

# Treatment of industrial wastewater

Water is used in industry for process needs, cooling, steam generation, dust suppression and many other purposes. Industrial wastewater is the water-like waste produced after water has been used for these purposes. Industrial wastewater is the result of dissolution or suspension of substances other than water in water.



Treatment of industrial wastewater includes the mechanisms and processes used to treat water that has been contaminated in some way as a result of its use in the above activities. The purpose of treatment is to remove dissolved and suspended substances from wastewater so that the treated water can be safely discharged to the environment, or recycled in the same process, or used in a different process.

## Components of wastewater

Industrial wastewater contains the following components that require proper treatment.

**Suspended solids** - These are contaminants that are visible to the naked eye and can generally be filtered out of the water using ordinary filter paper. Although there is no hard and fast definition, suspended solids are often larger than 1-2 microns in size. If water is allowed to sit without disturbing it, suspended solids will settle to the bottom of the container over time.

**Dissolved solids** - These are contaminants that are invisible to the naked eye and cannot be removed from the water by filtration. Dissolved solids are defined as substances that are generally smaller than 0.45 microns in size. Dissolved solids are normally soluble substances or antisoluble substances. Normally soluble substances are those that become more soluble as the temperature increases. Antisoluble substances are often referred to as "hardness" ions and are usually limited to salts of calcium, magnesium, strontium and barium in water treatment. These substances become less soluble as the temperature increases. These substances form scale on the hot surfaces of boiler or heat exchanger tubes.

**Colloidal solids** - These are not small enough to be considered dissolved, but also not large enough to be considered suspended solids. Generally, colloidal substances will appear as a mist in the water, and it is impossible to see visible particles with the naked eye. The size range of colloidal substances is typically between ~0.45 and ~2.0 microns. Colloidal solids do not precipitate out of water because they are so small that they are strongly influenced by their ionic surface charge. Colloidal suspensions in water are said to be a stable suspension.

**Color** - is a type of colloidal suspension. The organic molecules that contribute color to the original surface water are simply macromolecules that fall into the smaller colloidal size range. In water, these macromolecules carry an ionic surface charge that makes them stable and incapable of settling.

Biological Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) - BOD is a measure of the amount of oxygen consumed by bacteria during the breakdown of organic matter. Having a safe level of BOD in the wastewater is critical to producing quality wastewater. If BOD levels are too high, then the water may be at risk of further contamination, interfering with the treatment process and affecting the final product. Several factors can contribute to high BOD levels, such as the presence of nitrate and phosphate in the wastewater, water temperature and other factors. Each of these factors affects plant life in the water, such as algae, which in turn can have an impact on the organisms that help break down water pollutants during the wastewater treatment process. The highest quality wastewater treatment will occur in an environment that supports the life of these bacteria while maintaining a controlled bacterial population so as not to encourage rapid bacterial decomposition, which will produce higher BOD levels. Similar to BOD is COD. COD measures the amount of oxygen consumed by water during decomposition and oxidation, particularly of organic matter and oxidation of inorganic matter or chemicals. COD is a commonly used application for industrial wastewater.

## Wastewater Treatment Technologies

Technologies used to treat industrial wastewater are usually classified into four categories, namely (i) chemical technologies, (ii) physical technologies, (iii) biological technologies, and (iv) membrane technologies.

Chemical technologies - The main chemical technologies for industrial wastewater are as follows.

Neutralization - It is the adjustment of the alkalinity and acidity of the wastewater to a neutral value of pH 7.

Precipitation - Precipitation is the addition of chemicals to wastewater to alter the chemical composition of pollutants so that the newly formed compounds precipitate during the precipitation process. Precipitation is commonly used to remove heavy metals from

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