



# Water Quality Parameters

## **Fecal Coliform**

What is it?

Fecal coliform bacteria are found in the feces of human beings and other warm-blooded animals. By themselves, fecal coliform bacteria do not usually cause disease. In fact, they are already inside you. They occur naturally in the human digestive tract and aid in the digestion of food. However, when a human being or other warm-blooded animal is infected with disease, pathogenic (disease causing) organisms are found along with fecal coliform bacteria.

Why does fecal coliform matter?

Think of high levels of fecal coliform bacteria as a warning sign that water can make you sick, rather than as a cause of illness. If fecal coliform counts are high (over 200 colonies/100 ml of a water sample) in a body of water, there is a greater chance that disease causing organisms are also present. If you are swimming in waters with high levels of fecal coliform, you have a greater chance of developing a fever, nausea or stomach cramps from swallowing disease-causing organisms, or from pathogens entering the body through cuts in the skin, the nose, mouth, or ears. Some examples of diseases and illnesses that can be contracted in water with high fecal coliform counts include typhoid fever, hepatitis, gastroenteritis, dysentery and ear infections.

Fecal coliform bacteria are living organisms, unlike the other conventional water quality parameters. The fecal coliform bacteria multiply rapidly when conditions are good for growth and die in large quantities when they are not.

How does fecal coliform get in the water?

Untreated sewage, poorly maintained septic systems, un-scooped pet waste, and farm animals with access to streams can cause high levels of fecal coliform bacteria to appear in a water body.



# Water Quality Parameters

## Temperature

What is it?

Temperature is a measure of how much heat is present in the water.

Why does temperature matter?

Water temperature tells many things about the health of a river. Temperature affects:

- 1) *Dissolved oxygen levels in water* – Cold water holds more oxygen than warm water.
- 2) *Photosynthesis* – As temperature goes up, the rate of photosynthesis and plant growth also goes up. More plants grow and more plants die. When plants die, decomposers eat them and use oxygen. So when the rate of photosynthesis increases, the amount of oxygen needed by aquatic organisms increases.
- 3) *Animal survival* – Many animals need certain temperatures to live. For example, stonefly nymphs and trout need cool temperatures. Dragonfly nymphs and carp can live in warmer water. If water temperatures change too much, many organisms can no longer survive.
- 4) *Sensitivity to toxic wastes and disease* – Wastes often raise water temperatures. This leads to lower oxygen levels and weakens many fish and insects. Weakened animals get sick and die more easily.

How does water get warmer?

In the summer, the sun heats up sidewalks, parking lots and streets. Rain falls on these areas, warms up, and runs into the river. Factories and stations that generate electricity to cool their processes also use water. Warm water enters the river, raises the temperature of the downstream area and changes oxygen levels. These are forms of thermal pollution. Thermal pollution is one of the most serious ways humans affect rivers.

Cutting down trees along the bank of a river or pond also raises water temperature. Trees help shade the river from the sun. When they are cut down, the sun shines directly on the water and warms it up. Cutting down trees also leads to erosion. When soil from the riverbank washes into the river the water becomes muddy (turbid). The darker, turbid water captures more heat from the sun than clear water does. Even murky green water with lots of algae will be warmer than clear water.



# Water Quality Parameters

## Dissolved Oxygen (DO)

What is it?

Like people, aquatic organisms need oxygen to survive and stay healthy. In areas with waves, or where water tumbles over rocks, falling water traps oxygen and mixes it into the water.

Unlike people, aquatic organisms breathe oxygen that is dissolved in water. To breathe underwater, fish and other aquatic organisms use gills instead of lungs. These gills breathe the oxygen dissolved in the water. As you know, a fish out of the water will die because it can no longer breathe.

Why does DO matter?

Imagine living in a place with polluted air. As the air quality becomes worse, the health of the people who live there becomes worse. The same is true in water. Clean, healthy water has plenty of DO. When water quality decreases, DO levels drop and it becomes impossible for many animals to survive. Some fish such as trout require lots of dissolved oxygen. Others such as carp can live in water with lower levels of DO.

Warmer water holds less oxygen than cold water. Also, the time of year and many other factors affect the amount of DO in water.

How do DO levels in the water drop?

The main reason DO levels might fall is the presence of organic waste. Organic waste comes from something living or that was once living. It comes from raw or poorly-treated sewage; runoff from farms and animal feedlots; and natural sources like decaying aquatic plants and animals and fallen leaves in water.

Microscopic organisms, called decomposers, break down the organic waste and use oxygen in the process. Two common types of decomposers are bacteria and protozoa. More waste means more decomposers and more oxygen being used.

DO levels can also fall due to any human activity that heats the water.



# Water Quality Parameters

## Biochemical Oxygen Demand (BOD)

What is it?

When organic matter decomposes, microorganisms (such as bacteria and fungi) feed upon this decaying material and eventually the matter becomes oxidized. Biochemical oxygen demand, or BOD, measures the amount of oxygen consumed by microorganisms in the process of decomposing organic matter in stream water. The harder the microorganisms work, the more oxygen they use, and the higher the measure of BOD, leaving less oxygen for other life in the water.

Why does high BOD matter?

BOD directly affects the amount of dissolved oxygen in rivers and streams. The more rapidly oxygen is depleted in the stream, the greater the BOD. This means less oxygen is available for other aquatic life, such as insects and fish. A high BOD measure harms stream health in the same ways as low dissolved oxygen: aquatic organisms become stressed, suffocate, and die. The few organisms that can survive with less oxygen, like carp and sewage worms, will increase in number.

How do BOD levels rise?

As more organic matter enters a stream, the BOD will rise. Organic matter may include leaves and woody debris; dead plants and animals; animal manure; effluents from pulp and paper mills, wastewater treatment plants, feedlots, and food-processing plants; failing septic systems; and urban storm water runoff.



# Water Quality Parameters

## Total Phosphorous

What is it?

Phosphorus is a nutrient found in all living things. It is also a mineral in nature. Both plants and animals have phosphorus in their bodies. It is in most of the foods we eat. When people buy fertilizer for their gardens, they use nutrients such as phosphorus to help plants grow.

Why does total phosphorous matter?

Scientists believe that when too much phosphorus enters a river or lake, plants grow more. Tiny plants like algae use the phosphorus to grow. Other plants that live on the surface and bottom of a river or lake use phosphorus also. When plant growth increases, the water turns pea-green and becomes cloudy. The green color comes from the chlorophyll content of the tiny floating plants.

Too many plants living in the water can lead to some bad results. When these plants die (which, in the case of tiny plants or algae, is very often), they sink to the bottom. There, bacteria decompose the dead plant parts. They use up most of the oxygen in the water. They actually use more oxygen than the amount *added* by the plants through photosynthesis. Therefore, too many plants in the water from too much phosphorus leads to less oxygen. This is what happens when too much phosphorus enters the water:

1. Phosphorus enters the water
2. Plants take up the phosphorus and grow too much
3. Plants (algae) die and sink to the bottom
4. Bacteria at the bottom decompose the dead plants, using up oxygen in the process
5. Oxygen levels drop, killing fish or aquatic insects
6. Phosphorus continues to enter the water
7. The cycle continues

How does too much phosphorous get in the water?

Phosphorus enters the water from a number of places. It is found when human and animal wastes are flushed into waterways, either from poorly treated sewage, broken pipes or runoff. Some industrial wastes also carry phosphorus into the water. Whenever trees and grass are removed from an area, soil erodes into waterways, carrying the phosphorus that sticks to soil. Fertilizers used at homes on lawns and on farm fields carry much of the phosphorus in the fertilizer into streams when it rains. Since rivers

flow, the phosphorus is carried downstream. Lakes do not flow like rivers but trap nutrients instead. Therefore, high levels of phosphorus are more serious in lakes and ponds.



# Water Quality Parameters

## Nitrogen

What is it?

Nitrogen is one of the most common elements in the world. All living plants and animals need it to build proteins. Nitrogen and phosphorus are both nutrients.

Why does nitrogen matter?

High levels of nitrogen may make some people sick, especially young babies. This happens to people who drink directly from groundwater wells where the water has too much nitrogen.

Because nitrogen is a nutrient like phosphorus, the effects of this nutrient on water are almost the same. Like phosphorus, extra nitrogen in water leads to rapid plant growth. Too many plants living in the water can lead to some bad results. When these plants die (which, in the case of tiny plants or algae, is very often), they sink to the bottom. There, bacteria decompose the dead plant parts. They use up most of the oxygen in the water. They actually use more oxygen than the amount *added* by the plants through photosynthesis. Therefore, too many plants in the water from too much phosphorus leads to less oxygen. This is what happens when too much nitrogen enters the water:

1. Nitrogen enters the water
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5. Oxygen levels drop, killing fish or aquatic insects
6. Nitrogen continues to enter the water
7. The cycle continues

How does too much nitrogen get in the water?

Nitrogen can be found in fertilizers and in human or farm animal wastes. In some cases, home septic systems in rural areas leak waste into the ground. This waste should be filtered by the soil around the septic system. However, this does not always happen. Therefore, groundwater can become polluted by nitrogen in the wastewater.



# Water Quality Parameters

## pH

What is it?

pH is a measurement of the acidity or basic quality of water. For example, lemons, oranges and vinegar are high in acid (“very acidic”). Acids can sting or burn, which is what you feel when you eat some kinds of fruit with a sore in your mouth. The pH scale ranges from a value of 0 (very acidic) to 14 (very basic), with 7 being neutral. The pH of natural water is usually between 6.5 and 8.2

Why does the pH level matter?

At extremely high or low pH levels (for example 9.6 or 4.5), the water becomes unsuitable for most organisms. Young fish and insects are also very sensitive to changes in pH. Most aquatic organisms adapt to a specific pH level and may die if the pH of the water changes even slightly.

How do levels of pH become too high or low?

pH can vary from its normal levels (6.5 to 8.2) due to pollution from automobiles and coal-burning power plants. These sources of pollution help form acid rain. Acid forms when chemicals in the air combine with moisture in the atmosphere. It falls to earth as acid rain or snow. Many lakes in eastern Canada, the northeastern US, and northern Europe are becoming acidic because they are downwind of polluting industrial plants. Drainage from mines can seep into streams and ground water and make the water more acidic as well.



# Water Quality Parameters

## **Turbidity**

What is it?

Think of turbidity as the opposite of clarity. It is a measure of how cloudy a water body is. Most people have seen how rivers turn brown after a heavy rain. Soil particles carried by runoff cause this to happen.

Why do high levels of turbidity matter?

High amounts of soil in the water will block sunlight from reaching the bottom of a river or a lake in shallow water. When the water is turbid, floating particles absorb heat from the sun and cause the water temperature to rise. Higher temperatures cause oxygen levels in the water to fall, limiting the ability of fish and insects to survive there.

Another effect is that the floating particles may clog fish gills. When these particles sink, they can smother and kill fish and aquatic insect eggs that lay on the bottom. Turbidity can also limit plant growth. This happens when sunlight cannot reach the plants' leaves.

The combination of warmer water, less light and oxygen depletion makes it impossible for some forms of aquatic life to survive.

How do turbidity levels rise?

Higher turbidity can be caused by human activity like cutting trees and removing vegetation next to a body of water. Trees provide shade to keep the water cooler, and trees and other plants help block mud and soil from washing into the water. When roads and parking lots are constructed without the proper silt fencing, more soil and mud are likely to reach the water.