Water Pollution and Its Effect on Aquatic Life

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Abstract

Water quality issues have been the main challenges that humanity has faced for so many decades. Natural water contamination in almost all areas of the world has become a major public concern. The main groups of aquatic pollutants, their effects on animals, and approaches to water resource pollution reduction are examined here. Chemical pollution is emphasised, particularly inorganic and organic micropollutants. Also discussed are several aspects of waterborne diseases and the urgent need for improved sanitation. The review examines current scientific developments in dealing with the large variety of pollutants. Persistent organic pollutants (POPs) have also, on a global scale, affected water sources. The most important sources of long-term regional and local water pollution have been geogenic pollutants, mining activities and hazardous waste sites. Shorter-term effects on regional and local scales are achieved by agricultural chemicals and waste-water sources.A major global problem is water pollution. Water pollution has been proposed to be the leading cause of death and diseases worldwide. The Global Oceanic Environmental Survey (GOES) organisation considers water pollution to be one of the major environmental problems that in the next decades may pose a danger to the existence of life on earth.

Key Words : *Agriculture waste, geogenic, micropollutants, mining, pathogens, wastes, deep reservoir.*

Introduction

Water is life and its resources have been most exploited natural systems since man strode the earth. Thus water is essentially required by all kinds of life, and is most abundantly available on this planet. It is among the best solvents and is unique in many physico-chemical ways. It is the medium of life. Edwards et al. has studied a multidimensional feature of water (1989). Chen and Twillery explained a change in the biology of contaminated water (1999). House et al. studied silicon and nitrate in fresh water (2001).

Human beings create a huge amount of waste materials and have many kinds of adverse environmental effects. The crazy rate for growth among nations across the globe jeopardised man's own health. In agriculture and industry, progress has culminated in the unrestricted use of all resources. Unlimited human manipulation of nature has disrupted the fragile ecological balance between living and non-living elements of the biosphere. We pollute, and in many ways, we affect the climate, which eventually hurts us. Water used in homes and factories pollutes the bodies of water and destroys fish and wildlife. Pollution is a gift of industrial society and affects the biosphere directly. Water is used to remove both chemical wastes and waste heat. 300000 gallons of water is polluted in the production of a ton of aluminium; over half a million gallons are used in the production of a ton of synthetic rubber (Lavaroni, O'Donnell and Lindberg, 1971). We add species, often disrupting natural balances, and we kill species. Rainforests and other habitat types are lost, thereby jeopardising species whose role is not yet established in the stability of the earth. All the large spheres are polluted by hazardous and harmful materials. This clearly illustrates that everything is indeed related to everything else.

Pollution is an adverse alteration in the physical , chemical or biological characteristics of air , water and soil that can influence the life of any living organism harmfully or create a possible health danger. Although air can be globally accounted for, water is domestic. The most valuable natural resource is water. Pollution is an adverse change in air , water and soil's physical , chemical or biological characteristics that can harmfully impact the life of any living organism or create a potential health hazard.In the work of Dugan, chemical and biological aspects and their interactions in polluted water were explored (1972). Water represents the most important natural resource. A broad range of chemicals, bacteria, and physical changes such as elevated temperature and discoloration are the specific pollutants contributing to water contamination. Although many of the controlled chemicals and substances can occur naturally, such as calcium , sodium, iron , manganese, etc. In contrast to rural,urban civilization needs more water, and the quality of discharged water in urban areas is often chemically more hazardous (Bandy, 1984). Atmospheric deposition is emerging as a significant factor in water pollution. It may be that DDT is being transported through the atmosphere to the Great Lakes from as far as Mexico and Central America (Eisenreich,1987). Any change in water caused by humans and considered by humans to be unfavourable to humans and/or for other forms of life may be described as water pollution. It may also be described as adding or altering the physical and chemical characteristics of any material to water in any way that interferes with its use for legitimate purposes. The physical chemistry of water alteration involves acidity, electrical conductivity, temperature, and eutrophication. Eutrophication is an increase in the concentration in the ecosystem of chemical nutrients to a degree that increases the ecosystem's primary productivity. Subsequent negative environmental effects, such as oxygen depletion (anoxia) and severe decline water quality can occur, depending on the degree of eutrophication, affecting fish and other animal populations. When pollutants are introduced into the natural environment , water contamination results in water pollution. The release of insufficiently treated waste water into natural bodies of water , for example, may lead to the destruction of aquatic habitats. In fact, for individuals living downstream, this may lead to public health concerns. For drinking or bathing or irrigation, they may use the same polluted river water. The world's leading cause of death and disease is water contamination, e.g. due to water-borne diseases such as cholera , dysentery, typhoid, hepatitis etc. Polluted waters are turbid, unpleasant, bad smelling, unfit for drinking, bath and washing or other purposes.

When it is contaminated by anthropogenic contaminants, water is usually referred to as polluted. In addition, natural events such as volcanoes, algae blooms, hurricanes , and earthquakes cause significant changes in the quality of water and its ecological status. In the future, climate change will intensify these issues, leading to higher water levels, the melting of glaciers and an intensification of the water cycle, with even further floods and droughts. More than a third of the people in the world are affected by the shortage of clean drinking water. Point sources and non-point sources are sources of water contamination. Point sources, such as a factory, a storm drain, wastewater treatment plant or stream, have one recognisable cause of the contamination. In USA,1987, the clean water act (CWA) concept of point source was changed to include urban storm sewer systems as well as industrial storm water, such as from building sites. Even the point sources have considerable room for improvement. Fewer than half of the 200 sewge treatment plants along the Ohio and its feeder streams meet the federal standard of 85% removal of pollution (Tye,1983). Pollution from non-point sources refers to dispersed pollution that does not come from a single isolated source. Non-point sources, including agricultural runoff, are more diffuse. The leaching of nitrogen compounds from fertilised agricultural land is a popular example. The UK Environment Agency used the blue drain and yellow fish symbol to raise awareness of the ecological effects of contaminating surface drainage. Contaminated storm water washed away from parking lots, roads and highways, called urban runoff, is also included in the non-point source category. It is possible to affect both plants and species living in or exposed to contaminated bodies of water. Water pollution 's key causes are:-

1. Sewage and other waste
2. Industrial effluents
3. Persistent Organic Pollutants (POPs)
4. Agricultural discharges
5. Pathogens

Sewage is water-borne waste originating from domestic waste and from processing plants for livestock or food. They are unable to recycle them because of the concentration of sewage and other waste in these bodies and their self-regulatory capability is lost. Due to higher emissions, the decomposition of these wastes by aerobic microbes decreases. The water's self-cleansing potential is lost and it becomes unsafe for drinking and other domestic uses. As the decomposition of sewage and other waste is largely an aerobic process, its oxygen requirements (BOD) are increased by the accumulation of these in water. After reaching the water body, phosphates present in the detergents initiate algal growth , which in turn absorbs most of the water's available oxygen. The decreased amount of oxygen in water is harmful to the growth of other species. It produces the foul smell. Some decomposing plants produce toxins as strychnine which kills animals including cattle.

Both organic and inorganic contaminants are found in industrial waste. Oils, greases, oils, plasticizers, metallic waste, suspended solids, phenols, contaminants, acids , salts, dyes, cyanides, DDT and many more are among such pollutants. From breweries, tanneries, dying textiles, paper and pulp mills, steel industries and mining operations, they are released into water bodies. Many of these pollutants cause significant problems with emissions. The hardness of water is improved by the sulphuric acid that comes out as waste from coal mines. Sodium, copper, chromium , cadmium, arsenic , lead, etc. are the other heavy metals emitted from various other industries. Approximately 180 million litres of toxic effluents containing acids and alkalis, fluorides, free ammonia, radionuclides, insecticides, dyes, mercury, hexavalent chromium and lead are released daily by industrial units in the greater Cochin region into the Periyar River.The BOD of the river has gone up to 16.2 against the usual value of 5 because of this strong discharge. Around 78 million litres of effluent are received daily by the Vembanad Lake and Chitrapuzhaestuarine water way. Two major contaminants are toxic waste or physical contaminants, i.e. heat and radioactive substances. Those emissions come from nuclear and thermal plants. Both of these plants use huge amounts of water. After use, this waste water is returned to streams , rivers or lakes at very high temperatures, impacting the aquatic life in these water bodies and destroying certain plants and animals directly, altering the composition of the food chain, reducing biodiversity of species, and promoting invasion by new thermophilic organisms. The levels of oxygen are limited by high water temperatures. This also leads to thermal contamination. The rise or fall in the temperature of a natural body of water caused by human influence is thermal pollution. Unlike chemical pollution, thermal pollution results in a change in water's physical properties. The use of water by power plants and industrial producers as a coolant is a common source of thermal pollution. The release of very cold water from the base of reservoirs into warmer rivers can also cause thermal pollution. The biodiversity of any environment is influenced by changes in the ambient temperature. In response to thermal pollution, bacterial population reduction was studied by Zeikus and Brock (1972). Temperature also influences water electrical conductance (Talbot et al., 1990), which may be a significant factor in the alteration of biodiversity. Temperature also affects the oxygen content of water (Steele, 1989), increasing temperature renders the oxygen to flee from the medium. By increasing the temperature, the rate of biodegradation of organic compounds increases, further leading to the reduction of DO and nutrient accumulation. Dale studied the propagation pattern of plants with regard to temperature and light (1986)

A group of chemicals that have been and continue to be of greatest environmental concern are denoted as POPs. A compound is commonly classified as a POP if it exhibits the following four characteristics:

1. Persistent in the environment, which means that chemical, photochemical and biological transformation processes do not lead to a significant removal of compound in any environmental compartment.
2. Prone to long range transport, thus to global distribution, even in remote regions where the compound has not been used or disposed, owning to the compound’s physical-chemical properties.
3. Bioaccumulative through the food web.

4. Toxic to living organisms, including humans and wildlife.

Two international conventions (the Aarhus Protocol and the Stockholm Convention) have listed and discussed several popular classical POPs, also called legacy POPs or the dirty dozen, with the intention of evaluating their global presence and reducing their environmental emissions. Highly chlorinated compounds such as dichlorodiphenyltrichloroethane (DDT), polychlorinated dioxins and dibenzofurans, and polycyclic aromatic hydrocarbons (PAHs) are several familiar POPs Due to the differences adverse effects, including disruption of the endocrine, reproductive and immune systems, as well as their potential to cause behavioural problems, cancer , diabetes and thyroid problems, POPs may endanger the health of both humans and wildlife. POPs pose a serious problem in the sense of global water contamination, largely due to their especially high bioaccumulation and biomagnification potential in aquatic food webs. Critical amounts of POPs in freshwater and marine fish and in marine animals and, as a result, in human milk and human tissues of people relying on these food supplies have been identified in a series of monitoring studies. The most urgent action to be taken by the international community, from an environmental policy point of view, is to phase out POPs that are already in use and to ensure that no new chemicals with POP characteristics come on the market (Rene P. Schwarzenbach et al,2010).

Agricultural discharges primarily contain chemicals and pesticides used as fertilisers. An significant source of water contamination is known to be crude agricultural activity. Blanchard and Lerchard also found pesticides in river water (2000). In river water, herbicides used in agriculture were also identified (Galiulin et al., 2001). In order to maintain and increase crop yields through the control of fungi, weeds, insects and other pests, three to seven million tonnes of pesticides are produced annually. The natural world is affected by these chemicals. Our wells and ponds are accessed by nitrate fertilisers used on the soil. This renders water unfit for drinking, but causes diseases as wellI. In our body, the microbial flora of the intestine converts thi nitrate into nitrites which form methaemoglobin in combination with blood haemoglobin. It interferes with the ability of the blood to carry oxygen and induces a disease called methemoglobinaemia.The Mediterranean also receives considerable farm related pollution. ivers carrying nutrient runoff from the farming areas of Southern Europe contribute most to this problem. The Rhine and Po rivers are particularly bad(Helmer, 1977). In addition these rivers carry metals, organic matter, suspended solids, pesticides residues and many other pollutants found in domestic, industrial or agricultural dicharges. In Rajasthan, nitrate poisoning is common due to hard and saline water. In addition to sewage, fertilisers like phosphates and nitrates render water bodies rich in nutrients and become more active. This is referred to as eutrophication, which. It leads to the decrease in the levels of oxygen and an increase in the levels of Carbondioxide. It causes death of fish and other animalsThe clean body of water finally becomes a stinking drain. According to Pearson(1985), pesticide-related deaths are estimated at 10000 per year in developing countries and about 1.5-2 million people suffer from acute pesticide poisoning. Some chemicals such as DDT, lead , copper, strontium 90 and mercury reach our food chain through water, where their concentration continues to increase with the coming trophic level. This is known as biological magnification or biological amplification. This is the reason why our food grains as wheat, rice, vegetables and fruits contain varying amounts of pesticide (S.K. Sharma,R. Sanghi.2012).

Disease-causing microorganisms are considered pathogens. Pathogens can cause waterborne diseases in either human or animal hosts. As a bacterial indicator of water pollution, coliform bacteria are commonly used, and are not a true cause of disease. Other microorganisms that have caused human health problems often found in polluted surface waters include: Burkholderia pseudomallei, Cryptosporidium parvum, Giardia lamblia, Salmonella, Norovirus and other viruses, Parasitic worms like Schistosoma type. Older cities with ageing infrastructure may have leaky systems for collecting waste (pipes, pumps , valves) that can cause sanitary systems (pipes, pumps , valves). Some cities also have combined sewers, which during rain storms can discharge untreated sewage. Silt from discharges of sewage also pollutes bodies of water.

Pathogen discharges can also be caused by livestock operations that are poorly managed.

Contaminants and pollutants

When released into the atmosphere, the contaminants gain entry into the water through dissolution and from any of the three media, such as water , soil or air, will enter a biological system. Such pollutants are distinguishable as —-

1. Simple biodegradable pollutants provide simple wastes that are degraded into harmless constituents easily and rapidly. This group includes household waste, organic matter of plant and animal origin, faecal matter, blood , urine, etc.
2. Complex biodegradable contaminants include waste resistant by biological agencies to degradation. In the climate, they degrade very slowly and persist for a long period of time. In this category are synthetic chemicals, persistent pesticides, plastics, various polymers, polymeric resins, petroleum crude, etc.
3. Non-degradable pollutants include wastes which are not degraded by biological agencies. Heavy metals and toxic trace elements are placed in this group.
4. Pollution caused by physical agents include the pollution caused by harmful and irritating physical agents such as noise, heat and radiation etc. Thermal, noise and radioactive pollutants are placed in this group.

One common path of entry by contaminants to the sea are rivers which directly discharge their sewage and industrial waste into the ocean which leads to surface water pollution. In fact, the ten largest emitters of oceanic plastic pollution worldwide are, from the most to the least, China, Indonesia, Philippines, Vietnam, Sri Lanka, Thailand, Egypt, Malaysia, Nigeria, and Bangladesh, largely through the rivers Yangtze, Indus, Yellow, Hai, Nile, Ganges, Pearl, Amur, Niger, and the Mekong, and accounting for ninety percent of all the plastic that reaches the world's oceans. Large gyres or vortexes in the oceans trap floating plastic debris. On their way to sea, rivers add huge amounts of sewage, garbage, agricultural discharge, pesticides and heavy metals to it. Trash or waste, e.g. paper , plastic or food waste disposed of by people on the ground, along with accidental or deliberate dumping of waste, washed into storm drains by rainfall and ultimately dumped into surface waters. High levels of natural substances, such as calcium , sodium, iron , manganese, etc., may have harmful effects on aquatic flora and fauna. Approximately 1,500 substances have been identified as pollutants in freshwater ecosystems and a generalised list of pollutants includes acids and alkalies, anions (e.g. sulphide, sulphite, cyanide), detergents, domestic sewage and manure, food processing water, chlorine, ammonia gases, heat, metals(cadmium, zinc, lead), nutrients (phosphates, nitrates), dispersants of oil and oil, organic water, chlorine gases, ammonia, heat, metals (cadmium, zinc, lead), nutrients (phosphates, nitrates), dispers of oil and oil. Toxic chemicals from ocean waste can be ingested by plastic litter in the sea and seas, potentially killing any organism that consumes it. Many of those long-lasting bits end up in marine birds and animals' stomachs. This results in digestive pathways being obstructed, leading to decreased appetite or even hungerThere are a number of secondary effects that stem from a derivative state, not from the original pollutant. An instance is silt-bearing surface runoff, which in aquatic plants can inhibit the penetration of sunlight through the water column, hampering photosynthesis. In addition to these discharges, the disposal into the sea of tar, petroleum products and waste radionuclides such as Sr-90, CD-137, Pu-239 and Pu-240 also causes marine contaminationIn the sea of commercial fleets, large amounts of plastic are being discarded, while over 300 million lb are entering the USA by inland waterways. Most sea birds consume plastic that triggers gastrointestinal disorders. Some chemicals cause more significant damage, such as egg shell thinning and damage to the tissue of the egg. The most serious pollutant in marine water is tar. Every year, about 285 million gallons of oil was leaked into the ocean, mostly from transport tankers. More than 90000 litres of waste oil was obtained in 1984 from the Indra Dock basin alone. Oil contamination, including algae, fish , birds and invertebrates, causes damage to marine fauna and flora. Approximately 50000 to 250000 birds are killed by oil every year. The oil is soaked in the feathers, displacing the air, thereby interfering with body temperature buoyancy and maintenance. In the food chain, hydrocarbons and benzpyrene accumulate and human consumption of fish can cause cancer. Often hazardous to aquatic species are detergents used to clean up the spill. In certain parts of the planet, the geological structure of aquifers is the primary cause of the leaching of radioactive elements into the source of drinking water. Arsenic, fluoride, selenium and a few others, such as chromium and uranium, are the key elements of concern.

Arsenic has so far caused the greatest negative health effects, as well as global concern, of all the elements listed above. Arsenic-contaminated ground water affects between 35 and 75 million people in Bangladesh alone. In West Bengal in India, about 6 million people are at risk and other regions of concern include the heavily populated river deltas in Cambodia and Vietnam. Arsenic contamination in other areas of the world, such as the United States and Eastern Europe, is also of concern. High pigmentation of the hands and feet (Keratosis), high blood pressure, skin cancer, lungs, other internal organs and neurological deterioration result from the accumulation of arsenic in the skin , hair and nails. A possible solution is given by deep aquifers or rainwater harvesting.

Mercury reaches water both naturally and by industrial waste. The inorganic and organic forms are also extremely toxic. Mercury was blamed in Japan and Sweden for the Minamata outbreak that caused many deaths. The disaster occurred due to the intake by the villagers of heavily mercury-contaminated fish as the mercury is metabolically transformed by anaerobic microbes at the bottom of the water body into methyl mercury. This material is extremely persistent and therefore accumulates in the food chain. It is soluble in lipids and so accumulates in fatty tissues after being taken by animals. Fish can directly accumulate methyl ions. Nearly 3000 times more mercury could be found in fish than in water. Minamata symptoms include malaise, numbness, visual confusion, dysphasia, ataxia, mental deterioration, seizures, children's teratogenic effects, and final death. A single chloride manufacturing plant using mercury chloride as a catalyst was the source of mercury to the bay. Many rivers and lakes are still polluted in Sweden due to the extensive use of mercury compounds in the paper and pulp industry and in agriculture as fungicides and algicides. In Japan and Canada, these factories also cause mercury emissions (Gray NF. 2005).

In adults, lead poisoning is common. Effluents from the lead and lead manufacturing industries are the main source of water lead. Lead is also used to flavour and sweeten insecticides, meats, drinks, ointments and medicinal concoctions. Lead exposure causes liver and kidney damage, reductions in the formation of haemoglobin, constipation, stomach pain, mental retardation, neuromuscular or lead-lapse symptoms, fertility and pregnancy abnormalities, symptoms of the central nervous system or CNS syndrome that can lead to coma and death.

Fluorine is detected in nature as fluoride. The fluoride content of crop plants grown in high fluoride soils in rural, non-industrial areas was as high as 300 ppm. Endemic fluorosis has been caused by the ingestion of fluoride-rich water from wells in Punjab and Haryana. Dental fluorosis was also caused by elevated fluoride water content in Andhra Pradesh. Fluorosis affects between 20-25 million Indians on average. In Rajasthan, Jodhpur, Bhilwara, Jaipur, Bikaner, Udaipur, Barmer and Ajmer, this problem is more severe. Prolonged water-containing fluoride ingestion contributes to humped back, stiffening of bone joints, mottling of teeth, pain in the bones , joints, and knee weakening of the legs (Knock-knee syndrome). It also induces decreased development of milk, lameness and lithargy in cattle.

In our country all the fourteen major rivers have become polluted. Godavari, Ganga, Gomti, Cavery, Narmada and Mahi all are facing pollution problems. Panesar et al. (1985) conducted an analysis of the chemical composition of waste water in Amritsar city, in which they reported on the suitability of water for different uses. Olaniya et al. (1976) researched pollution in the Chambal River at Kota and confirmed that the water was moderately polluted at most of the study sites. Mitra conducted a comparative study of the chemical characteristics of surface water in the Godavari, Krishna and Tungbhadra rivers (1982). Bhargava (1977) also performed similar comparative research between the Ganga, Yamuna and Kali rivers. River Godavari chemistry was studied by Ganpati and Chacko in

Rajamundhary (1951). Fresh water pond management in Varanasi was conducted by Mishra (1993). Hakim studied pollution in the Gandak River at Samastipur (1984). A large number of scientists at the Nagpur National Environmental Engineering Research Institute (NEERI), A large number have studied the pollution of the river Ganga. In Mirzapur by Shukla (1989) and in Varanasi by Shukla et al, physico- chemical characterisation of the same was studied (1989). In the river Ganga, bacteriological contamination was studied by Shukla et al. (1992) and in the river Varuna by Shukla et al (1988). The reports support the existence of a large number of pathogenic and non-pathogenic micro-organisms well beyond their limit of excess. The consistency of sewage water entering the Yamuna river was investigated by Sharma et al (1981). The water quality of the Yamuna river was studied in Agra by Sangu et al. (1984) and in Okhla by Mohan et al (1965). Kaushik and Prasad (1964) studied bacterial research at Yamuna in Delhi. Compared to the Ganga River, the biological properties of the Yamuna river are much weaker in most cities. The Indian Gomati River study of blue-green algae was performed by Prasad and Saxena (1980). Similar studies were carried out in Orissa on the Mahanadi River (Patra et al., 1984). River Bhadra pollution in Mysore was investigated by David (1956). The pollution analysis of selected rivers in Andhra Pradesh was carried out by Venkateshwarlu (1986). Rao and Govind have studied pollution in the Tungbhadra reservoir (1964). The physico-chemical properties of Hoogly estuary water at different points were carried out by Basu (1966). Agrawal and Srivastava (1984) carried out pollution studies at Allahabad in Ganga and Yamuna. The waste water from nuclear power plants is not as hot, but still has adverse effects on aquatic life. These are —

1. Hatching of eggs from fish.
2. Trout eggs fail to hatch.
3. Spawning failure of salmon.
4. enhancement of BOD.
5. Changes in the organism 's everyday and seasonal behaviour and metabolic responses.
6. Major change to more heat-tolerant forms of algal forms and other organisms, leading to a decline of species diversity.
7. Changes in Macrophages.
8. Migration of such aquatic species.

Wetlands are the transitional areas between aquatic and terrestrial ecosystems where water table is usually at or near th surface of land and is covered by shallow water. Dwivedi(2000) and Sharma(2006) studied biological characteristics with regard to physico-chemical properties in ponds (2000) The pH of the wetland sediment of Konkar lake of Gonda district of UP, India was found maximum (8.2) in December and minimum (7.4) in April.The temperature also varied from 23.1 to 33.3C (Sharma,A.K.,2004). Temperature is of great importance in ecological studies of the lake (Kaul,1977). Findlay (1984) conducted the study of evolving phytoplanktonic composition with regard to reducing pH in Lake 223 of Canada. pH is also considered to be an important index in determining the ecological conditions of aquatic environments (Juday,1940). Many of our lakes have become dark, with foul odour, choked due to excessive algal growth, and have silt deposits, like Dal and Chilka.Eutrophication is caused by both organic and inorganic carbon (Goldman, 1972), which eventually influences river chemistry (Crowder, 1991). Sharma researched the pollution caused by spillage (1999). In water streams, toxic organic pollutants of agricultural origin were also identified by Thanas et al (2001). In the rivers of Buenos Aires and Argentina, organic pesticides have been studied by Rovedatti et al (2001). The Ganga and its tributaries are the country's largest river basin. It was a sign of purity, but it is grossly corrupted today. The restoration of the catchment area by tree planting can reduce sedimentation. The three main sources of biological contamination are municipal liquid and solid waste, dead bodies of animals and people, and cattle wallowing. In Kanpur, the worst stretch of Ganga is. Just 12 units have operating effluent treatment plants out of about 132 medium and large industries. The construction of sewage treatment plants at the bank of the river for 27 cities is expected to handle around 1000 million litres of sewage daily before being discharged into the river. The maximum load of emission from domestic sources is from West Bengal and that from UP is from industrial sources. In the first step of the control plan, excess water can be diverted so that the river does not flood and then used beneficially. Other steps include the refurbishment of sewage pumps, the rehabilitation of trunk sewer and other cognate components, the expansion of sewerage in unsewered areas, the transfer of waste from unsewered areas to treatment plants and the construction of new treatment plants. The Ministry of Environment and Forests is currently establishing a fully fledged Ganga Project Directorate and the Central Ganga Action Plan is being implemented. It is sensible to describe both agriculture and impacts when considering the detailed impacts of agriculture and how these can be mitigated. Agriculture here means altering the landscape for the production of goods which, whether eaten or used in other ways by settled human societies, are used for sustenance or for the market. Thus, forestry, crop culture, fuel biomass production and animal husbandry are included.

The Yamuna from Wazirabad to Okhla in Delhi is the most polluted segment of the river, covering 48 km of the entire 2100 km course. A pure river of holiness has been turned into an open sewer. The water near Delhi is not suitable for irrigation, drinking, bathing, swimming , fishing, industrial refrigeration, etcWithout any chemical treatment, sewage lines release some 120 million gallons of waste water and filth into the river daily. The coliform count is an indicator of sewage pollution. The coil shape count is 75/100 ml when the river enters Delhi at Wazirabad and when it leaves at Okhla, the number becomes 240000/100 ml. In the recent past, there have been epidemics of jaundice, cholera and hepatitis in the trans-Yamuna regions (Gupta, P.K. Salunkhe,D.K. 1985).

Ocean pollution

Pollution of the oceans is indeed a great problem. Although the dynamics of biomagnification may indeed lead to the contamination of high tropic-level organisms over wide expenses of world's oceans (Barber and Warlen,1979; Gossett, Brown and Young,1983). The pollution of coastal areas is very serious. It is mainly caused by oil spills, sewage and other wastes. High levels of nutrients, different types of disease causing microorganisms, chemicals and low oxygen levels were found to be characteristic of coastal waters. Coastal pollution affects some of the most important natural systems on earth - the estuaries. Estuaries are important because they serve as breeding areas for species that hold key positions in many oceanic food chains and marine ecosystems. Estuaries are among the most productive ecosystems on earth. 44 percent of the assessed stream miles, 64 percent of the assessed lake acres, and 30 percent of the assessed bays and estuarine square miles were listed as contaminated in a study on water quality in the United States in 2009**(Min Shao, Xiaoyan Tang et al.)**.

Effects of Ocean Pollution on Marine Life

Statistics on the effects of ocean pollution on fish and other marine life are difficult to determine because of the number of animals involved and the size of the ocean. Scientifically, there are many unknowns. However, there have been some interesting studies done in small areas of the ocean and test groups of marine life.

In 2015 scientific review found that 693 marine species encounter marine debris. Plastic made up 92% of the debris they encountered. The same study found that the survival of 17% of the species on the IUCN Red List were threatened by marine debris. Man-made debris was found in 55-67% of all marine species according to a Nature study.

In 2017 scientific review reports that 233 marine species, 100 percent of marine turtles, 36 percent of seals, 59 percent of whales, and 59 percent of seabirds, as well as 92 species of fish and 6 species of invertebrates had plastic in them. This lead to starvation, stomach problems and even the death of the animal.Chemistry of water, controls distribution of the fishes in waterbodies as studied by Shieh et al. (1999).Multidimensional effect of environmental pollution was studied by Pritchard (1985).

Entanglement was reported in 344 species, 100% of marine turtles, 67% of seals, 31% of whales, and 25% of seabirds, as well as 89 species of fish and 92 species of invertebrates. This leads to injury, deformations, restriction in movement making them vulnerable to predators, drowning or starvation.

A Center for Biological Diversity report states that within a year of the British Petroleum oil spill in the Gulf of Mexico, 82,000 birds of 102 species were likely harmed or killed. In addition, approximately 6,165 sea turtles, 25,900 marine mammals, and an unknown number of fish were harmed or killed. As of mid-June, 2010, the spill contributed to the death of 658 sea birds, 279 sea turtles, 36 sea mammals, and countless fishFive turtle species that live in the Gulf of Mexico are now endangered. According to National Geographic, embryos from two fish have heart defects, loons and whales have very high amounts of toxins in them, and 900 dolphins have been found dead. According to a Guardian study in 2017, coastal ecosystems of marine birds and animals are being polluted or damaged by marine debris floating and collected on remote islands far from regions of dense human populations. So ocean pollution impacts all regions of the marine world as ocean currents move water around the world. The effects of ocean pollution on marine life are -

1. Effects of oil on the ocean
2. Coral reef impact
3. Toxic materials

The increase of pollutants in the world's oceans is affecting the variety of creatures that live in the ocean. Although the big oil spills from offshore drilling get a lot of attention, there are millions of gallons of oil dumped into the world's oceans every year from other sources. According to National Oceanic and Atmospheric Administration (NOAA), there are four main ways oil pollution occurs, and man-made causes account for more than half of it. These are Natural oil seeps originating from the ocean beds spreads into the seas and accounts for 45% of oil pollution. Consumption of oil in various phases such as storage, and waste production like municipal and industrial waste, and urban runoff causes 37% water pollution. Oil transportation by sea causes 10% of oil pollution. Included here are the small and major oil spills that people usually associate with ocean pollution. Offshore oil extraction processes release 3% of oil also into the ocean. Oil is dangerous to marine life in several ways. According to the NOAA , if fur-bearing mammals or birds get oil on their fur or feathers, they may not fly or move properly, maintain body temperature, or feed. The oil washes up on beaches and contaminates nesting areas and feeding grounds. As marine mammals try to clean themselves, they may ingest oil which can poison them. Although fish and shellfish aren't impacted in deep seas, those living, feeding or spawning in shallow waters can be vulnerable resulting ultimately in death. according to the University of Delaware and Office of Environmental Health Hazard Assessment, fish can also get contaminated from oil residues and become unfit for human consumption.

Oil may impact coral reefs in a negative way. These reefs are not only beautiful, they provide a habitat for many sea creatures. NOAA indicates the impact of oil on coral reefs is difficult to predict. Oil also clogs up the gills of the fish that live there and suffocates them. When oil floats on the surface, it blocks sunlight and prevents marine plants from using light for photosynthesis. These plants are important parts of the food chain and the reef habitats found in the oceans.

Toxic materials are a side effect of modern living. Thanks to water's solvency, toxic pollution often ends up in the ocean, sediment, and the sea surface micro-layer. Eight percent of pollution has non-point sources and comes from land, reports the World Wide Fund for Nature (WWF). Toxic pollution sources include industrial waste, sewage discharge, radioactive waste from power plants, nuclear dumps, and nuclear submarines, fertilizers and manure waste, household cleaning products and pollutants find their way into the ocean and sink to the bottom. Bottom feeding organisms ingest these chemicals and contaminates the food chain. The smaller fish is eaten by the larger fish, which is then eaten by a human. Toxins build up in the tissues of the people who eat the contaminated fish and may lead to illnesses like cancer, reproductive disorders, birth defects, and other long-term health problems. The National Resources Defense Council offers a guide to fish you should avoid due to high mercury and PCB content. Fertilizers, sewage, and household waste loaded with phosphorus and nitrogen cause nutrient pollution points out Environmental Protection Agency (EPA) that cause dead zones in seas. Plastic bags, balloons, medical waste, soda cans, and milk cartons all find their way into the oceans of the world. These items float in the water and wash up on beaches. According to the WWF, marine debris creates health hazards for marine life.Ocean mammals get entangled in old nets and drown because they cannot get to the surface for air. Birds, turtles, and fish ingest a variety of plastic items, especially micro-beads and their digestive systems become clogged, reports The Guardian. Sea turtles are attracted to floating plastic bags which appear to be jellyfish, one of their favorite treats. The plastic bags block their digestive system and cause a slow and painful death. Various pieces of trash cause entanglement, starvation, drowning, and strangulation. When the trash washes up onto beaches and into marshes and wetlands, it ruins breeding grounds and habitats. Marine plants may be strangled by debris and die. Debris removal efforts may alter ecosystems. Daily Mail in 2017 reports that there are 5.25 trillion pieces of plastic in oceans around the world and 8 million tons of waste is added each year. Other forms of ocean pollutions like noise, acid rain, climate change and ocean acidification can also take their toll on marine life. Source water reservoirs easily become thermally and dynamically stratified. Internal pollution released from reservoir sediments is the main cause of water quality problems **(**Sharma, P.D. et al.2011)

Conclusion

Water pollution is not the fault of biodegradable contaminants alone. In addition , non-degradable or slowly decaying contaminants such as heavy metals, mineral oils, biocides, synthetic products, etc. that are dumped into water lead to a significant contamination load. The most scientific method of managing water contamination is stabilisation. It involves reducing waste input, biomass harvesting and elimination, nutrient trapping, fish conservation and aeration. In order to avoid contamination, different approaches can be used to preserve the diversity of species and ecological equilibrium in the water body. Another way to control water pollution is by recycling and reusing waste. Urban waste can be recycled to generate cheaper gas and energy from fuel. One large recycling treatment plant is already operational in Okhla, New Delhi. NEERI is also interested in the development of effective technologies for the recycling of waste water by aquaculture, the use of domestic and industrial waste water in agriculture and the biological detoxification of phenols and cynides in waste. One distillery in Gujarat is capable of handling 450,000 litres of waste on a daily basis and producing energy equal to 10 tonnes of coal.

Water pollution control requires adequate facilities and management plans. Infrastructure can include treatment plants for waste water In order to protect water bodies from untreated waste water, sewage treatment plants and industrial waste water treatment plants are usually required. The treatment of agricultural waste water for farms and the prevention of erosion at construction sites can also prevent water pollution. Solutions focused on nature are another solution to water pollution reduction. Efficient urban runoff management involves reducing the speed and volume of flow. Best management practises for water contamination in the United States include methods to reduce the amount of waste and increase the quality of water. One of the biggest issues is that water pollution kills phytoplankton, which contains 70% oxygen and eliminates a significant portion of the earth's carbon dioxide. Two countries with high levels of water contamination are India and China. Every day, 580 people in India die of water pollution-related diseases, including waterborne diseases, according to one report. In the cities of China, about 90 percent of the water is polluted. Half a billion Chinese people have no access to clean drinking water. In addition to the acute issues of water contamination in developing countries, developed countries are still also dealing with pollution problems.

By suitable methods, such as absorption, electrodialysis, ion exchange , reverse osmosis, etc., various radioactive, chemical and biological contaminants present in the water body may be extracted. To desalinate brackish water, reverse osmosis is widely used and can also be used to purify sewage water. It has been noticed that with an increase in the growth and frequency of distribution of different aquatic macrophages from polluted to non polluted sites, the phosphate and nitrogen contents of the water bodies decreased (Sharma et.al. 2004). The growth, frequency and distribution of different growth forms at non-polluted sites showed a positive relationship with transparency and dissolved oxygen content and negative relationship with water temperature. The pH value also showed similar relationship as it was found neutral to slightly alkaline at non-polluted sites which enhanced greatly the growth and distribution of aquatic macrophytes (Srivastava,A. et.al.,2007) It was probably due to high requirement of these nutrients during rapid organic production by aquatic macrophages in low and non-polluted sites (Sarkar et.al.2002). Ammonia can be removed by ion exchange technique, mercury can be removed by using mercury selective ion exchange resin, phenolics can be removed by using polymeric absorbents, by an electrolyte decomposition technique, the waste water from the printing and sari dying industries could be decolonized and sodium salts could be removed by reverse osmosis process similarly. Recently , researchers from some American laboratories have claimed that solar power is cheaply used to clean polluted waterExperiments show that chemically poisonous water ants can be broken down by a combination of sunlight and a catalyst such as titanium dioxide. Pesticides, explosives, solvents, PCBs, dioxins and cyanides can be destroyed by such photocatalytic reactions. In the books for water pollution prevention and clean drinking water, there are some very strong rules. The clean water effort can be helped by citizens by insisting that these laws be enforced. The amount of research that marine biologists, ecologists, and others have done is staggering. The growing issue of ocean and other water pollution is a worldwide concern and there is no simple and easy solution to the problem in sight. Oceans are an integral part of the Earth 's climate, and to protect marine health and, eventually, human health, they must be preserved and kept clean (PSchwarzenbach R. et al.,2003).

Enteric diseases transmitted mainly by faeces polluted with water from sick people and animals. Reliable hygienic drinking water quality criteria are also needed to determine treatment systems, including the potential for water recycling, with regard to the transfer of waterborne pathogens. Despite the urgent need for so-called pathogen indicators, there is still a shortage of quick, cheap and easy-to-use methods for global application. The hygiene principle of today is based on the identification of indicators such as a parameter of the consistency of hygienic drinking water and enteric bacterium E. Globally, coli is used as an indication of potential faecal pollution. Moreover, by counting the total number of colony-forming microbes developing on a nutrient agar plate (the heterotrophic plate count, HPC), the general microbiological condition of water is evaluated. Since the HPC method largely underestimates the number of heterotrophic microbial cells present in the water sample , the HPC was omitted from the recent hygiene parameter lists of the WHO, the European Union and the United States. As a result, it is becoming current practise to rely solely on E's presence / absence. Coli to assess the sanitary standard of drinking water. This method, however, is not ideal for monitoring the hygienic quality of the treatment and distribution of water. In Milwaukee in 1993, when chlorine-resistant Cryptosporidium oocysts from an upstream cattle farm polluted the drinking water, the weakness of this definition was painfully illustrated. In spite of chlorination and the lack of E. About 50 people died of coli after ingestion of polluted water and 400,000 people died of cryptosporid diseases(Bascom, W. et al 1982).

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