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Analysis of Water Pollution Specifically for Eliminating Diseases Caused Due to It

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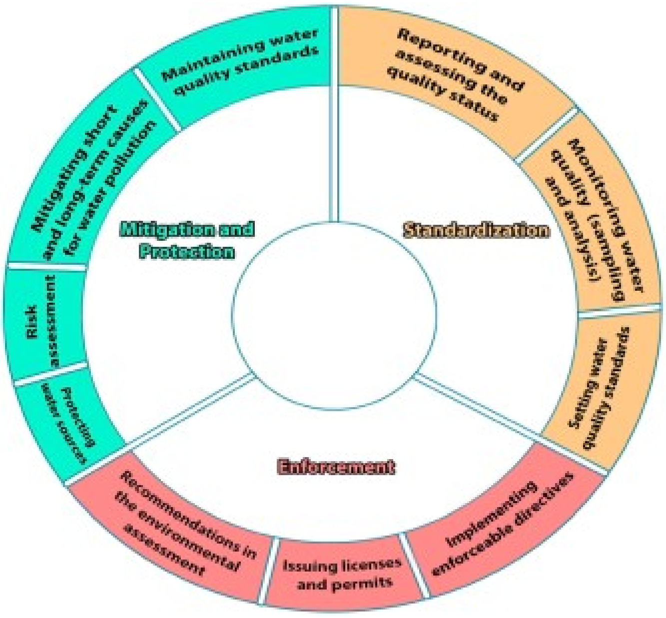
Abstract: A practical definition of water pollution is: "Water pollution is the addition of substances or energy forms that directly or indirectly alter the nature of the water body in such a manner that negatively affects its legitimate uses". Therefore, pollution is associated with concepts attributed to humans, namely the negative alterations and the uses of the water body. Water is typically referred to as polluted when it is impaired by anthropogenic contaminants. Due to these contaminants it either does not support a human use, such as drinking water, or undergoes a marked shift in its ability to support its biotic communities, such as fish.

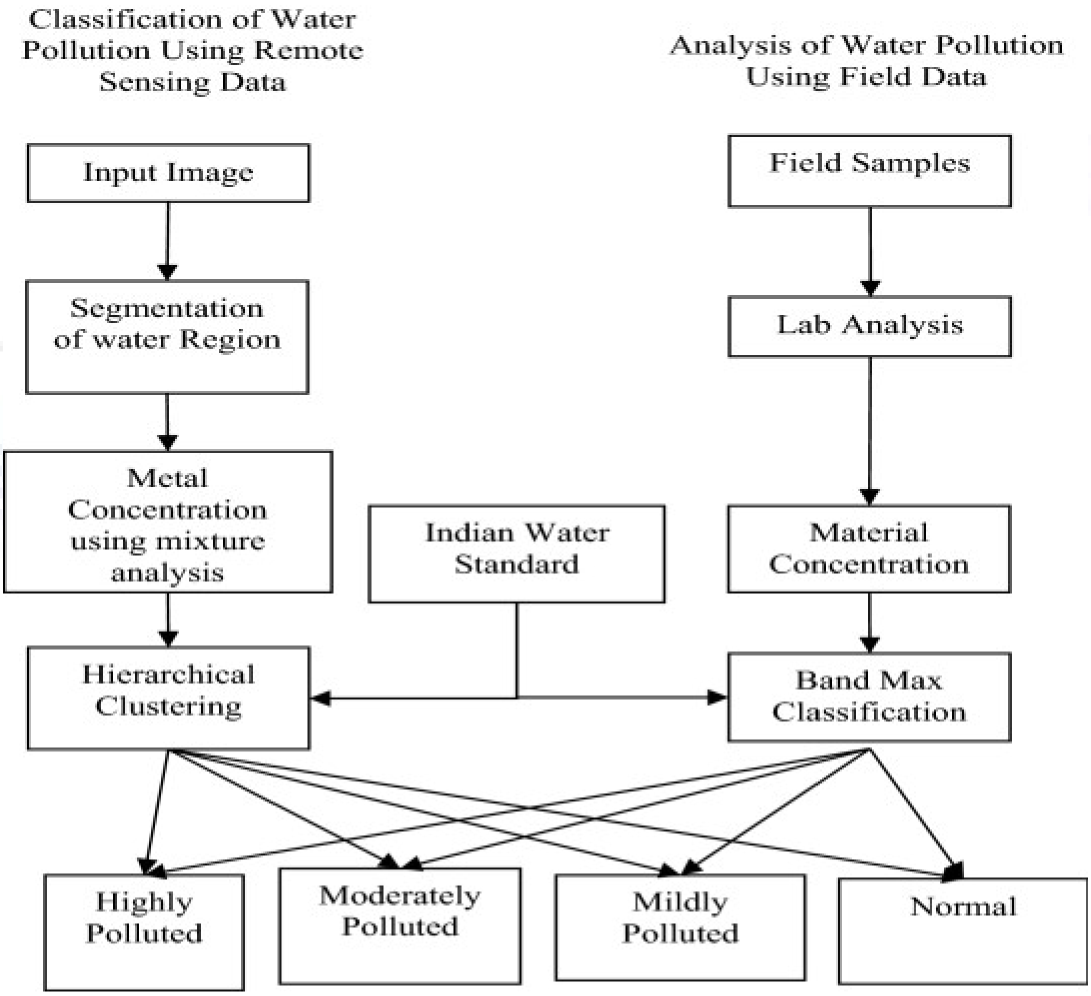
Key words: pollution, water, analysis, diseases, human, community, country, environmental, risks.

Introduction

The study shows that the values of four parameters namely, Temperature, Total Coliform, TDS, and Hardness are increasing yearly, whereas the values of pH and DO are not rising heavily.



The considered physicochemical parameters for the study are TDS, Chlorides, Alkalinity, DO, Temperature, COD, BOD, pH, Magnesium, Hardness, Total Coliform, and Calcium. As per the results and trend analysis, the value of total coliform, temperature, and hardness are rising year by year, which is a matter of concern. The values of the considered physicochemical parameters have been monitored using various monitoring stations installed by the Central Pollution Control Board (CPCB), India. Water pollution (or aquatic pollution) is the contamination of water bodies, usually as a result of human activities, so that it negatively affects its uses.[1] Water bodies include lakes, rivers, oceans, aquifers, reservoirs and groundwater. Water pollution results when contaminants are introduced into these water bodies. Water pollution can be attributed to one of four sources: sewage discharges, industrial activities, agricultural activities, and urban runoff including stormwater.[2] It can be grouped into surface water pollution (either fresh water pollution or marine pollution) or groundwater pollution. For example, releasing inadequately treated wastewater into natural waters can lead to degradation of these aquatic ecosystems. Water pollution can also lead to water-borne diseases for people using polluted water for drinking, bathing, washing or irrigation.[3] Water pollution reduces the ability of the body of water to provide the ecosystem services (such as drinking water) that it would otherwise provide.



Sources of water pollution are either point sources or non-point sources. Point sources have one identifiable cause, such as a storm drain, a wastewater treatment plant or an oil spill. Non-point sources are more diffuse, such as agricultural runoff.[4] Pollution is the result of the cumulative effect over time. Pollution may take the form of toxic substances (e.g., oil, metals, plastics, pesticides, persistent organic pollutants, industrial waste products), stressful conditions (e.g., changes of pH, hypoxia or anoxia, increased temperatures, excessive turbidity, unpleasant taste or odor, and changes of salinity), or pathogenic organisms. Contaminants may include organic and inorganic substances. Heat can also be a pollutant, and this is called thermal pollution. A common cause of thermal pollution is the use of water as a coolant by power plants and industrial manufacturers.

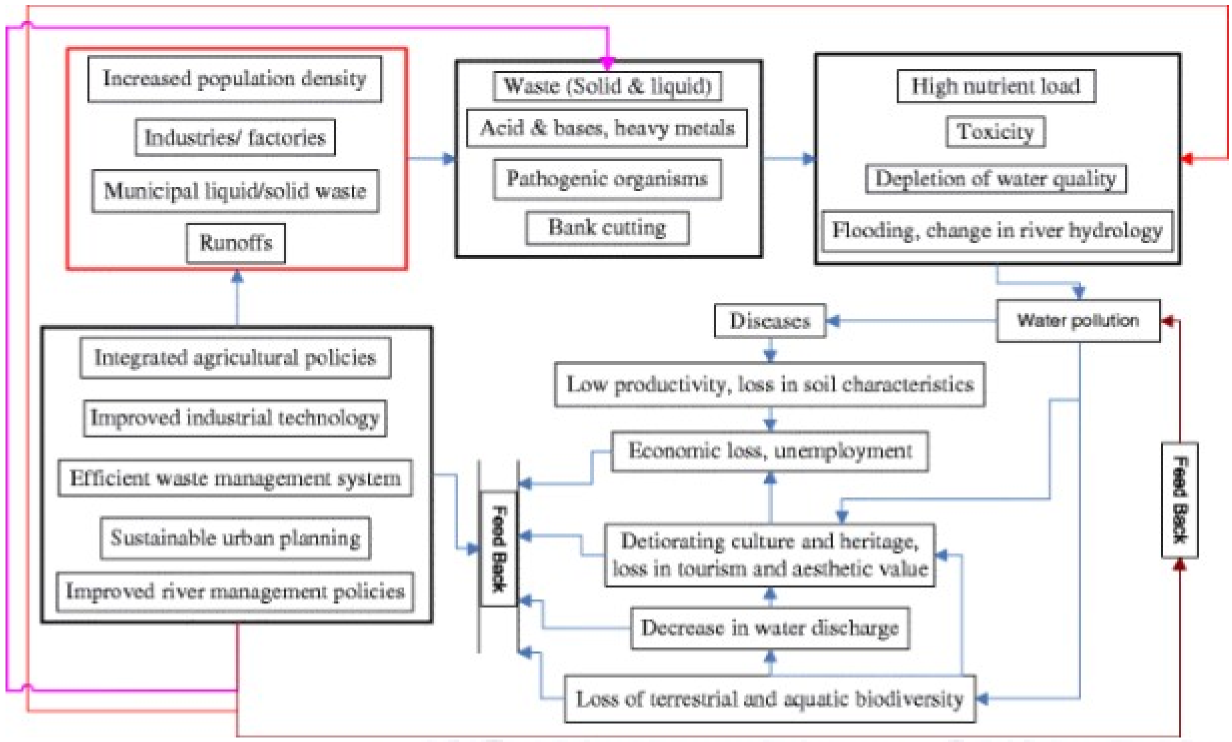
Control of water pollution requires appropriate infrastructure and management plans as well as legislation. Technology solutions can include improving sanitation, sewage treatment, industrial wastewater treatment, agricultural wastewater treatment, erosion control, sediment control and control of urban runoff (including stormwater management). Effective control of urban runoff includes reducing speed and quantity of flow.[4]

Discussion

Pollutants and their effects (sources of these pollutants are municipal and industrial wastewater, urban runoff, agricultural and pasture activities).

Pollutant	Main representative parameter	Possible effect of the pollutant
Suspended solids	Total suspended solids	✓ Aesthetic problems ✓ Sludge deposits ✓ Pollutants adsorption ✓ Protection of pathogens
Biodegradable organic matter	Biological oxygen demand	✓ Oxygen consumption ✓ Death of fish ✓ Septic conditions
Nutrients	➢ Nitrogen ➢ Phosphorus	✓ Excessive algae growth ✓ Toxicity to fish (ammonia) ✓ Illnesses in new-born infants (Blue baby syndrome from nitrate) ✓ Pollution of groundwater
Pathogens	➢ Coliforms, such as E. Coli ➢ Helminth eggs	Waterborne diseases
Non-biodegradable organic matter	➢ Pesticides ➢ Some detergents ➢ Others	✓ Toxicity (various) ✓ Foam (detergents) ✓ Reduction of oxygen transfer (detergents) ✓ Non-biodegradability ✓ Bad odors (e.g.: phenols)
Inorganic dissolved solids	➢ Total dissolved solids ➢ Conductivity	✓ Excessive salinity – harm to plantations (irrigation) ✓ Toxicity to plants (some ions) ✓ Problems with soil permeability (sodium)

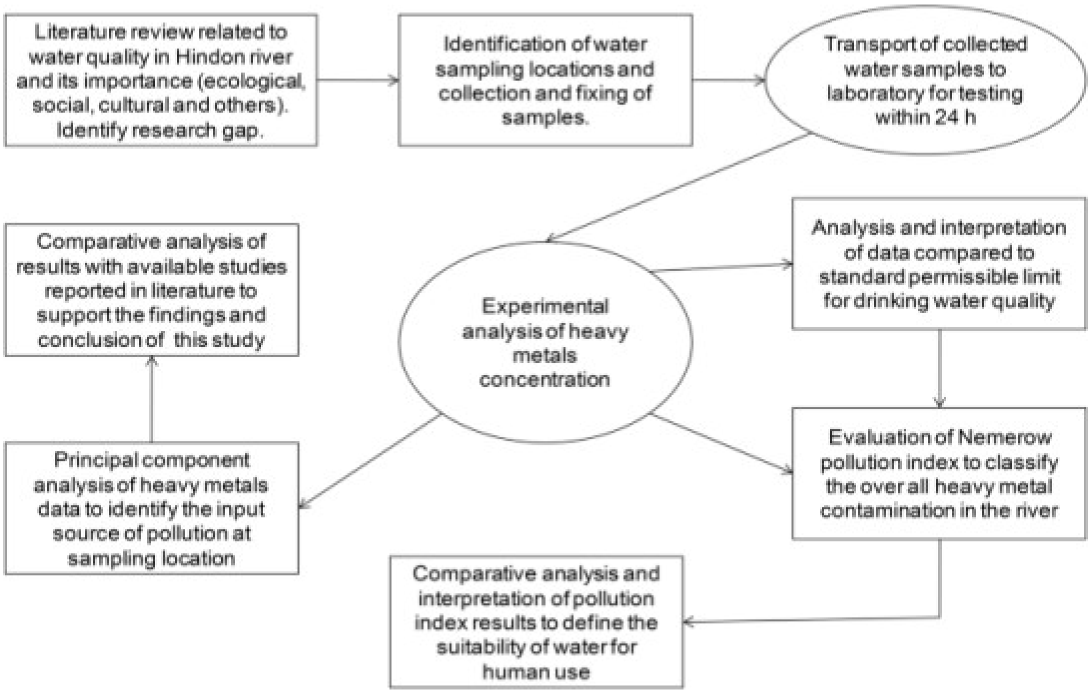
Pollutants and their effects (sources of these pollutants are municipal and industrial wastewater, urban runoff, agricultural and pasture activities). [5]



The major groups of pathogenic organisms are: (a) bacteria, (b) viruses, (c) protozoans and (d) helminths. In practice, indicator organisms are used to investigate pathogenic pollution of water because the detection of pathogenic organisms in water sample is difficult and costly, because of their low concentrations. The indicators (bacterial indicator) of fecal contamination of water samples most commonly used are: total coliforms (TC), fecal coliforms (FC) or thermotolerant coliforms, escherichia coli (EC). Pathogens can produce waterborne diseases in either human or animal hosts. Some microorganisms sometimes found in contaminated surface waters that have caused human health problems include: *Burkholderia pseudomallei, Cryptosporidium parvum, Giardia lamblia, Salmonella, norovirus* and other viruses, parasitic worms including the *Schistosoma* type. The source of high levels of pathogens in water bodies can be from human feces (due to open defecation), sewage, blackwater, manure that has found its way into the water body. The cause for this can be lack of sanitation or poorly functioning on-site sanitation systems (septic tanks, pit latrines), sewage treatment plants without disinfection steps, sanitary sewer overflows and combined sewer overflows (CSOs) during storm events and intensive agriculture (poorly managed livestock operations).

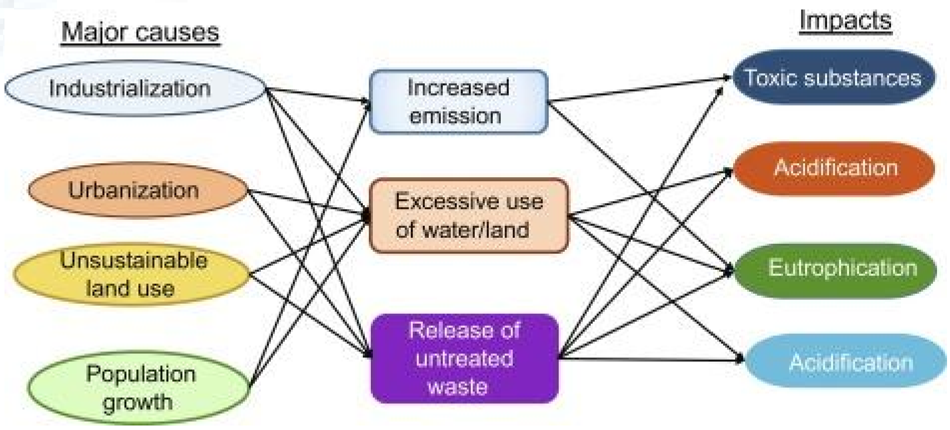
Solid waste can enter water bodies through untreated sewage, combined sewer overflows, urban runoff, people discarding garbage into the environment, wind carrying municipal solid waste from landfills and so forth. This results in macroscopic pollution– large visible items polluting the water– but also microplastics pollution that is not directly visible. The terms marine debris and marine plastic pollution are used in the context of pollution of oceans.

Microplastics persist in the environment at high levels, particularly in aquatic and marine ecosystems, where they cause water pollution.[3] 35% of all ocean microplastics come from textiles/clothing, primarily due to the erosion of polyester, acrylic, or nylon-based clothing, often during the washing process.[6]



Results

Nutrient pollution, a form of water pollution, refers to contamination by excessive inputs of nutrients. It is a primary cause of eutrophication of surface waters (lakes, rivers and coastal waters), in which excess nutrients, usually nitrogen or phosphorus, stimulate algal growth. Sources of nutrient pollution include surface runoff from farm fields and pastures, discharges from septic tanks and feedlots, and emissions from combustion. Raw sewage is a large contributor to cultural eutrophication since sewage is high in nutrients. Releasing raw sewage into a large water body is referred to as sewage dumping, and still occurs all over the world. Excess reactive nitrogen compounds in the environment are associated with many large-scale environmental concerns. These include eutrophication of surface waters, harmful algal blooms, hypoxia, acid rain, nitrogen saturation in forests, and climate change.



Groundwater pollution (also called groundwater contamination) occurs when pollutants are released to the ground and make their way into groundwater. This type of water pollution can also occur naturally due to the presence of a minor and unwanted constituent, contaminant, or impurity in the groundwater, in which case it is more likely referred to as contamination rather than pollution. Groundwater pollution can occur from on-site sanitation systems, landfill leachate, effluent from wastewater treatment plants, leaking sewers, petrol filling stations, hydraulic fracturing (fracking) or from over application of fertilizers in agriculture. Pollution (or contamination) can also occur from naturally occurring contaminants, such as arsenic or fluoride. Using polluted groundwater causes hazards to public health through poisoning or the spread of disease (water-borne diseases).[7]

In many areas of the world, groundwater pollution poses a hazard to the wellbeing of people and ecosystems. One-quarter of the world's population depends on groundwater for drinking, yet concentrated recharging is known to carry short-lived contaminants into carbonate aquifers and jeopardize the purity of those waters.

Industrial processes that use water also produce wastewater. This is called industrial wastewater. Using the US as an example, the main industrial consumers of water (using over 60% of the total consumption) are power plants, petroleum refineries, iron and steel mills, pulp and paper mills, and food processing industries. Some industries discharge chemical wastes, including solvents and heavy metals (which are toxic) and other harmful pollutants.

Industrial wastewater could add the following pollutants to receiving water bodies if the wastewater is not treated and managed properly:

- Heavy metals, including mercury, lead, and chromium
- Organic matter and nutrients such as food waste: Certain industries (e.g. food processing, slaughterhouse waste, paper fibers, plant material, etc.) discharge high concentrations of biochemical oxygen demand (BOD), ammonia nitrogen and oil and grease.
- Inorganic particles such as sand, grit, metal particles, rubber residues from tires, ceramics, etc.;
- Toxins such as pesticides, poisons, herbicides, etc.
- Pharmaceuticals, endocrine disrupting compounds, hormones, perfluorinated compounds, siloxanes, drugs of abuse and other hazardous substances
- Microplastics such as polyethylene and polypropylene beads, polyester and polyamide
- Thermal pollution from power stations and industrial manufacturers
- Radionuclides from uranium mining, processing nuclear fuel, operating nuclear reactors, or disposal of radioactive waste.
- Some industrial discharges include persistent organic pollutants such as per- and polyfluoroalkyl substances (PFAS).

Water pollution may be analyzed through several broad categories of methods: physical, chemical and biological. Some methods may be conducted *in situ*, without sampling, such as temperature. Others involve collection of samples, followed by specialized analytical tests in the laboratory. Standardized, validated analytical test methods, for water and wastewater samples have been published.[8]

Common physical tests of water include temperature, Specific conductance or electrical conductance (EC) or conductivity, solids concentrations (e.g., total suspended solids (TSS)) and turbidity. Water samples may be examined using analytical chemistry methods. Many published test methods are available for both organic and inorganic compounds. Frequently used parameters that are quantified are pH, biochemical oxygen demand (BOD), chemical oxygen demand (COD), dissolved oxygen (DO), total hardness, nutrients (nitrogen and phosphorus compounds, e.g. nitrate and orthophosphates), metals (including copper, zinc, cadmium, lead and mercury), oil and grease, total petroleum hydrocarbons (TPH), surfactants and pesticides.

The use of a biomonitor or bioindicator is described as biological monitoring. This refers to the measurement of specific properties of an organism to obtain information on the surrounding physical and chemical environment. Biological testing involves the use of plant, animal or microbial indicators to monitor the health of an aquatic ecosystem. They are any biological species or group of species whose function, population, or status can reveal what degree of ecosystem or environmental integrity is present. One example of a group of bio-indicators are the copepods and other small water crustaceans that are present in many water bodies. Such organisms can be monitored for changes (biochemical, physiological, or behavioral) that may indicate a problem within their ecosystem. The complexity of water quality as a subject is reflected in the many types of measurements of water quality indicators. Some measurements of water quality are most accurately made on-site, because water exists in equilibrium with its surroundings. Measurements commonly made on-site and in direct contact with the water source in question include temperature, pH, dissolved oxygen, conductivity, oxygen reduction potential (ORP), turbidity, and Secchi disk depth.[9]

Conclusions

One aspect of environmental protection are mandatory regulations but they are only part of the solution. Other important tools in pollution control include environmental education, economic instruments, market forces and stricter enforcements. Standards can be "precise" (for a defined quantifiable minimum or maximum value for a pollutant), or "imprecise" which would require the use of Best Available Technology (BAT) or Best Practicable Environmental Option (BPEO). Market-based economic instruments for pollution control can include: charges, subsidies, deposit or refund schemes, the creation of a market in pollution credits, and enforcement incentives

Moving towards a holistic approach in chemical pollution control combines the following approaches: Integrated control measures, trans-boundary considerations, complementary and supplementary control measures, life-cycle considerations, the impacts of chemical mixtures.

Control of water pollution requires appropriate infrastructure and management plans. The infrastructure may include wastewater treatment plants, for example sewage treatment plants and industrial wastewater treatment plants. Agricultural wastewater treatment for farms, and erosion control at construction sites can also help prevent water pollution. Effective control of urban runoff includes reducing speed and quantity of flow.

Water pollution requires ongoing evaluation and revision of water resource policy at all levels (international down to individual aquifers and wells).[10]

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