Requirements for the quality of drinking water

Drinking water is water from any natural source, that meets **health and technical requirements** and is used by humans. „It is harmless to health, with continuous consumption it does not cause illness or health disorders due to the presence of microorganisms or substances affecting the health of individuals and their offspring through acute, chronic or late effects, its sensory properties and quality do not prevent its consumption and use for the hygienic needs of individuals." *(According to the definition of drinking water, which is similarly enshrined in Act No. 258/2000 Coll. and Decree of the Ministry of Health of the Czech Republic No. 252/2004 Coll.)*. We distinguish between **underground and surface** water. Requirements for drinking water are established by Decree **No. 252/2004 Coll.**. Drinking water must not be an environment in which pathogenic microorganisms and parasites spread. It must have satisfactory organoleptic properties and a suitable composition from the point of view of the representation of microelements and macroelements. Finally, they must comply with the technical standards of waterworks.

Drinking water

We distinguish between public and individual supply.

Public supply

This is a supply from a public water supply or a public well, the range of users is **open**. Naturally, there are **stricter requirements** for the microbiological and biological composition of water.

Individual supply

It works for a **closed** circle of customers (less than 50 people). Daily consumption does not exceed 10 m^3. And these are mainly domestic wells. There are **less strict** requirements for microbial and biological indicators.

Sign: „drinking water"

Drinking water quality

The quality of the supplied drinking water is checked in accordance with applicable legislation right up to the customer's tap. The water that is supplied to households undergoes a series of checks and meets strict quality criteria. The water quality monitoring plan is developed in accordance with the applicable legislation, weekly water samples are taken directly from drinking water sources and three times a week a number of samples are taken from consumers.

Water quality indicators

Limit value

The value beyond which the water loses its satisfactory quality. Less health-risk indicators are treated with this value, e.g. Cl^-, NH_4^+, psychrophilic bacteria.

The highest limit value

The value, exceeding which excludes the use of water as drinkable. Health risk indicators, e.g. NO^{2-}, Pb, Hg, E. coli.

Risk limit reference value

Value for substances with non-threshold effects (late effects). The exceedance excludes the use of the water as drinkable. The essence of the test is the determination of mutagenic activity using the Ames test.

Recommended value

Indicators used to determine the biological value of water. They are not binding on the manufacturer. Optimal concentration of Ca, Mg, Fe, Cl$^-$ F, K.

Physical and organoleptic properties of water

- Temperature 8–12 °C (max. 2 °C fluctuation).
- pH 6,5–9,5.
- Clear, transparent liquid without turbidity, precipitates.
- Refreshing taste acceptable to customers.
- Odor acceptable to customers.

White color of water

The white color of the water is due to air dissolved in the water. When cold water from the distribution network comes into contact with warmer internal distribution systems, this air is released from the water and a large number of small bubbles cause its "milky" color. The air will gradually evaporate from the water, so just let the water stand for a few minutes. After that, the water should be clear again. The white color of the water is not harmful to health.

Requirements for drinking water

Drinking water:

- it must not be an environment in which pathogenic microorganisms and toxic substances occur;
- it must have a suitable composition and contain some trace elements;
- it must have satisfactory organoleptic properties. That is temperature (10–12 °C), color, clarity, refreshing taste, reasonable water hardness and CO_2 content, odorless;
- it must also comply with the technical requirements of waterworks (some substances destroy distribution pipes without being harmful to humans).

Norms

The current requirements are mainly of a repressive nature. They mainly indicate what must not be contained in drinking water. The maximum permissible concentrations of some dissolved substances are also calculated here. A "positive" standard that would indicate the optimal composition of drinking water does not yet exist.

Nitrates and nitrites

In artificially fed children up to 3 months of age, a larger amount of nitrates can cause so-called **alimentary methemoglobinemia**. The reduction of nitrates by bacteria in the digestive tract produces nitrites, which after absorption cause the formation of methemoglobin. Methemoglobin is characterized by the presence of Fe^{3+}, and is not able to reversibly bind oxygen (it has a higher affinity for oxygen and it is harder to release it). Hypoxia, cyanosis and eventually death occur. The formation of methemoglobin also contributes to the fact that infants still have a certain percentage of fetal hemoglobin, which is more sensitive to nitrite oxidation (methemoglobin reductase).

The upper limit of nitrates in water has been set at a concentration of **50 mg/l** (for both adults and infants; the previously stated value of 15 mg/l for infants no longer applies). The maximum permissible concentration of nitrites is two orders of magnitude lower, i.e. **0,5 mg/l** and this is because nitrites do not need to be further transformed in the body and, in the received form, directly affect hemoglobin.

Among other requirements for drinking water, we also include quantity requirements. This is a general summary of the needs of the population, industry and agriculture in the given area. It is also necessary to account for consumption in hotels, medical facilities, etc. In the balance of water resources, we always calculate the maximum daily need.

Phosphates

The phosphate content in drinking water has both advantages and disadvantages.

- **Advantages**: phosphates protect water pipes from corrosion and reduce secondary iron contamination of drinking water.
- **Disadvantages**: the higher content of phosphates is a supporting factor for the growth of legionella, against which there is usually not a sufficient content of disinfectants in warm water. Legionella can cause Legionnaires' disease or less severe Pontiac fever in weakened individuals (e.g. patients after surgery, transplantation, with chronic disease).

Chlorine in water

Chlorine prevents the multiplication of bacteria germs in water networks. It acts as a food preservative and guarantees the preservation of water quality. The water is distributed in excellent bacteriological quality and contains only the elements necessary for health, especially salts and minerals. To avoid secondary contamination, it is necessary to add chlorine to drinking water. Chlorine is added additionally because it is consumed during water distribution by reacting with pipe walls and other components contained in the water, including unwanted microorganisms. Microorganisms in water are also destroyed by ozone or UV radiation, moreover, these treatment methods do not change the taste properties of drinking water. However, unlike chlorine, it does not protect the water throughout the distribution period.

Water hardness

By this term we mean the concentration of polyvalent cations of alkaline earth metals. Calcium and magnesium play the biggest role here. Other elements also contribute: aluminum, manganese, zinc.

Scale

very soft → soft → medium hard → hard → very hard.

The optimal hardness of drinking water (Ca and Mg content) from a health point of view is difficult to determine in general. We prefer harder water. Approximate values could be around **20-30 mg/l for magnesium** and **40-80 mg/l for calcium**, with a total water hardness of 2-4 mmol/l. Water hardness can be regulated by various processes (water hardening or softening).

Tap water

- one liter of water is roughly 100 times cheaper than one liter of bottled water;
- it is harmless to health – it is subject to more frequent and stricter control, everyone has the right to be informed about the quality of tap water, and that in the full range of parameters, unlike bottled water, which only has a selection of a small number of parameters on the packaging;
- in terms of quality, tap water is completely comparable to bottled water, due to the lower content of minerals it puts less strain on the kidneys;
- always fresh, optimally stored in the cold and dark in the water pipe;
- when consuming tap water, there is no need for transport by trucks, the need for storage and disposal of non-ecological waste in the form of PET bottles.

Links

Related articles

- Bottled water
- Individual source of drinking water
- Water treatment in field conditions
- Mass water supply
- The issue of drinking water in the Czech Republic
- Health risks from water
- Water treatment of drinking water

References

- Czech Republic. Decree on requirements for the quality and health safety of bottled water and on the method of its treatment. In *275/2004*. 2004. Available from <[1] (https://portal.gov.cz/wps/portal/_s.155/701/.cmd/ad/. c/313/.ce/10821/.p/8411?PC_8411_name=Vyhl%C3%A1%C5%A1ka%20%20o%20%20po%C5%BEadavc%C3jic h%20%C3%BApravy&PC_8411_l=275/2004&PC_8411_pi=10&PC_8411_ps=10&)>.

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