

## (2) Water: Water Pollution

'Water pollution' Central Pollution Control Board, Ministry of Environment and Forests, 2011

We have read in the last chapter that water gets polluted due to the presence of harmful substances in the water like micro-organisms, chemicals, contaminated water generated from industrial, domestic or commercial establishments etc. In fact, it is called water pollution. The physical, chemical and biological properties of water are affected due to the mixing of such harmful substances. Due to the harmful side effects of pollutants on water quality, polluted water is no longer eligible for domestic, commercial, industrial agriculture or any other common use.

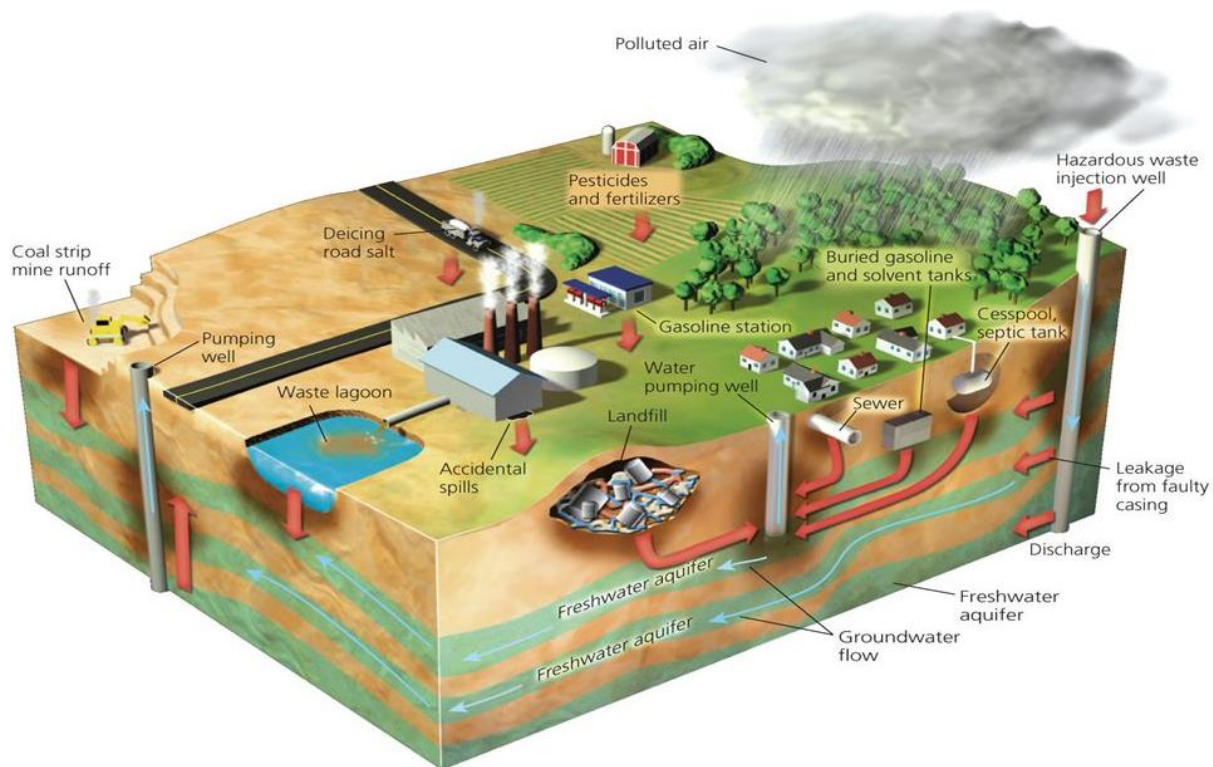
In addition to drinking, household, irrigation, agricultural work, use of cattle, industrial and commercial activities etc. consumes large amounts of water and the water used is converted into contaminated water after use. As a residue in this contaminated water, during the activities carried out through them, the parts of substances or chemicals in contact with water remain. Their presence makes the water unsuitable for use. When this contaminated water is found in a clean water source, it also contaminates it. The contaminated water contains viruses, bacteria and other harmful micro-organisms along with organic and inorganic compounds and chemicals which pollute the waters according to their nature.

Pollution of water sources occurs in two ways: - 1. Pollution through point source

Other is 2. Pollution through Wide Source

**1. Pollution through point source:** - When contaminated water comes out of a certain process and gets directly into the water source, it is called point source water pollution. In this, the nature and quantity of contaminated water found in the water source is known. Therefore, the pollution level can be reduced by treating this contaminated water. That is, point source water pollution can be reduced. Examples are the release of contaminated water through an industrial unit directly into a water source, the mixing of domestic contaminated water into a pond or river through a drain or drain.

**2. Wide source water pollution:** - When the contaminated water generated during many human activities is found in a source by different means, it is called wide source water pollution. Due to coming from different mediums, it is not possible to collect and treat them together. Such as industrial and domestic contaminated water in rivers or coming through different means.



### **The pollutant points of different waters are also different.**

**1. Rivers:** - Where industrial contaminated water is found in rivers through various drains, domestic water is also immersed in it through drains etc. Also, fertilizers, pesticides and soil effluents along with the flow of water are also found in the rivers.

**2. Pollution of seawater:** - All the rivers eventually meet in the oceans. So they are definitely polluted through them. Industrial contaminated water and sewage, pesticides, fertilizers, heavy metals, plastics, etc. are found in the sea through rivers. Apart from these, maritime pollution also occurs due to maritime activities such as sea transport, exploitation of petroleum products from the sea, etc.

Only by observing the physical condition of the watershed can they be estimated to be polluted. The increase in the number of aquatic weeds along with the color of the water, its smell, taste etc., decrease or die in the number of aquatic organisms such as fish and other animals, floating oily material on the surface, etc. are signs of water pollution. Sometimes, water may be contaminated even without these symptoms, such as acid or alkaline discharge or mixing in water bodies or meteorites from metallic pollutants. Chemical analysis of water is mandatory to detect such pollutants.

### **The nature of substances that pollute water is mainly of two types -**

1. Biologically perishable
2. Biologically non-perishable



Primarily all organic matter pollutants are biologically perishable. These pollutants are destroyed by micro-organisms present in the water. In fact, organic materials are the food of microbes. These activities of micro organisms use a large amount of dissolved oxygen in water. This is the reason that when organic matter pollutants such as sewage or contaminated water of distillation industry are found in the watershed, there is a significant decrease in the amount of dissolved oxygen in them, sometimes it happens that aquatic animals like fish etc. lack oxygen Are killed due to

Conversely, there are many pollutants that are not destroyed under normal conditions, such pollutants contain various metallic pollutants or inorganic salts.

**Some of the major pollutants are: -**

1. Sewage or other oxygen absorbent pollutants such as organic waste.
2. Contaminants of infectious nature such as waste from hospitals.
3. Fertilizers used for agricultural work, due to which water is found, there is a tremendous increase in the number of aquatic plants. Subsequently, these aquatic vegetation rotting in water gradually reduces or eliminates the use of dissolved oxygen in the water. In this way, due to rotting of vegetation, deodorant starts coming from the water.
4. Various chemicals, salts or metallic contaminated water, along with industrial contaminated water, are found in water bodies.
5. Chemical pesticides etc. used in agricultural work also mix with rainwater when coming to sources. These complex organic compounds are carcinogenic (carcinogenic) in nature.
6. Many radiation substances also flow with water and are found in natural waters.
7. The temperature of contaminated water coming out of many industries like distillation industry, power plant etc. is very high. Contaminated water with high temperature, combined

with any water, increases its temperature. Which has a direct effect on aquatic organisms and flora.

8. Domestic solid wastes also cause major pollution of water.

**Water pollutant factors can also be divided into three categories based on their physical condition: -**

**1. Depending on the suspended state in water: -** Many water pollutants remain suspended in water. The size of these particles is more than one micro meter. They are suspended in the water and they sit down when the water is stagnant or stable for some time. They are easily filtered and separated.

**2. Making colloidal state with water: -** Some small size particles from suspended particles come into colloidal state with water. These pollutants cannot be separated from the normal filtration process, because their particles are so small that they pass through the filtration medium.

**3. Dissolved Pollutants: -** Many pollutants dissolve well in water. Such pollutants cannot be separated by normal filtration process. These can be separated by chemical methods only after the action of other reactants.

Apart from sewage, industrial contaminated water is also a major factor in polluting natural waters. Various scientists, environmentalists and chemists have divided them into different categories based on water pollutants. Ferguson has classified them into seven categories which include sewage, carcinogens, pollutants, organic chemicals, inorganic chemicals, solid wastes, radiation substances and high heat generating pollutants. Similarly, in 1972, they were classified based on their physical and chemical properties and divided them into 10 categories. On this basis, they are characterized by their acidity or alkalinity, the concentrations of minerals present in them, the amount of suspended particles, the tendency to use dissolved oxygen, the amount of dissolved organic matter, the amount of organic chemicals, the toxicity of pollutants, the presence of bacterial germs, the chemical. The presence of chemicals containing compounds such as nitrogen and phosphorus and very high temperatures.

**Peter also studied the nature of these pollutants and the adverse effects on the environment due to them. We can categorize it as follows: -**

Sr.No.	Nature or properties of pollutants	effect
1	Acidification / alkalinity	Common indifferent pH in a water source , Resulting in water, drinking, agriculture or industrial use.
2	Increase in concentration of minerals	Large quantities of minerals are dissolved in the water coming out of various mines or quarries, in addition they also appear in suspended form, making them unfit for drinking, agricultural work or industrial use in the watershed.
3	Volume of suspended particles	Harmful to aquatic organisms
4	Use of dissolved oxygen	Harmful to aquatic organisms
5	Dissolution of organic matter	Deodorant in water, harmful to aquatic organisms

6	Amount of organic chemicals	Ineligible for drinking water and other uses
7	Toxicity of pollutants	Harmful to health
8	Germ	Risk of infectious diseases like cholera, jaundice, diarrhea, hepatitis etc.
9	Containing nitrogen or phosphorus	A sudden increase in aquatic flora due to the nutritional effect on the watershed, whose rot increases the load of pollution on the watershed.
10	Extreme heat	Adverse effects on aquatic organisms and flora

In addition to the fluid wastes from industries, chemicals used in various activities or the water generated from them also contain harmful substances. These soluble or insoluble substances combined in water sources make it contaminated or unfit for drinking. We will briefly discuss some of these.

**1. Pesticide or Biocidal:** - There are many pests in our ecosystem; Those who depend on flora or botanical products. In addition to insects, parasitic bacteria or viruses that grow on crops are also found in large numbers. When pests or other parasites attack the crops, the entire crop is licked on sight. In order to save crops, pesticides are sprayed on the crops as necessary.

Most chemicals used as pesticides are complex organic compounds. Most such compounds are carcinogenic to organic matter. These chemicals are sprayed on the surface of plants by spraying them. During rainy days, when the plants are watered, these chemicals dissolve in water, or form colloidal solutions with water. In both the states, they come out in the water source and they contaminate it and make it harmful.

Similarly, bio-destructors are used on food items while storing water etc. These bio-destructors also play an important role in polluting the water bodies.

Most pesticides or biocides are chlorinated hydrocarbons. These pesticides are non-biodegradable or biologically non-biodegradable chemicals. That is why their extreme effects fall on water bodies and aquatic life.

**2. Sewage drainage:** - Residential colonies have also expanded with the country's growing population. The amount of sewage waste has also increased in the same proportion. Even today, there is no satisfactory system of sewage treatment in our country. As a result, a large amount of these contaminated water gets directly into the rivers. Domestic contaminated water contains a large amount of organic matter, which reduces the amount of dissolved oxygen in the water of rivers and causes life threat to aquatic organisms. Apart from this, they are also factors of diseases. Many infectious diseases spread due to these.

**3. Industrial contaminated water:** - Contaminated water of different nature is produced from different industries. These have different effects on natural waters. The amount of organic matter in the contaminated water from food-based industries is very high, which significantly reduces the concentration of dissolved oxygen in the water bodies. Similarly, the contaminated water generated from distilleries, paper mills etc. also exerts the same effect. The contaminated water coming out of chemical industries, stains and pharmaceutical manufacturing factories is very complex in nature and affects the water bodies in many ways. Many industrial discharges have high amounts of heavy metals. These metals adversely affect aquatic organisms and flora. It also has many side effects on human life. By

using such contaminated water, they directly affect them, as well as the use of heavy metal flora or fishes affected by them, these metals reach the human body. These heavy metals have long-term effects in the human body.

**4. Industrial and domestic solid waste and their abduction:** - Industrial or domestic solid waste is directly immersed in water bodies and in addition to the water flowing from the disposal site created for them, or the leachate generated from them directly or mixed with rainwater in the water bodies also Water is polluted.

**5. From agricultural wastes:** - Large amounts of water are used for irrigation in agricultural work. Except for the part of water used in agriculture that evaporates or is absorbed by the land, the rest flows back into the water streams. In this way, it sheds pesticides, organic matter, soil and its residues etc., including natural or chemical fertilizers, and mix them in the water bodies.

**6. Radiated chemicals:** - Contaminated water from nuclear power centers, nuclear test centers, laboratories that carry out radiation experiments, etc., contain large amounts of radioisotopes. These leave the water and make it highly harmful.

**7. From oil waste and petroleum products:** - During marine activities, seepage, exploitation of oil and petroleum products, etc., large quantities of oil and petroleum materials waste in seawater together affect the watersheds.

**8. Thermal pollution:** - Water from thermal power plants is used in cooling in chemical industry and many other industries. Often, high temperature contaminated water is also produced during the process. These types of water, combined with normal water, increase its temperature several times than normal. As a result, aquatic life and ecosystems are adversely affected.

**9. Pollution from plastic and polyethylene bags:** - Plastic is generally not biodegradable. Some of its products, such as polystyrene, are fissioned, but after fission, they turn into low but harmful products. Polyethylene bags are also not biologically destroyed. When they are put in water, they die due to trapping of aquatic animals in them. Similarly, aquatic vegetation also traps and rot in them and affects the quality of water.

**Effects of water pollution:** Water is called nectar. Without water, we cannot imagine creation. After air, water is the most important ingredient for life. This water which is an essential part of life, when harmful, undesirable or toxic substances are found in it, then it becomes poison.

In our country, rivers have been of special importance from the industrial point of view as well as daily life, they have also been considered important from the cultural point of view. They are worshiped by giving them the status of mother-power. Five lifesaving rivers filled the fertile land of Punjab with greenery crops, giving farmers a bag. Even today, we remain the most dependent on these rivers as water resources. The land situated on the banks of the rivers is absolutely suitable for agricultural work. We depend only on rivers not only for irrigation but also for the supply of drinking water. It is common practice to prevent water by making anicuts on rivers and to meet the drinking water and other needs of the city. Due to various industrial and human reasons, the water quality of the rivers is being affected. Rivers like the vast and holy Ganges, Yamuna and Narmada of our country are not untouched by water pollution.

Water pollution directly impacts health. These effects can be short term or long term. Many times water pollution has an impact on health, and after a long time it is known that the

health effects are due to contaminated water. But sometimes the use of contaminated water can also be fatal. In addition, many such diseases occur due to the arrival of drinking water in contact with contaminated water; Which causes a crisis on life.

Before discussing the ill effects of contaminated water, it would be appropriate to discuss the incident in Minamata, Japan in 1953. In 1953, a chemical industry producing vinyl chloride in the city of Minamata in Japan, in which mercuric chloride was used as a catalyst as a manufacturing process, was discharged in large quantities with industrial discharge. This discharge gathered in a large lake and mercury reached the body of the fish found there. About 43 people died due to eating these contaminated fish. Through investigation and testing, it was found that the fish found here had been consumed by all these, which themselves had acquired mercury. The accident drew worldwide attention to the ill effects of water pollution, which reflected the potential consequences of harmful substances not directly from the water but from aquatic organisms through water contaminated water and then consuming them. This disease of mercury poisoning is also known as Minamata-Disease due to this accident occurring in Japan city of Minamata.

In our country, the incident of polluting the water of Chaliyar river has come to light due to the finding of mercury-contaminated water coming out of gold extraction and rayon manufacturing units in Chaliyar river in Kerala.

Along with mercury or mercury, many heavy and toxic metals are found in the contaminated water resulting from many industrial processes, which have harmful side effects.

## **Here we will discuss in detail the various polluting factors and their effects.**

**(1). Effect of organic materials present in contaminated water:** - Sewage or similar contaminated water in which organic matter is present in large quantities, together with clean water sources, their B.O.D. Weights increase. That is, the action of microorganisms reduces the amount of dissolved oxygen in the water due to the mixing of organic materials which are biologically degraded. Also, due to increase in drinking water of harmful bacteria, there is a risk of many skin diseases including diseases like diarrhea, hepatitis, jaundice etc.

In our country, many deaths occur due to these diseases due to pollution of drinking water every year. Especially during the rainy season, when favorable conditions are found for germs to thrive. The quantity of diseases caused by drinking water also increases.

The addition of phosphate and nitrate-containing organic compounds in fresh water leads to a rapid and unexpected increase in the number of algae and other aquatic plants found in them due to the increase of nutrients in the water. This phenomenon is called autotroph or eutrophication.

The word 'eutrophication' is derived from the Greek word eutrophus. The word eutrophic means nurturing. The increase in the growth rate of aquatic flora due to increasing concentrations of these nutrients in them due to the addition of organic matter, nitrate and phosphate in a water body such as a pond, lake, etc. is actually eutrophication or autophagy. Although the process of eutrophication or autophagy also occurs naturally, when various organic matter flows with rainwater, it is mixed in a water source. But it takes many years for such natural self-sufficiency. But due to human activities, the process of rapid autophagy starts. On this basis, it can be divided into two categories.

(A) Natural autophagy

(B) Triggered Autonomy

**(A) Natural autophagy:** - Generally, the number of nutrients in any lake or pond is limited, which depends on their construction, soil of that place, water quality, etc. the waste present in it. The amount of nutrients present in it depends on the ecological system and life cycle of this source and is controlled by it. For example, the algae found in the lake is gradually nourished and used by the nutrients present in the lake. Similarly, when the algae are destroyed by rot, these nutrients become available again in the lake, so that they can be used by other algae or aquatic flora. This cycle continues in this manner and remains orderly and balanced until nutrients are entered into the lake through an external source.

**(B) Triggered Autonomy:-** The process of catalyzed eutrophication or autophagy begins with the entry of these nutrients into the water source by external means. The initiation of this eutrophication process leads to a rapid increase in the number of aquatic vegetation naturally found in the watershed, and similarly decomposition or decomposition occurs at a much faster rate. But after the entry and use of nutrients into the aquatic source, the cycle of decolorization of aquatic flora which was earlier balanced now becomes disjointed, because the entry of nutrients increases the growth of vegetation, etc., such as algae. When they are destroyed, the nutrients stored in them become available again. In this way, the amount of nutrients in the water source increases.

Gradually increasing amounts of organic matter slowly start collecting at the bottom of the water bodies and due to this the amount of wastes deposited at the bottom of the bottom also increases. Slowly, swamps, bogs, marsh gases etc. are formed and finally the water present in the water source starts to rot.

**There are different types of sources of nutrients or organic matter in a water source.**

**1. Domestic contaminated water or sewage waste:** - In ponds, lakes, etc., it can be considered as the most responsible for promoting self-sufficiency.

**2. Water flowing from urban or rural areas:** - Water flowing from different places contains a large amount of organic matter. Along with the soil, silt of underground leaves, fertilizers, dung and other animal waste, etc., come in gardens, fields etc. Apart from this, nitrate, ammonia, etc. present in the atmosphere along with rain water, are also mixed in the watershed.

**3. Industrial waste:** - Large quantities of organic matter contaminated water is produced from agriculture and agro-product based industries, such as distilleries, sugar factories, rice and poha mills, food processing or food processing units etc. Their contaminated water contains a large amount of organic matter. In which phosphate and nitrate etc. are present in large quantities. They also enhance the process of self-nutrition by mixing contaminated water produced in these industries in the water bodies.

Therefore, it would not be said that the increase in the rate of eutrophication due to various activities is called catalytic eutrophication. When this happens, the growth rate of aquatic flora in the lake or pond suddenly increases. Eutrophication affects the physical, chemical and biological properties of water. The rapid growth rate of flora in the water source disrupts the normal equilibrium state of the water source. On the one hand, algae growth in water



increases the production of fish, sometimes fish and aquatic organisms are killed due to harmful chemicals or secretions from some algae. Due to eutrophication, uncontrolled growth of aquatic flora causes the lake water to become dirty. Due to which her appearance deteriorates and she becomes unfit for beauty, tourism or boating etc. Due to rotting of vegetation, the smell of water starts. Besides increasing the level of pollution, along with deteriorating water quality, it also becomes dangerous for the life of aquatic animals. Gradually, a lake of fresh water turns into a polluted and dirty lake.

In this way, very uncontrolled and erratic eutrophication or autophagy have their opposite effect on water source. To save the lake from these side effects, an attempt is made to control the process of eutrophication. This includes preventing organic matter water from getting into the lakes, the flow of fresh and fresh water into them, removal of nutrients and their deposits from the lake, adding less nutrient-rich water by using nutrient-rich water elsewhere. Thus the rate of eutrophication or autophagy can be reduced.

**(2). Effect of heavy metals present in contaminated water:** - Their solubility of large quantities of metals with contaminated water from various industrial processing units, paper mills, chlor-alkali units, galvanizing or electroplating units, metal extraction units, utensils, battery manufacturing or recycling, chemical industry etc. , Discharges in the form of semi-soluble insoluble chemical compounds or mixtures. These impurities get into the river water due to mixing of effluent water into the river drains. From where it reaches our body through food chain or directly through drinking water. By reaching our body, they adversely affect different parts of our body. Sometimes they gather in the body and slowly show their effect.

Industrial wastes generate heavy metals in the form of leachate, they drain with rainwater and pollute the watersheds, while most of the side effects are seen on underground waters. Due to natural or various human activities, the water does not become potable due to the addition of heavy metals in the water bodies.

### **The side effects of various metals on human health are as follows: -**

**1. Mercury:** - Mercury or mercury is a highly toxic metal, the effect of which is fatal and fatal. Mercury compounds, both organic and inorganic, are highly toxic. Mercury, as methyl-mercury, is the most permanently polluting element in the food chain. We are familiar with the incident of multiple deaths in Japan due to mercury poisoning. There has also been a discussion on the large scale contamination of the Cheliar river water due to the mixing of mercury-contaminated water from the gold extraction and rayon manufacturing units in the Che liar River in Kerala province of the country. The presence of mercury in drinking water damages the brain and nervous system.

**2. Cadmium:** - Cadmium is generated as a large amount of pollutants from metal extraction units such as zinc extraction units, lead-cadmium battery producers or recycling units etc. The presence of cadmium in drinking water can cause vomiting, diarrhea, and heart disease.

**3. Chromium:** - Chromium is present in a large amount of solid waste from these units, with various chromium-containing chemical compounds such as potassium bichromate, potassium chromate, contaminated water coming out of the manufacturing units and leachate resulting from its manufacturing process. They are soluble in water in their hexavalent form and as a result they show their side effects at this stage. In water-soluble states, they produce yellow color. Chromium salts are carcinogenic factors.

**4. Arsenic:** - Arsenic exhibits its toxicity by remaining soluble in the trivalent state. Ground water from natural geological formations has been found to be contaminated with arsenic in many places. Many industrial units where arsenic is mixed with contaminated water also cause arsenic poisoning.

**5. Lead:** - Lead poisoning has been found in underground water sources in many places of the country including Midnapore in West Bengal. When lead enters the body, it remains in the digestive system for a long time. And gives rise to many health problems.

<b>Health effects of heavy metals present in water bodies</b>		
Order	Heavy metals	effect
1	Mercury	Brain and nervous system damage
2	Lead	Side effects on the digestive system and brain
3	Arsenic	Skin disease, bone deformity, mental disease
4	Cadmium	Nausea, diarrhea and heart disease
5	Chromium	Cancer factor

**(3). Effect of pesticides present in contaminated water:** - Chemical pesticides and fertilizers that flow from the gardens, fields, etc., pollute them in the water bodies. Most pesticides are complex organic compounds, which are virtually carcinogenic. The quality of water is not only affected by the addition of contaminated water with chemical pesticides in water bodies, they also have their harmful effects on aquatic organisms. They also harm human health by using contaminated water. Their excessive presence gives rise to many diseases. The presence of fertilizer in the water that comes with the flow of rainwater creates conditions for catalyzed eutrophication in addition to health-related side effects. Regarding which detailed discussion has been done earlier.

**(4). The acidity or alkalinity of industrial contaminated water has adverse effects on agricultural land:** - The contaminated water coming out of many metallic units like galvanizing units, acid plants, fertilizer plants, etc. is acidic in nature. When these acidic water comes into contact with the land, the nutrients present in it dissolve in acid or acidic water and dissolve the essential elements in themselves and make the land infertile or barren. The general nature of soil is alkaline. Alkalinity of soil is reduced due to exposure to highly acidic contaminated water. Similarly, the contaminated water from many industries is highly alkaline in nature, such as soap, caustic soda.

**Diagnosis for water pollution problem :-** The main sources of water pollution are industrial effluents and contaminated water discharged from domestic sources.

Large amounts of contaminated water are generated from various industrial activities. The nature and quantity of pollutants present in this contaminated water varies according to industrial production. The contaminated water originating from some industries is of a highly polluting nature, dirty or toxic. While the contaminated water of some industries is not much polluted. In addition, the water released from cooling, boiler blowdown, etc. is mostly normal. Which can either be taken to another task or recycled.

The most important way to avoid the situation of water pollution is to prevent polluted water from getting into clean water sources. For this, after proper treatment of the contaminated water coming out of each source, it will be appropriate to use it or recycle it in the process.

After treatment as per the prescribed criteria, the treated water should be flown into the water source only if necessary.

Apart from this, polluting activities occurring in water bodies like defecation on rivers / ponds etc. activities; Excavation of household waste, idols or worship material, carcasses should be used to curb the façade in rivers etc. Steps should also be considered to prevent silt from flowing into the rivers, chemical fertilizers used in orchard farms and pesticides from overflowing by normal flow of rain. Presently, in view of erratic rainfall situation, low rainfall etc., industries should control their water consumption and properly treat the contaminated water generated and develop a process for its complete recycling. So that the situation of excessive exploitation of water bodies can be avoided. For this, industries should adopt modern treatment process / plants for treatment of contaminated water effectively and make zero discharge conditions as possible. In this way domestic contaminated water can be treated and used for industrial use, plantation, roads, spraying water in industries etc. The best way to protect natural water resources, especially rivers, from the ill effects of water pollution is to prevent the discharge of contaminated water in them.

**Sources of water pollution :-** The purity of water depends on its physical, chemical and biological states. Water pollution can be identified by its hardness, acidity, alkalinity, pH, color, taste, opacity, odor, oxygen mong (chemical and biological), radio religiosity, density, temperature etc.

**Primary components of pollution:-** Cation - like Calcium, Magnesium, Sodium, Potassium, Iron, Manganese etc. Anion- like chloride, sulfate, carbonate, bi-carbonate, hydroxide, nitrate etc. Ion-free - Oxides, oils, phenols, fats, greases, waxes, soluble gases (oxygen, carbon dioxide, nitrogen) etc. Ground water is more pure than surface water. Water hardness is maintained by soluble solids in groundwater due to alkalinity (carbonate, hydroxide), calcium, and magnesium.

**Water pollution factors:-** The flow of silt and sediment from adjacent areas is the flow of sewage and dirt by humans and animals, the pollution of maximum rivers and lakes is caused by the city's dirt, industry-dirt and agricultural-dirt etc.

**Difficulties created by water pollution:-** Decreased soluble oxygen levels, causing adverse effects on aquatic life (fish etc.). The soluble oxygen level in Nainital Lake has fallen to an alarming level of 2.5 milligrams per liter. The initial eutrophication state is created when the nitrate level is 350 mg / l. The pre-eutrophication situation has occurred due to nitrate level of 250 mg / l in Nainital lake. Toxic materials accumulate in the bottom of the lake. The quality of drinking water is reduced due to organic matter and due to various types of microbial microbes, aquatic diseases are caused in humans and animals. Sunlight does not fully enter the water due to suspension of soil particles (silt, clay) and other particles, which reduces the photosynthesis by plants in water.

## **There are two types of pollution that we humans put into water:**

**(1) Water pollution due to industrial activities:** - The major cause of water pollution is industrial discharge. All industrial units consume more or less water. Contaminated water is produced in this proportion. The nature of the contaminated water depends on the water in the industrial process, the use of raw materials, the product and the production process. There are mainly 2 types of pollutants in contaminated water coming out of industries: -

(A). Organic nature pollutants

(B). Inorganic nature pollutants

**(A). Contaminants of organic nature:** - All types of agro-based industries, distilleries, rice mills, poha mills, food processing industries, paper mills etc. consume large amounts of water under the process. The amount of contaminated water produced from them is also quite high. This contaminated water contains a large amount of organic matter. Combining such polluted water in a water source has an immediate adverse effect on its quality. Increasing pollution load in a water source increases its normal parameters. The major parameters thus affected are: -

**1. Total Solids:** - The addition of contaminated water in a water source increases the amount of total solids present in the water.

**2. Suspended Solids:** - The quantity of suspended solids also increases with the addition of contaminated water in the water bodies.

**3. Dissolved Oxygen:** - Due to the high amount of organic matter in the contaminated water, when it is found in a water source, the dissolved oxygen of the water decreases. Organic materials present in contaminated water increase the rate of growth of microorganisms in them. Therefore, dissolved oxygen is reduced due to dissolved oxygen in the water source.

**4. B.O.D. :** - BOD of contaminated water containing organic matter in the water source. That is, bio-chemical oxygen demand increases. B.O.D. Increase of water means increasing pollution load of water.

**5. C.O.D. :** - Also, the mixing of organic matter contaminated water in normal water has its COD. That is, chemical oxygen demand also increases. C.O.D. Increasing pollution load of water also increases.

**6. Quantity of microorganisms:** - Organic materials act as nutrition for microorganisms. In the presence of these, microbes like bacteria etc. flourish rapidly in water bodies. Due to which their number increases rapidly.

<b>Diseases caused by microorganisms / pathogens / organism growing in water bodies</b>		
<b>Serial</b>	<b>microorganisms / pathogens / organisms</b>	<b>Disease</b>
1	Salmonella typhosa	disease
2	s. Typhimurinum	Typhoid
3	s. Scotumieri	Enteric fever
4	Lies	Gastroenteritis
5	Hook worm	Typhus
6	Mosquito	skin disease
7	Vibrio-colliery	Malaria, Yellow Fever, Elephant Feet, Brain Fever.
8	Tape worm	Cholera

**7. Increase in metallic pollutants:** - In some industries like paper industry, galvanizing / electroplating units, metal extraction units, etc., the concentration of metallic pollutants, especially mercury, chromium, etc., is quite high. Apart from this, copper, lead, cadmium and nickel are also present in their treatment. Similarly, arsenic, mercury, zinc and chromium in the treatment of leather industry, arsenic, mercury, zinc, chromium, copper, lead, nickel etc. are present in the treatment of textile industry.

<b>The effects of some toxic metals on human health are categorized as follows: -</b>			
<b>serial number</b>	<b>Toxic metal</b>	<b>Leading source</b>	<b>Effects on human health</b>
1	Arsenic	Coal burning, phosphate, sulfide ore mines etc.	Cancer Factors, Gastrointestinal Disease
2	Lead	Paint, Gasoline	brain damage
3	Beryllium	Burning coal, rocket fuel	Pulmonary disease
4	Mercury	Paper mill, insecticide	Brain damage, Minimata disease
5	Cadmium	Electroplating unit, chemical industry	Kidney, liver, pancreas related disease, itching disease.

**(B). Inorganic nature pollutants:** - Different types of galvanizing units, metal extraction units, metallurgical product units, etc. use water at different stages. The contaminated water produced from them is of inorganic nature. The contaminated water arising from galvanizing / electroplating units is acidic in nature.

The following parameters are affected when the contaminated water coming out of the above units is found in the water:

**1. Ph. D. :** - As we know, the contaminated water generated from galvanizing / electroplating units is acidic in nature. When such contaminated water is found in a water source, it damages its indifferent nature. Acidic contaminated water, which is found continuously in stable water bodies like ponds and lakes, etc., makes the water source acidic.

**2. Increase in metallic pollutants:** - A large amount of metallic pollutants are present in the discharge of metallurgical units, galvanizing units etc. In the contaminated water from galvanizing units, zinc, lead and metallurgical units contain arsenic, cadmium, lead, mercury, zinc, etc. metals which together increase the concentration of these harmful metals in water bodies.

**3. C.O.D. :** - When the contaminated water discharges containing various types of chemical pollutants are found in the water bodies, their C.O.D. Increase it.

The presence of heavy metals in water bodies, which are mostly toxic in nature, adversely affects health. Keeping this in mind, it is necessary to assess the presence of heavy metals in the watershed. Since the presence of heavy metals can only be detected by chemical analyzes and such analyzes are quite complex and expensive, they are usually analyzed only in the event of a problem or complaint. Nevertheless, it is very important to assess the presence and quantity of heavy metals in all the water resources which are directly used as drinking water or for irrigation work or fisheries etc. Because in addition to drinking water, the use of flora, vegetables, fruits and fauna also causes heavy metals in our body and they have harmful and fatal effects on our body. Their high concentration can also prove fatal.

The most popular means of testing the presence of metals is bio-monitoring. Flora or fauna is used as an indicator in this method. Algae are prominent among them. Sphagnum algae is used to detect zinc, lead, cadmium in water. Similarly, zinc can be detected by *Thlaspi alpestre*, zinc by *Minutia varna*, and cadmium *Tragopogon spikes*.

The recommended maximum quantity of heavy metals in drinking water is as follows: -	
Element or metal	Maximum permissible concentration mg / liter
Mercury	0.001
Cadmium	0.01
Selenium	0.01
Arsenic	0.05
Chromium	0.05
Copper	0.05
Manganese	0.05
Lead	0.1
Iron	0.1
Zinc	5.0



Now we will discuss about the major water polluting industries established in our country and the nature of contaminated water arising from them. Agriculture and agro-products based industries are in abundance in our country; Some of these are as follows: -

**1. Sugar Industry:** - Sugarcane is the mainstay of Indian commercial agriculture. Sugarcane cultivation is done on a large scale in the provinces of Uttar Pradesh, Maharashtra, Madhya Pradesh, Chhattisgarh etc. Sugar or sugar is made from sugarcane. Large amounts of water are used in the sugar-making process. Contaminated water is also produced from the industry in the same proportion. The contaminated water is acidic in nature and there is also plenty of organic matter in it. Molasses is produced in large quantities by the sugar industry, whose B.O.D. And C.O.D. Is excessive. If not treated

properly, the contaminated water coming out of the sugar industries has a very adverse effect on the water resources. There are about 300 sugar mills in our country.

**2. Distilleries:** - There are about 150 distilleries or distilleries produced in the country. As mentioned, molasses are produced in large quantities as liquid waste from sugar factories. This molasses is used as a raw material to make alcohol in most distilleries. Ethyl alcohol is made by fermentation of molasses. In addition to molasses, grain is also used as a raw material in distilleries. Contaminated water from distilleries is also highly polluting in nature.

Most distilleries are located on the banks of rivers. Due to the excess of organic materials, the BOD, COD of their contaminated water. Etc. are excessive. If the contaminated water from the distilleries is discharged into the watershed, there is a sharp drop in dissolved oxygen concentrations in the watershed and other aquatic organisms including fish are killed due to lack of oxygen.

**3. Edible oil and vegetable industries:** - The number of edible oil and vegetable industries in our country is more than 500. There are two major units in the edible oil and vegetable industries - 1. Solvent extraction plant and 2. Refining unit (finishing unit)

1. Edible oil in solvent extraction plant is separated from the relevant raw material by solvent extraction method. Various solvents are used for this, among which hexane is predominant. The solvent is then separated and the oil is obtained.

2. Edible oil obtained from the above method is refined in the refining unit. Edible oil is obtained mostly from ricebran or paddy kohda, soybean, sunflower, peanuts, mustard, sesame, coconut, olive etc.

Contaminated water is produced in large quantities in the process of obtaining edible oil, especially during refining. The amount of organic matter is also very high in this contaminated water.

**4. Food Processing Industries:** - Food version units consume a significant amount of water during the process of washing fruits, vegetables etc. Contaminated water is also produced in this proportion, which contains a large amount of organic matter. BOD of contaminated water coming out of these industries. And C.O.D. Is very high. If there is no proper treatment of the contaminated water, it produces very strong odor. Such contaminated water containing organic matter pollutes the clean water source. Due to the addition of organic material, the rate of self-cultivation in the water source increases and the water does not become potable due to increase in coliform.

**5. Paper and pulp industry:** - A large amount of waste paper used in paper manufacturing is recycled or recycled. Old paper, sugarcane or card board is recycled even in making pulp of paper or sugarcane or card board. The pulp is prepared first in the manufacture of both. For which large amount of water is consumed. During making paper or cardboard, the pulp is pressed and water is extracted from it. This water contains large amounts of paper or cardboard fibers and suspended particles. Hence, most of the particles in it are recycled during the re-making of pulp during treatment. Nevertheless, the amount of contaminated water generated from the industry is considerable. Similarly, a large amount of bleaching chemicals are used while making white paper. Metallic compounds are present in these chemicals. The black liqueur (contaminated water) emanating from such industries is highly polluting in nature, containing many toxic metals, among which mercury is prominent. Apart from affecting the quality of water as black liquor is found in its waters, it also has a fatal effect on aquatic animals.

**6. Milk Industry:** - There are about 150 factories producing pasteurization of milk and making milk products in the country. In which cheese, butter, ghee etc. are made by separating cream from milk. A number of small scale industries are also produced on a small scale including state-of-the-art and large factories of major groups like Amul, Dinshaw, Sauchi etc. Water is consumed in industries at the container, washing, floor, washing, and other levels. The amount of organic matter, especially oil and grease, is high in the contaminated water produced from them. BOD of contaminated water in the same proportion And C.O.D. Is also determined. Contaminated water from milk industries can be used in post-irrigation irrigation.

**7. Textile Industry:** - Maharashtra has the largest number of textile mills in the country. Many textile mills were closed for various reasons. Among which the major textile mill of Chhattisgarh; BNC Mill, Rajnandgaon is also included. Nevertheless, around 100 cloths found in the country are still produced. The process of fabric manufacturing involves many activities ranging from fabrication of fibers, fabrication of fibers and dyeing of fabrics. The process of dyeing fabrics is most complicated in the process of fabric manufacturing which uses complex compounds. They contain heavy metals. Large quantities of these are also present in contaminated water discharged from the industry using various pigments. Such contaminated water increases the concentration of heavy metals in land and water bodies.

**8. Metallurgical Industry:** - Water is used in the metallurgical industry for transportation of raw materials, metal extraction, refining etc. The contaminated water from these industries contains large amounts of metallic wastes. Similarly, a large amount of contaminated water is also generated from other intermediate (secondary) units installed in metallurgical industries. For example, the contaminated water from the coke-oven byproduct unit of the integrated steel plant contains phenol, phenolic compounds, deadly and toxic. Similarly, due to the use of various processes and machines, there is also a large amount of oil and grease in the contaminated water coming out of these industries. Lead is present in the discharge arising from lead smelters.

**9. Mines:** - In the mines, minerals and ores are extracted below the land surface. During quarrying in these mines, ground water and thereafter rain water comes in contact with these minerals. The water flowing through or flowing from here flows with it in a dissolved state by suspending large quantities of minerals and sometimes depending on the solubility of the elements present in the mineral. These waters increase the concentration of harmful substances in rivers or other water bodies and also increase silt in them, causing these sources to become shallow.

**10. Drug, pesticide etc. industries:** - These industries use large quantities of chemicals during the process. Which also contains a large amount of contaminated water from industries. Due to their high concentration in the contaminated water coming out of both types of industries, they cause huge harm to aquatic organisms. Also, they make the water resources ineligible for any other use. Carcinogenic chemicals may also be absent in contaminated water from pesticide industries.

**11. Fly Ash Pond:** - A large amount of fly ash is generated due to burning of coal in thermal power plants ie thermal power plants. Which is collected in the form of slurry in the ponds. Heavy metals are present in this fly ash. The leachate released from them also contains concentrations of heavy metals. The mixing of this leachate directly or in combination with rainwater in a water source increases the concentration of heavy metals in that source as well.



**12. Industrial solid waste drainage site:** - Numerous chemicals, including heavy metals, are present in leachate arising from the site of industrial solid waste. The possibility of getting polluted by the sources of water in those waters remains polluted. Similarly, there are other types of industries in the country from which less or more quantity of contaminated water is produced. For whose treatment separate or combined treatment arrangements are made. Which we will discuss further in detail.

## Sources of Water Pollution



## (2) Water pollution due to human activities:-

As soon as we talk about water pollution, we come across scenes of contaminated water coming out of big industries. We refer to water pollution only by industrial water pollution. But human activities are the major cause of water pollution in addition to industries. Here we discuss some human activities that cause water pollution.

**1. Domestic contaminated water:** - Our country has a population of more than 1 billion and there is no proper treatment of domestic contaminated water or sewerage in various cities except metros. In cities where there is a system of sewerage treatment, there is also no adequate system for treatment of sewerage originating from the entire city. As a result, a large amount of sewerage or contaminated water remains untreated and these untreated contaminated water flows directly into rivers through drains.

Sewerage treatment plants designed to treat contaminated water coming out of the country's capital Delhi are also not able to treat the entire sewerage in the entire city of Delhi. As a result, a large amount of this domestic contaminated water is mixing in the Yamuna River and polluting it. The same is also with the Ganges river, in which the contaminated water

coming out of the cities situated on the banks of the river is getting into the river without any treatment. Today the situation is that due to various human activities, the major rivers of the country have turned into drains.

As we know that domestic contaminated water, which consists mainly of human feces and urine in large quantities, is one of the main causes of pollution of clean water. This not only contaminates the water bodies, but also causes many fatal diseases. Many coliforms thrive in this contaminated water and cause various diseases. Germs of jaundice, typhoid, hepatitis, cholera, diarrhea, dysentery, skin diseases etc. thrive in such contaminated water. Microbiologists say that there are many such germs in domestic contaminated water, which do not die by filtering, boiling even normal chemical treatment of water. Rather, the treated water reaches the digestive system of drinkers and gives rise to many diseases.

Foul gases such as hydrogen sulfide, etc., are produced by the rotting of domestic contaminated water. This hydrogen sulfide gas is also the main reason for bad odor in sewage. A single drop of sewage contaminates thousands of gallons of drinking water and makes it unfit to drink. Because one drop of sewage, water contains innumerable colonies of coliform. When this water is found in clean water, colonies of coliform also multiply rapidly and the entire drinking water gets contaminated.

Domestic contaminated water contains large amounts of organic compounds. In addition, it contains large amounts of nitrate and phosphate. Domestic contaminated water causes autophagy in clean water sources. Due to this, the rate of growth of algae and other vegetation in clean water increases. The vegetation starts to rot in the water due to the absence of balance between the growth and destruction of the vegetation. In this way, clean water sources are contaminated with sewerage water, due to rotting aquatic flora, both their rate and quantity of contamination increases.

Water is not only dirty or contaminated due to the use of domestic sewage water in water resources, use of urban-rural effluents, etc., but many harmful and life-threatening bacteria are found in it. Fecal contamination of water causes bacteria, virus protozoa, parasitic pests and many disease carriers in the water, which are responsible for giving rise to various diseases.



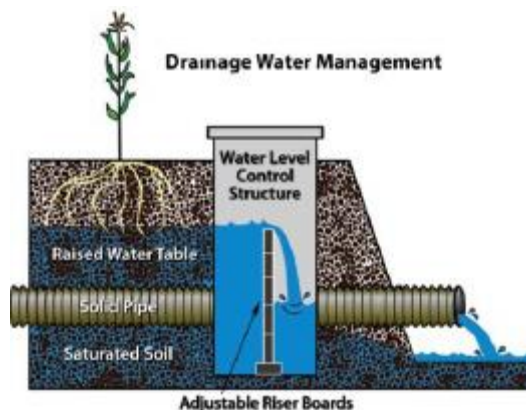
<b>Diseases caused by bacteria / viruses that grow in contaminated water</b>	
<b>Disease</b>	<b>Productive organism</b>
Typhoid	Salmonella typhi
Cholera	Vibrio cholerae
Bacterial diarrhea	Sigella spp
Leptospirosis	Leptospera
Viral infection hepatitis	Hepatitis virus
Protozoa amoeba	Entamobahistolytica

Latch	Giardia
Helminths Bilurgia	Systemosa spp
Guinea pest	Draculunculus medinensis

Thus, domestic contaminated water thus causes pollution in clean water sources.

**2. Use of water resources like drainage:** -In our country even today, natural waters are used for disposal. These include ponds, rivers, streams and canals. Even today, clean toilets have not been constructed in the country, especially in villages or slums, for daily activities like defecation etc. Due to lack of resources and personal habits, most people still practice unclean and unhealthy open defecation etc. Most of the ponds are used for this in rural areas. Apart from this, the functions of bathing, washing clothes, bathing animals etc. are also done in the ponds.

Their water is polluted by such activities on the banks of water bodies. This is the main reason for increasing number of coliforms. Similarly, bath and laundry soap is also found in the water source. Laundry soap contains large amounts of caustic soda, phosphate etc. Thus, water sources are also chemically polluted.



**3. By immersion of idols and other materials in water resources:** -Various festivals have a very important place in Indian culture. These include the public Ganeshotsav and the Goddess Durga Puja festival. Statues of Ganapati and Goddess Durga are publicly installed on these occasions. After the ten-day Ganeshotsav and the nine-day Durgotsav, these idols are immersed in the rivers or ponds and the idols of the cities on the seashore. Earlier these statues were made from clay, but now most of the statues are made from plaster of Paris due to its ease of construction, shape and transportation. Finishing of idols made of them is also done easily and well.

Chemical paint, varnish, paint etc. are used to give attractive appearance and decoration to these idols. During the immersion, all these harmful chemicals, including lead chromium, copper, mercury, cadmium, heavy metals and organic solvents, etc. are mixed in the water bodies. All substances soluble and insoluble in water cause water pollution. In addition to heavy metals in paints, varnishes and paint chemicals, other chemical solvents or carcinogenic chemicals are found, which are added to the water by immersion of idols in water. Similarly, Plaster of Paris is also a mixture of various chemicals. It naturally collects in the form of debris and not in soil but in an undissolved state. This debris not only reduces the depth of the watershed, but also reduces their water holding capacity. Rather, it also reduces the porosity or porosity by depositing at the foothills of silt in the form of silt, so that water does not enter the land surface.

As a result, the process of natural recharge through the water bodies on the surface decreases and also stops in time. Studies have found that the water quality of water bodies is affected during and after immersion of idols. During and immediately after immersion, the amount of dissolved oxygen in the water becomes extremely low or sometimes even zero. That is, the chemicals present in the idol fully utilize the dissolved oxygen in the water. Thus, a decrease in dissolved oxygen adversely affects aquatic organisms and vegetation.

Before, during and immediately after immersion of idols in local watersheds, the general parameters in water samples were collected and concluded, which concluded that the BOD of the water bodies during and immediately after immersion. And C.O.D. Increases by 2 to 3 times. Similarly, microscopic amounts of heavy metals were also observed in water during this period.

In addition to the above events, people generally carry small idols, worship materials, flowers, garlands, etc. used in homes in rivers, canals etc. All these materials are often tied directly into polythene and put into rivers. These things pollute the water by rotting in the water. These polythene bags adversely affect water and animals that grow in water. Many animals die from suffocation due to being trapped completely in these bags or stuck in their neck. Some organisms swallow them as their food and as a result they die. Thus they affect aquatic life.



**4. Pesticides and Fertilizers:** - The flow of pesticides and fertilizers used in agricultural work along with the rainwater has adverse effects on the water bodies. After the Green Revolution in our country, the biggest change in agricultural production was that large amount of chemical fertilizer is being added to the soil during cultivation to increase agricultural yield, so as to get maximum production. Similarly, pesticides are sprayed extensively to protect standing crops from various bacteria, viruses, grasshoppers, pests etc.

These pesticides spread air pollution during spraying. Similarly, during rainy days when rain water comes in contact with these chemical pesticides and chemical fertilizers, then they dissolve them and bring them away. When this flow is found in water bodies, then these chemical fertilizers and pesticides are also found in them. Harmful chemicals present in pesticides harm aquatic, organisms, flora and human health.

In some places, vegetables and fruits like melon, melon, cucumber, cucumber etc. are cultivated in the cachar along the rivers. Fertilizers and pesticides applied during their cultivation are also found in the river water. By using them on the river bank, the chances of getting them in the water are also high and their effect is also high, because they are directly mixed in the water.



**5. From domestic solid waste:** - Proper management of household waste is still a major environmental problem in the country. Due to lack of proper management, there are huge piles of garbage in our cities and villages. Even at the dump site designated for these, they are dumped instead of performing properly. The water that falls on these piles of waste during the rainy days sheds dirt, bacteria etc. and mix it in the water bodies. In this way, these contaminated water pollutes the clean water source. Domestic solid waste dump sites where domestic solid waste is dug and buried. There the water source gets polluted due to mixing with the rainwater of leachate originating from these dump site of waste.



**6. By organizing fairs etc. on the river bank:** - As we know that Indians celebrate all their festivals with great enthusiasm. Rivers are known to be life-giving and sacred, since they represent the creation of the universe. Religious Hindus consider bathing in the river on many festivals and days as virtuous. Besides, a fair is also organized on special occasions such as Kumbh Mela etc. on the banks of rivers. A large number of people gather on these occasions. Due to various activities, large amounts of dirt and waste are dumped in the river, which pollutes the river water.



Thus various human activities also cause water pollution. By controlling these and the proper treatment of contaminated water arising due to human activities, water pollution can be controlled.

### **Sources of water pollution:-**

**Point sources** - whose main sources are fixed, such as hospitals, laboratories, markets, urban-dirt, hotels, hostels etc.

**Non-point sources** - whose main source is not fixed, such as soil erosion, mountain-soil erosion, dead animals, manure, medicines, pesticides etc.