contaminants but prevents their transport by eliminating or significantly hindering their mobility. This process may be performed either ex-situ or in-situ.

10.2.2. Soil washing

Soil washing is an ex-situ remediation technique that removes hazardous contaminants from soil by washing the soil with a liquid (often with a chemical additive), scrubbing the soil, and

then separating the clean soils from contaminated soil and wash water. The wash water may be augmented with a basic leaching agent, surfactant, pH adjustment, or chelating agent to help remove organics and heavy metals.

The toxic compounds are removed by dissolution in water or water-based solution. This is used for organic as well as inorganic pollutants (metals, radioactive substances, etc.)

10.2.3. Soil Flushing

Soil flushing is an in situ chemical method of soil remediation. It involves the extraction of heavy metals via a fluid injected into the contaminated soil. The extraction fluid is pumped to the surface, which brings along the absorbed contaminants with itself. The extraction fluid is made by the liquefaction of various gases such as propane, carbon dioxide and butane. Soil flushing works on all types of soil pollutants, usually in combination with other techniques. Only soil types that contain spaces large enough to allow the extraction fluid to seep through the soil particles can be purified using this technique

10.3. Biological techniques (Bioremediation)

Bioremediation techniques have been used for decontamination of surface and subsurface soils and contaminated land ecosystems.

Bioremediation can be defined as

"Bioremediation is a process used to treat contaminated media, including water, soil and subsurface material, by altering environmental conditions to stimulate growth of microorganisms and degrade the target pollutants."

There are two types of bioremediation:

- **In situ bioremediation** is the in-place treatment of a contaminated site, and
- **Ex situ bioremediation** is the aboveground treatment of contaminated soil or water that is removed from a contaminated site.

10.3.1. Types of bioremediation

a. Phytoremediation

Phytoremediation is a bioremediation process that uses various types of plants to remove, transfer, stabilize, and/or destroy contaminants in the soil and groundwater.

b. Mycoremediation

Mycoremediation is the bioremediation technique which employ fungi in the removal of toxic compounds.

c. Bioventing

Bioventing is a process of stimulating the natural in situ biodegradation of contaminants in soil by providing air or oxygen to existing soil microorganisms.

d. Bioleaching

Bioleaching (or biomining) is a process in mining and biohydrometallurgy (natural processes of interactions between microbes and minerals) that extracts valuable metals from a low-grade ore with the help of microorganisms such as bacteria or archaea.

e. Landfarming

Landfarming is an ex-situ waste treatment process that is performed in the upper soil zone or in biotreatment cells. Contaminated soils, sediments, or sludges are transported to the landfarming site, incorporated into the soil surface and periodically turned over to aerate the mixture.

f. Composting

Composting is the process that speeds up decomposition of organic materials by providing ideal conditions for microorganisms to thrive.

g. Bioaugmentation

Bioaugmentation is the practice of adding cultured microorganisms into the subsurface for the purpose of biodegrading specific soil and groundwater contaminants.

h. Biostimulation

Biostimulation involves the modification of the environment to stimulate existing bacteria capable of bioremediation. This can be done by addition of various forms of rate limiting nutrients and electron acceptors, such as phosphorus, nitrogen, oxygen, or carbon (e.g. in the form of molasses).

10.3.2. Advantages of bioremediation

- Completely natural process with almost no harmful side effects
- Carried out in situ for most applications with no dangerous transport
- Positive public acceptance due to natural organic process and little disturbance
- Cost effective to maintain and economical to input
- Little energy consumed compared to incineration and landfilling
- High acceptance from regulatory authorities

10.3.3. Disadvantages of bioremediation

- **Bioremediation** takes a longer time to compare to other treatment options.
- **Bioremediation** is limited to those compounds that are biodegradable.
- If the process is not controlled, it is possible the organic contaminants may not be broken down fully resulting in toxic by-products that could be more mobile than the initial contamination.