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# Technological Improvements to Control Soil, Water, Air and Environmental Pollution

(*Parikha Prakash Singh[1] and Abhishek Sharma[2])
[1]Department of Plant Physiology, JNKVV, Jabalpur
[2]Department of Agronomy, JNKVV, Jabalpur
*Corresponding Author's email: parikhaprakashsingh@gmail.com

Our environment is contaminated by a variety of toxins that are released through human activity or industrial processes in the current, technologically advanced world. When contaminants are introduced into the environment, they modify the physical, chemical, and biological characteristics of the air, water, soil, and surrounding areas. This is known as pollution. Hence, the term pollution is generally expressed as disambiguation. A factory or mine would be considered a point source of pollution, and runoff would be considered a nonpoint source of pollution.

Pollutants are the substances which causes pollution. Examples are CO, CFCs, heavy metals, hydrocarbons, NOX, organic compounds, SO2 and particulates. These are all responsible for causing air and soil pollution. Human activities, such as oil, coal and gas combustion, have significant potential that deteriorate the environmental prosperity completely. Water pollution caused by various factors, like waste disposal, oil spills, leakage of fertilizers, herbicides and pesticides, by-products of industrial processes and combustion and extraction of fossil fuels. And their summation leads to adverse effect on environment causing environmental pollution. Thus, for the sake of environment and each and every entity on our planet we need to combat and reduce the increasing pollution hence, we need a technology that is able to monitor, detect and, if possible, clean the contaminants from the air, water and soil and also improve the quality of existing environment.

## Here is short description about the technologies that are designed to Prevent Environmental Pollution (Soil, Water, Air):

### Basic techniques

1. **Follow 3 R's:-** Reduce, Reuse, Recycle. Waste minimization as much as possible, preparation of compost from wastes etc. In addition to reducing manufacturing costs and limiting pollution, it can assist in recovering valuable materials from trash.
2. **Air pollution control by Thermal oxidizer:** It decomposes hazardous gases at a high temperature and releases them into the atmosphere.
3. **Cyclonic separation:** It is a method of removing particulates from an air, gas or liquid stream, without the use of filters. When removing particulate matter from liquid, a hydro cyclone is used; while from gas, a gas cyclone is used. Rotational effects and gravity are used to separate mixtures of solids and fluids.
4. **Electrostatic precipitator:** It is a filter less device that removes fine particles, such as dust and smoke, from a flowing gas using the force of an induced electrostatic charge.
5. **Green chemistry and green manufacturing:** Thousands of chemicals (acetone, xylene, and methylene chloride) are used on a daily basis have environmental impacts, from mild

to serious. By developing alternative chemicals (microemulsions) with better environmental performance, significant reductions in pollution can be obtained.

6. **Nature-based soil remediation technologies:** This includes phytoremediation as well as bioremediation techniques. These technologies use microorganisms, macro-organisms and plants to biodegrade, stabilize or separate the contaminants. They have been used successfully to treat soils polluted with petroleum hydrocarbons, chlorinated solvents, polycyclic aromatic hydrocarbons, pesticides, as well as trace elements.
7. **Use of Geographic information systems (GIS) for controlling water pollution:** Technology and policy are now beginning to address runoff and eutrophication pollution, which was previously hard to measure, because it is "nonpoint" sources. The tools of GIS have offered to identify and observe these sources. The techniques combine land-use information with hydrology, topography, and soil data to make detailed, digitized maps at very fine scales and measure the potential for runoff.
8. **Use of Remote sensing technology in addressing the Polluted conditions:** Remote sensing data on actual farming activities, collected by aircraft and satellites, can be combined with the digital maps to provide more accurate and timely monitoring and estimation of polluted lands and conditions at any place.
9. **Use of Precision Technique for controlling pollution:** This technique really has a bright future as it is totally need based without wastage i.e. applying resources at need based. Precision practice tool uses real-time, computerized, and detailed information about crop health.

## Use of Nanotechnology for controlling pollution

**i.) Nanotechnology for clean water:** Water pollution has gained significance in recent years. The majority of conventional techniques, including extraction, adsorption, and oxidation, are inefficient, costly, and time-consuming, whereas the more ecologically friendly biological degradation is affordable but takes a long time. Nanomaterials are a cutting-edge technique that can be applied. They have improved affinity, reactivity, huge surface area, capacity, selectivity, and better disposal capability for heavy metals and other impurities. e.g. zeolites, carbon nanotubes, biopolymers, etc.

**ii.) Bioactive nanoparticles for water disinfection:** Antimicrobial nanotechnology eliminates microorganisms in water, an issue that has gotten worse as the population has increased. TiO2, ZnO, silver nanoparticles, fullerene, and other nanomaterials have demonstrated potent antibacterial activities. Since it is inexpensive, nontoxic when consumed, and stable in water, TiO2 has been suggested as the best substance among all others.

**iii.) Nanofibres and nanobiocides for water purification:** They provide a possibility to improve the quality of water filtration membranes. Membrane fouling caused by bacteria in the water which reduce the quality of water, inhibition of these bacteria can be caused by nanofibres. Both PVA and PAN nanofibres containing silver nanoparticles have excellent antimicrobial activity.

**iv.) Air remediation using nanosize semiconductor photocatalyst:** A few substances, including TiO2, ZnO, Fe2O3, and WO3, can act as photocatalysts. In terms of the environment and water remediation, they can remove benzene, toluene, ethylbenzene, and xylene (BTEX) from groundwater by oxidizing organic contaminants into harmless molecules.

**v.) Nanotechnology for sensors and detectors of pollution:** The environmental and human health can be sustained by using nanosensors, which are quick and accurate enough to identify contaminants at the molecular level before their concentration reaches risky levels.