What's an ideal drinking water ?

Which are the desired and the unwanted components of an "ideal drinking water"?

In order to define the good quality of a drinking water, a high number of parameters ought to be considered, even those which are present only in negligible traces. We must also remember that the definition of ideal water depends on the final use of it: for example many people require a low sodium water, whereas children need a calcium rich water, and a hard water is not desired in households... As drinking water is distributed to the entire community, its quality will always represent a compromise between its multiple final uses.

Main components

Here follows a brief description of the most important parameters, with an indication of the desired concentrations in drinking water.

Sodium : < 20 mg/l
The salt input due to our solid food intake amply covers our daily needs in sodium. A high quantity of sodium in mineral or drinking water contrasts with the principles of a balanced and healthy diet.

Potassium
Potassium is an essential mineral salt which accounts for various vital functions in our organism, such as the transmission of nervous impulses. It plays an important role in the prevention of arterial hypertension and kidney stones. As the amount of potassium in water is negligible, a diet rich in fruit and vegetables is recommended.

Magnesium : 5 – 30 mg/l
Our body needs magnesium for bone growth and for the metabolism of many enzymes (proteins). Magnesium helps prevent muscular cramps and heart attacks. An adult daily needs 500 mg of magnesium, which can also be found in cereals, nuts, almonds and bananas.

Calcium : 40 – 125 mg/l
This mineral salt is essential for bone and teeth growth, for blood circulation and for the correct functioning of our muscles. A daily intake of 800 mg is necessary: calcium can be found in dairy products, cabbages, leguminous plants and almonds.

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Chlorides : < 20 mg/l
Chlorides are widely present in nature, generally as sodium or potassium salts (NaCl or KCl). Alkaline waters containing a high amount of chlorides have a laxative effect and should be avoided by people with kidney or cardiovascular problems. At concentrations > 200 mg/l chlorides give a bad taste to the water and can create a corrosive effect in the distribution network.

Free chlorine : 0.05 – 0.15 mg/l
The use of chlorine, chlorine dioxide and ozone for disinfection purposes is regulated by law. A low amount of free chlorine allows a residual disinfection of the distribution network by hardly altering the taste of the drinking water.

Nitrates : < 25 mg/l
Nitrates are particularly unwanted in drinking water, since our body can transform them into nitrites and subsequently into carcinogenic nitrosamines.

Hydrogen carbonates
Hydrogen carbonates help in the digestion process and can neutralise acid body liquids.

Sulphates : < 50 mg/l
Sulphates activate bile and intestines. They are therefore useful in the digestion process, but can have a laxative effect at higher concentrations.

pH : 6.8 – 8.2
The pH value (hydrogen potential) indicates whether a liquid is acid (ph < 7) or alkaline (pH > 7). At a lower pH the risk of corrosion is higher.

Electric conductivity at 20°C : 200 – 400 µS/cm
The electric conductivity of water is related to its salinity. A high conductivity can be due to abnormal pH values or to a high content of mineral salts.

Total hardness : 15 – 25 °F
Limestone can easily dissolve when it comes into contact with water. Technically, total hardness represents the sum of all polyvalent cations. Practically, it is the amount of calcium and magnesium ions, which are the predominant minerals in natural waters. A hard water is not unhealthy, on the contrary it may improve the taste of the drinking water, but it is definitely not popular in households, since it can cause calcium carbonate deposits. However a very soft water is also unwanted due to its corrosive effect.

Turbidity : < 0.2 NTU
Turbidity indicates the presence of suspended particles in water, which can transport by adsorption some unwanted substances. Events like storms or snowmelt can lead to high turbidity peaks in the raw water.

Unwanted components

A drinking water must be free from or only contain traces of the following components (in brackets the tolerance or fixed limits according to Swiss laws).

Biological impurities

- Bacteria indicating a faecal contamination (absent in 100 ml)
- Other microorganisms (cyanobacteria, algae, nematodes, etc.: bad taste and smell)
- Parasitic protozoa (amoebae, giardia, cryptosporidium, etc. : gastroenteritis)
- Pathogenic viruses.

Mineral impurities

- Heavy metals (cadmium, chrome, copper, lead, mercury, etc. : toxic and/or carcinogenic effects)
- Ammonium (0.1 mg/l, precursor of carcinogenic chloramines)
- Arsenic (0.01 mg/l, carcinogenic)
- Cyanide (0.05 mg/l, toxic)
- Iron (0.3 mg/l, colour, taste and deposits in piping systems)
- Fluoride (1.5 mg/l, negative effects on bones and teeth)
- Manganese (0.05 mg/l, colour, taste and deposits in piping systems)
- Nitrite (0.1 mg/l, precursor of carcinogenic nitrosamines)
- Selenium (0.01 mg/l, toxic).

Organic impurities and anthropogenic micropollutants

- Natural organic matter (colour, taste and smell, precursor of carcinogenic disinfection by-products)
- Hydrocarbons (carcinogenic, bad taste)
- Pesticides and phytosanitary products (0.0001 mg/l per substance, 0.0005 mg/l for the sum of all organic pesticides : toxic and/or carcinogenic effects)
- Phenols (0.005 per substance, bad taste even in very low concentrations)
- Medicine residues and synthetic hormones
- Chlorinated solvents (dichloroethane, trichloroethylene, etc. : carcinogenic effects)
- Disinfection by-products (trihalomethanes, bromate, etc. : bad taste, carcinogenic effects)
- Radioactive substances (carcinogenic effects).