Dr. UMESH KUMAR

DEPARTMENT OF BOTANY

U.R. COLLEGE ROSERA
(SAMASTIPUR)

B.Sc. PART- II
(BIOLOGY SUBSIDIARY).
[GROUP- D]

(i) WATER POLLUTION.

B.Sc. Part - II [Botany subsidiary]

Group - 'D'

Water Pollution

Pollution [Pollute: To contaminate] → "Any undesirable change of the physical, chemical or biological characteristics in the atmosphere, lithosphere and hydrosphere which is harmful to man directly or harmful to him indirectly through his animals, plants, industrial units or raw materials is called pollution.

Pollution is defined as a deviation from the natural composition of a part of the environment, resulting in adverse effects of life. Pollution is usually brought about by the addition to the environment of waste products of human activity. When the waste products are not efficiently assimilated, decomposed or otherwise removed by the natural, biological and physical processes of the biosphere, adverse effect may result as a pollutants accumulate or as converted to more toxic substance.

Water pollution is degradation of quality of water due to addition of substances (e.g; silt), chemical (e.g: metals, inorganic and organic) or factors (e.g; heat) and deprivation that makes it a health hazard, unfit for human use, use by animals and industries as well as growth of aquatic biota.

Sources of water Pollution

water pollution is both natural and anthropogenic.

(A) Natural water Pollution → It is water pollution caused by natural process of soil erosion, addition of clay or silt and run off and leaching

(B) Anthropogenic Pollution → It is

(Anthros: Human)
(Genesis: To produce)

man-made pollution. It is caused by human activities. Anthropogenic pollution is as follows -

(1) Domestic sewage or municipal waste water → It is waste water carried out by municipical sewerage system. It contains waste from Kitchen, toilets, household washings and some industries located located in or around municipal areas (e.g; animal sheds, slaughter houses, canning industries, tanneries and commercial establishments)

Only 0.1% of municipal waste water is sewage or waste organic matter. It consists of grit, biodegradable organic matter, pathogenic contaminants and inorganic salts. Their relative quantity is variable. Grit forms the suspended components. Organic produces both suspended and colloidal matter while inorganic salts form the dissolved fraction.

Many municipalities of the country still dunot possess sewage treatment plants. They allow the raw sewage to pass directly into rivers, canals and large stationary water bodies. Most rivers of India including Ganga, Yamuna and Gomti have been heavily polluted by discharge of these waste water by municipalities.

(2) Industrial waste water → Both small and large industries such as chemical industries, petrochems. coils, paper manufacturing, metal extraction and processing produce waste water and effluents having types of organic and inorganic pollutents. They are discharged into rivers and other water bodies.

(3) Hot water → many effluents produce hot effluents. Several industries use water as a coolent e.g. thermal plants, oil refineries. They produce

hot water which has a temperature (4)
of 8°-10°c higher than the intake water. Hot water passing into water bodies rises its temperature. It causes thermal pollution. It reduces dissolved oxygen or 'DO' content of water which reduces aerobic decomposition, increases organic loading promotes aerobic breakdown through putrefaction and fermentation. A lot of toxic chemicals are burned.

(4) Run off from Agriculture fields

It is of three types -

(i) Animal wastes → Animal excreta from cattle sheds, pisseries and poultry farms, is often dumped in bits. The same is washed during rains into water bodies. Decompuer activity is increased.

(ii) Fertilizers → Part of fertilizers added to crop fields are passed down into water bodies. They enrich them and bring about eutrophication.

(iii) Pesticides → Pesticides include insecticides, fungicides, nematicides, rodenticides, herbicides, algicides and soil fumigants. They are chemically chlorinated hydrocarbons, organophosphates, metallic salts, carbamates, thiocarbamates and acetic acid derivatives. They enter food chain, accumulate in adipose tissues and show biomagnification

⑤ Run off from Urban and Industrial sites. → It occurs during rains. Run off and storm water from urban areas mainly contains garbage and organic remains. They are biodegradable pollutants which cause eutrophication. Run off from industrial sites contains pollutants of different type like acids, alkalies, inorganic compounds, heavy metals and other toxins. ⑤

(6) Oil spills → An oil spill is an accidental and incidental discharge of petroleum in oceans, estuaries and rivers. The main sources are offshore exploration wells, oils refineries, capsized oil tankers, loading and unloading of tankers. Oil spills spread over large stretches.

Water Pollutants

Those organisms or substances which create water pollution are called water pollutants.

Types of water pollutants

(i) Biological Pollutants → They include pathogens, such as viruses, bacteria, protozoa, algae and worms, cyanobacteria

(ii) Chemical Pollutants → They are both organic and inorganic chemicals. Organic chemicals are pesticides (biocides)

polychlorinated biphenyls (PCBs, used in fire resistances), dyes, paints and organic wastes. Inorganic chemicals are heavy metals (e.g. Ni, As, Pb, Cd, Hg) and salts (e.g. fluoride, nitrite, phosphate, sulphide).

(iii) Physical Pollutants → They are hot industrial effluents, hot water, oil spills and oil wastes.

Effects of water Pollution

(1) Effect on Aquatic Ecosystem → Pollutants affect the biotic community of the aquatic ecosystem either directly or through depletion of dissolved oxygen (DO). The amount of dissolved oxygen depends upon surface turbulence, photosynthetic activity, temperature, consumption by animals and consumption by decomposers.

A healthy aquatic ecosystem has a dissolved oxygen (DO) content 14.0 mg/l litre. A DO content below 8 mg/l litre indicated pollution. In heavily polluted water, the DO may fall below 4.0 mg/l litre. Due to depletion in DO aquatic biota do not respire properly. They start to die.

(2) Effects on Human Health → Municipal waste waters contain a number

of pathogens, They spread veriously water born diseases like jaundice, cholera, typhoid, amoebiasis etc. Such sewage contaminated waters are unfit for drinking, bathing, swimming, cattle and even irrigation. Industrial waters contain heavy metals which cause serious health problems.

(i) Mercury → It is released by paper and paint industries, combustion of coal and smelters. In water it is changed to soluble dimethyl state, $Hg(CH_3)_2$. The latter enters food chains and get concentrated with the rise in trophic level. It poisons aquatic animals. Regular intake of meat from such poisoned fishs causes minimata or minomata disease. This disease is first reported in "Minamata village" of Japan in 1953.

Symptoms of minomata disease

→ Impairment of various diseases (tactile, vision, speech and hearing).
→ Numbness of lips and limbs
→ Repeated diarrhoea
→ Haemolysis and meningitis.

It ultimately leads to death.

(ii) Cadmium → The metal is released by welding, electroploting, pesticides

and metallurgical industries. In human beings it accumulated in liver, kidney and thyroid The pollutant causes nausea, vomiting, diarrhoea, cramps, hypertension. testicular atrophy, liver and lung cancers, skeletal deformities due to softening of bones and multiple fractures. The disease is called "itai - itai"

(iii) Lead → The contaminant is released by battery, pesticides, paint and chemical industries. The disorder produced by use of lead polluted water is called 'plumbism.' It is characterised by colic, bluish lines around gums, anaemia, loss of appetite, convulsions, irreperable damage to kidneys, liver and brain.

(3) Ground water Pollution → Ground water is being polluted by percolation of water from agriculture runoff, gravitational flow in fields, seepage from sanitary pits, sewerage channels and water bodies receiving municipal and industrial waste waters. Following diseases occurred by ground water pollution

(i) Methaemoglobinaemia → It is caused by presence of nitrate in drinking water.

Nitrate is changed into nitrite in alimentary canal. Nitrite passes into blood and oxidises ferrous ion of haemoglobin into ferric ion. The modified ferric haemoglobin is called 'methaemoglobin'. It is unable to carry oxygen. Therefore, oxygen transport is impaired. It results in cyanosis especially in infants where it is called blue-baby syndrome. In adults the disorder causes breathlessness, nausea, vomiting and drowsiness.

(ii) Fluorosis → It is caused by presence of excess fluorine or fluoride in drinking water. It causes mottling of teeth if the contamination occurs during enamel forming stage. Bones undergo both 'osteosclerosis' and 'osteomalacia' resulting in hardening, stiffening and bending of bones that bring about painful joints. The disorder is called "skeletal fluorosis."

(iii) Black foot disease → It is caused by arsenic in drinking water. Arsenic pollution causes repeated diarrhoea, hyperkeratosis or skin thickening, peripheral neuritis (inflammation of peripheral nerves), lung and skin cancers. There is vascular insufficiently

and hyperpigmentation resulting in gangrenous condition known as "black foot disease."

(4) Biomagnification [Bioconcentration]

Biomagnification is increase in concentration of persistent pollutants (DDT) or other substances such as toxic chemicals, heavy metals per unit weight of the organism with the rise of trophic level. It is caused by non-utilization of the substance in metabolism, accumulation in fat and non-breakdown by decomposers.

Extensive use of DDT (dichlorodiphenyl trichloroethane) resulted in several disorders in higher trophic level like disturbed calcium metabolism in birds causing thinning and premature breaking of egg shells resulting in death of embryos. So population of many predator birds declined.

Other disorders caused by DDT magnification are liver cirrhosis, softening of brain, hypertension, cerebral hoemorrhage, defective sex-hormones.

(5) Eutrophication [Eu = well, trophic = nourishment]

It is a nutrient enrichment of water body resulting in increased growth of

algae, other plants and animals. Increased growth of algae is called algal bloom. Bloom formation reduces light to submersed plants and aquatic animals which get killed.

Control of water Pollution

(1) Treatment of waste water → The sewage is taken to sewage treatment sites. In this industrial and municipal waste waters are treated in Effluent Treatment Plant (ETP) before their discharge in water bodies.

(2) Recycling of wastes → Gobar gas plant can be used for prevention and control of water pollution and to recycle the various kinds of waste products.

(3) Reverse Osmosis [RO] → By this technique brackish water is demineralised by pumping it through a semipermeable membrane under strong pressure.

(4) Thermal pollution can be checked by employing heat or dry cooling towers.

(5) Water hyacinth removes biological and chemical pollutants. It also removes metals like Cd, Hg, Pb and Ni.

Dr. Umesh Kumar
Department of Botany
U.R. College, Rajera
Mobile → 9490850876