

WATER

Notes about origin, quality, treatment processes

Water: what is, how it reaches us

We all know the natural cycle of water: evaporation of rivers, sea, lakes - clouds - rains, snow - rivers, sea etc., and so on.

Part of the rain water flows on the ground to the rivers, lakes, seas; part of it, instead, penetrate into the ground. Then, it comes out through the sources or the wells.

The water is a chemical compound, H₂O (hydrogen and oxygen), but it also contains several substances; the quantity and the quality of these substances are depending on the ways and the materials the water flows through.

Water is such an excellent solvent, so it contains many dissolved materials : evaporating water is pure and distilled water, but water in the form of rain adsorbs carbon dioxide through the atmosphere, flowing on the ground it carries away sand, organical substances, pollutants, etc.

When the water flows through the several layers of the ground, it is cleaned, since it flows through very slowly, and most of impurities are trapped by the ground itself.

In the same time the water dissolves part of the minerals of which the ground is made. This process, throughout which the water becomes riche in salts, goes on until the water comes back to the sea.

Drinking water

Generally speaking, we can define the water as drinkable, when it can be safely drunk without any damages for the human health.

From legal point of view, the acceptable quality for drinkable water is stated by local laws (Directive 778/80 for countries of European Union), which are different from country to country.

The laws usually state the maximum allowed quantity far each substances (or minimum quantity in some special cases) but, as a general rule, we can assume that the water must be free of heavy metals, toxical organic substances, bacteria, etc.

In the same time, some water can be defined as drinkable, according to local law, but its use cannot be recommended for some people: for example, the water with high quantity of calcium for peoples with kidney troubles; the same water can have favourable effects for human bony system.

No matter how the water is, all waters can be treated to obtain drinkable water.

In most cases the problem is very easy and cheap, in others very difficult and expensive.

Industrial use of water

Naturally, the water used for purposes other than drinking, does not require special characteristics as drinkable water.

Rather, according to the utilization, other features are required, for example :

- the water with high contents of calcium carbonate is not recommended to be used as feed water of thermal plants (boilers, water exchangers, etc); even if it is drinkable.
- the water used in laboratories must be demineralized, completely free of any dissolved salts.

Naturally, in these and many other cases, water must be treated, in order to make its quality suitable for the applications.

Water treatments

There are many processes of water treatment.

The most common of them are listed below, together with a brief description.

For more detailed informations, see also the special technical bulletins of water treatment processes.

It is important to note that a combination of two or more processes is often used in order to improve the quality of water, according to the specific applications.

1. Drinking water plants

All the water treatments to make the water drinkable; for example filtration, sterilization, desalinization etc.

2. Filtration

Filtration is the process that removes all the solids contained in water.

3. Clarification (filtration by dual media filter)

It is a special kind of filtration, allowing to take off all the suspended solids contained in the water, as undissolved form (sludge, mud, etc.); it allows to remove the turbidity and to get clear water.

Usually this process consists in to let the water flowing through a bed of media filter (several layers of selected sands with different grain-sizes, or a bed of carbon), alike the natural process of the water flowing through the several layers of the ground.

4. Sedimentation - settling

This process allows the settling of the suspended parts contained in water, in order to reduce the quantity to be filtered. A chemical agent is often added to the water in order to improve the sedimentation.

5. Sterilization - disinfection

These processes are used to make drinkable the water containing bacteria; the most common way of sterilization is the addiction of chlorine. Other ways of sterilization are UV rays diffused by special lamps, the ozone addiction .

The laws of some countries allow only chlorine addiction or, better, require a safety chlorine addiction together with other treatments.

6. Dechlorination — Removal of organic substances

The most common way to remove organic pollutants (pesticides, chloroform) or chlorine residual from disinfection treatment is the filtration through a bed of activated carbon (see also Activated Carbon bulletin).

This action improves the quality of water, removing bad taste and smell. Other substances (ammonia, sulphides,) can be stripped by special degassing tower, in which air is used as degassing agent.

7. Softening

This is the treatment allowing to take off calcium and magnesium contained in the water. These two elements, together with bicarbonates, are the causes of the scale deposits in thermal plants (boilers, heating systems, laundries, water heaters, dish-washers, etc.); they also can cause problem when water is used in industrial process.

Usually the softening is realized by ion exchange resins.

8. Distillation

This system is realized by evaporating of water and subsequent condensing.

This way allows to obtain water free of salts and, in the same time, sterilized by temperature.

The distilled water is used in pharmaceutical or chemicals industries, laboratories, ecc.

9. Demineralization

This process allows to get water free on any salts without using heat. Normally the demineralization (or deionizing) is made by ion exchange resins. The process allows to obtain water with residual salts lower that the distilled water but, on the other end, deionized water is not sterile.

The deionized water is used in many fields of industries and for thermal plants.

10. Desalinization — Reverse Osmosis

These processes allow to get water with an acceptable contents of dissolved salts, by treating brackish or sea water.

They have been used to produce drinkable water from sea water, and the systems are mainly the distillation (by heating) and the Reverse Osmosis system (passage of water through a selected membrane, see also Reverse Osmosis bulletin).

11. Chemical addition

Generally, it means all treatments in which a chemical agent is added to the water to improve the quality or to make water suitable to the utilization (for example addition of corrosion inhibitor for feed water of steam boilers, or chlorine addition for drinking water etc).

The above informations are only for general directions about the water and its treatments.

Apply Nobel Service or Technical Centers for further informations.