environmental warehouse
water sciences
Level 26, 44 Market Street, SYDNEY NSW 2000, Australia Tel: 1300 417 697

Water Quality Terminology

Turbidity

Turbidity is used as a measure of the amount of suspended solids or sediment in water. Suspended material can be particles of clay, silt, sand, algae, micro-organisms, and other substances.

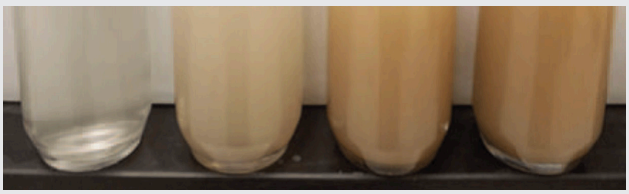
Turbidity is determined by passing light through a water sample and measuring the intensity of the scattered light at an angle of 90 degrees to the incoming light.

The units used for turbidity measurements are abbreviated as NTU (which stands for nephelometric turbidity unit), but sometimes (especially in Europe) the FNU unit is used (formazin nephelometric unit).

The difference is that NTU records the scattering of white light, while FNU records the scattering of infrared light.

Turbidity levels in rivers & streams vary from 1 NTU in clear mountain streams, to over 1,000 NTU during storms or in muddy waters and dams. The more material that is suspended in water, the greater is the water's turbidity.

Turbidity affects how far light can penetrate water. Water that has high turbidity prevents light penetration, and this can stop the natural oxygenation of water by aquatic plants. The lack of oxygen can create a toxic environment for fish and other oxygen dependent species living in the water.



increasing turbidity →

High turbidity indicates the presence of water borne sediment that has run off from erosion, which is typical on construction sites, from un-grassed areas around dams and from irrigation run off, etc. Turbidity is also a factor in the suitability of water for drinking and for irrigation purposes.

According to the World Health Organisation (WHO), for water to be permissible for drinking purposes the turbidity should be less than 5 NTU. This is quite a high number, as the sediment in the water at 5 NTU is enough to harbour viruses and bacteria, so before drinking it should undergo disinfection first.

The instruments used to measure turbidity are usually either a turbidity tube or turbidity meter.

An alternative method of determining how much sediment is in water is to filter a sample, then dry and weigh the sediment that is collected on the filter. This is a more complicated process requiring specialised measuring, filtering, weighing and drying equipment, and it takes 1–2 hours to complete. Turbidity on the other hand takes seconds to evaluate.

To reduce the level of turbidity in water, there are three options available:

1. **Time**

   Turbidity will often reduce over time if the water is left undisturbed. If the sediment is a very fine particle size (< 2 microns) or a dispersive type clay, then the turbidity may take many months to improve.

2. **Filtration**

   Turbidity can be removed using filtration devices such as cartridge filters, disc filter and sand filters.

3. **Chemical treatment**

   A range of chemicals can be applied to flocculate the sediment out of the water. This is a common approach and there are a variety of products available that are suitable even for drinking water applications. Chemical treatments can also be applied in conjunction with filtration for drinking water and irrigation applications.

Colour

The most common cause of colour in natural waters is due to tannin and lignin. These are naturally occurring compounds that come from the decomposition of plant materials, and they can impart a brown colouring in the water (the colour is similar in appearance to a weak cup of tea). Tannin and lignin often result from water running through forests and swamps that have decaying leaves and plants.

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Colour can also be the result of water-soluble minerals (metals) found in clays and other material. Colouration due to minerals is usually caused by iron, and sometimes by manganese.

There are 2 types of colour measurement:

i. **Apparent colour**

Apparent colour is the total colouration of the water, thus it includes both dissolved substances and suspended sediment.

ii. **True colour**

True colour is due to the colour of dissolved species only, meaning the water has to be filtered to remove any sediment first before measuring.

Colour in water bodies is often measured in Hazen units (HU), which is just a measure of the colour given by various concentrations of platinum-cobalt stock solution in water. The scale ranges from 0 parts per million (ppm) in distilled water (clear), up to 500 ppm of stock solution (light yellow).

To reduce the level of colour in water, the following options can be used:

1. **Filtration**

Colour can be removed using filtration devices such as a cartridge filter that contains carbon, or for larger volumes of water using a combined sand & carbon filter.

2. **Chemical Treatments**

DamClear Clarity Aid PA is a chemical that can be applied to remove colour from water. Clarity Aid PA is used when treating large volumes of water; it is commonly used for colour removal in drinking water plants of towns and cities.

Chemical treatments can also be applied in conjunction with filtration.

3. **Aeration**

If iron is the cause of water colouration (often found in water drawn from wells), aeration of the water can be used, as this process changes the chemical state of iron so that it will precipitate out as a sediment.

For water to be permissible for drinking, the WHO recommend the colour be <5 HU. In Australia the guideline is <15 HU to be aesthetically acceptable.

If the water is to be disinfected for human consumption using ultraviolet light, then all the colour must be removed prior to the UV lamp.

pH

pH is a measure of the acidity or basicity of water, and is a key indicator for the quality of water and its suitability for many applications.

pH has a range from 0–14.

A pH value of 0 is equivalent to water containing about 4% of a strong acid. If the water/acid mixture contains more than 4% acid, then the pH scale is not meaningful anymore.

A pH value of 7 is considered a neutral pH. Most natural water bodies have a pH between 6–8.

A pH value of 14 is equivalent to a strong alkali like sodium hydroxide dissolved in water at a strength of around 2%. If the sodium hydroxide solution is any stronger than about 2%, then the pH scale is not meaningful anymore.

Rainwater typically has a pH of about 6.5. For water to be suitable for drinking purposes the pH should be between 6.5–8.5.

When water becomes stagnant in a dam or river, the pH of the water can be become acidic (usually from bacterial activity). When water flows through limestone, the pH of the water will increase and become slightly alkaline at a pH of about 8–9.

The pH can be altered by adding suitable acidic or basic (alkaline) material, and this is best done while monitoring the water pH with a pH probe (and meter) to help stop overdosing.

Conductivity

The conductivity is an indirect measure of the amount of salts dissolved in water. As the salt content increases, the electrical conductivity of the water increases. Since conductivity helps measure water salinity, it is a key indicator of water quality and its suitability for use.

Rainwater has a low conductivity usually <5 µS/cm, whereas the conductivity of seawater ranges from 30,000–50,000 µS/cm equating to about 2–4% by weight of salt.

For water to be permissible for drinking, the WHO recommend the conductivity be less than 1,000 µS/cm (or <0.5 grams of salt per litre of water).

The conductivity of dam water and inland river water is usually less than 500 µS/cm. Underground water sourced from wells and springs can have low conductivity or very high conductivity depending on the nature and geology of the rocks the water has travelled through.