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5. Water Pollution

Dr. Rajabhuvaneswari Ariyamuthu

Assistant Professor,
Srisairam Institute of Technology, Chennai.

5.1 Introduction:

Water pollution is one of the greatest crises facing the country. The largest source of it is the sewage water without treatment, as also water coming from pesticides-ridden fields, and chemical waste producing small and big industries. In addition to the acute problems of water pollution in developing countries, developed countries also continue to struggle with pollution problems.

5.2 Definition:

Water pollution may be defined as, “the alteration in physical, chemical and biological characteristics of water making it unsuitable for designated use in its natural state. which may cause harmful effects on humans and aquatic life.

The Contamination of water with undesirable substances which make it unfit for usage is termed water Pollution. “The pollutants include sewage, industrial chemicals and effluents, oil and other wastes.

Besides, chemicals from the air dissolved in rainwater, and fertilizers, pesticides and herbicides leached from the land also pollute water. Addition of certain substances such as organic, inorganic, biological and radiological to the water, which degrades the water quality and makes it unhealthy for use.

5.3 Sources of Water Pollution:

5.3.1 Point Sources:

Point sources of pollution occur when harmful substances are emitted directly into a body of water. Major point sources are industries, power plants, underground coal mines, offshore oils wells etc.

5.3.2 Non-Point Sources:

Nonpoint sources deliver pollutants indirectly through environmental changes.

Surface run off from agricultural fields, overflowing small drains, rain water sweeping roads and fields, atmospheric deposition etc. It is much more difficult to control. Pollution arising from non-point sources accounts for a majority of the contaminants in streams and lakes.

5.4 Types of Water Pollution:

5.4.1 Ground Water Pollution:

Groundwater- 6.2 % of total water, 30 times more than surface water. Seems less prone to pollution as soil retains contaminants due to CATION EXCHANGE CAPACITY.

But there are a number of potential sources like septic tanks, industry, deep well injection, mining etc responsible for ground water pollution which is IRREVERSIBLE.

Ground water pollution with arsenic, fluoride and nitrate are posing serious health hazards

5.4.2 Surface Water Pollution:

a. Sewage
b. Industrial effluents
c. Synthetic detergents
d. Agrochemicals
e. Oil

5.4.3 Domestic Sewage:

a. Refers to wastewater that is discarded from households. Also referred to as sanitary sewage, such water contains a wide variety of dissolved and suspended impurities.
b. It is large by volume and contains impurities such as organic materials and plant nutrients that tend to rot.
c. The main organic materials are food and vegetable waste, plant nutrient come from chemical soaps, washing powders, etc.
d. Domestic sewage is also very likely to contain disease-causing microbes.

i. Industrial Effluents:

- Wastewater from manufacturing or chemical processes in industries
- Industrial wastewater usually contains specific and readily identifiable chemical compounds.
- Mainly in the form of toxic wastes and organic pollutants.
- Chromium, mercury, lead, copper, cadmium etc.

ii. Synthetic Detergents and Oils:

- Added because of washing clothes, cleaning utensils.
- In industries for washing
- Add surfactants and soaps to water
- Toxic to fish, aquatic life.
- Oceans are polluted by oil on a daily basis from oil spills, routine shipping, run-offs and dumping.

- Oil spills make up about 12 to 15% of the oil that enters the ocean. The rest come from shipping travel, drains and dumping.

iii. Agrochemicals:

- Routine applications of fertilizers and pesticides for agriculture and uncontrolled run off in water bodies.
- Adds Nitrogen and Phosphorus to water
- Causes Eutrophication and algal blooms.
- Nitrate concentration is above the permissible level of 25 ppm in 14 states, covering 102 districts.

iv. Ground Water Pollution:

- Septic tanks
- Mining
- Deep well injection
- Arsenic, Nitrate, Fluoride

v. Fluoride Poisoning:

- Fluoride when ingested in small quantities (<0.5 mg/L) is beneficial in promoting dental health by reducing dental caries, whereas higher concentrations (>1.5 mg/L) may cause fluorosis. Fluoride exposure in humans is related to (1) fluoride concentration in drinking water, (2) duration of consumption, and (3) climate of the area. In hotter climates where water consumption is greater, exposure doses of fluoride need to be modified based on mean fluoride intake. Various cost-effective and simple procedures for water defluorination techniques. The study investigated the geochemistry and occurrence of fluoride and its contamination in groundwater, human exposure, various adverse health effects, and possible remedial measures from fluoride toxicity effects.
- Fluoride had been reported to cause depressions in DNA and RNA synthesis in cultured cells and significant reductions in DNA and RNA levels in mice.
- Conditions including ageing, cancer, and arteriosclerosis are associated with DNA damage.

vi. Arsenic Poisoning:

- The recommends a limit of 0.01 mg/l of arsenic in drinking water. Exposure to high enough amounts of arsenic can be fatal.
- High levels of arsenic above the permissible levels of 50 parts per billion (ppb) are found in the alluvial plains of Ganges covering six districts of West Bengal.
- Ground water continues to be the most common source of arsenic poisoning. One of the most effective preventive measures against arsenic poisoning is to make sure you drink clean, filtered water. Arsenic contamination of drinking water causes a disease called arsenicosis, for which there is no effective treatment.

- There's no specific method used to treat arsenic poisoning. The best way to treat the condition is to eliminate arsenic exposure.

vii. Effects:

- Depletion of dissolved oxygen
- Eutrophication
- Biomagnification
- Blue baby Syndrome
- Minamata disease
- Pathogen spreading diseases
- Genetic deformities

viii. Marine Pollution:

- River discharge, manmade pollution and oil spills etc.
- An excessive amount of mercury in water can cause Minamata disease in humans and dropsy in fishes; Lead in large amount can cause dyslexia,
- Polluted water has less amount of Dissolved oxygen (DO) content which is important for sensitive organisms, thereby eliminates sensitive organisms.
- Excess of nitrate in drinking water is dangerous for infants and human health, excess fluoride causes neuromuscular disorder and teeth deformity, hardening of bones and painful joints.
- Biological magnification and eutrophication occur.

ix. Control Measures of Water Pollution:

- Usage of water should be minimized by changing the techniques involved.
- Recycling and Treatment of water before leaving in water bodies.
- The quantity of discharge of wastewater can be minimized and Restoration of polluted water bodies.
- Excessive use of fertilizers and pesticides should be avoided.
- Organic farming should be increased.
- Judicious use of agrochemicals. Avoid use of these on sloped lands.
- Using Nitrogen fixing plant instead of fertilizers.
- Reducing pesticides by adopting integrated pest management.
- Prevent run-off of manure. Divert run-off to basin for settlement.
- Separate drainage for sewage and rain water to prevent overflow of sewage with rain water.
- Planting trees will reduce pollution by sediments and will prevent soil erosion.
- Total solids, BOD, Chemical Oxygen Demand (COD), nitrates & phosphates, oil & grease, toxic metals etc.
- Primary & secondary treatment reduce BOD, COD levels.
- Advanced treatment removal of nitrates & phosphates will prevent eutrophication.

5.5 Water Quality Standards:

a. INDIAN STANDARD INSTITUTION—ISI
b. WORLD HEALTH ORGANISATION—WHO
c. INDIAN COUNCIL OF MEDICAL RESEARCH—ICMR
d. UNITED STATES PUBLIC HEALTH SERVICE—USPHS