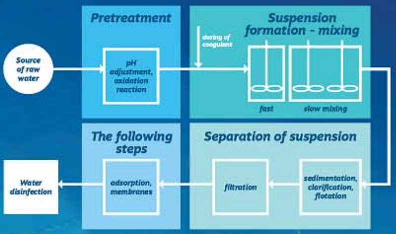
DRINKING WATER TREATMENT

Drinking water

is obtained by treating **raw** (natural) water from **surface** (dams, rivers) or **underground** (boreholes, wells) **water sources**. Water treatment takes place in so-called **water treatment plants**. It involves a number of **physical, chemical** and in some cases also **biochemical** processes that remove **undesirable pollutants** (humic substances, clay minerals, iron, manganese, etc.) and **harmful impurities** (nitrates, radon, pesticides, cyanobacteria, bacteria) from the water, or adjust selected **water properties** (pH, water hardness – calcium and magnesium content, etc.).

The involved water treatment processes differ depending on the water source (surface vs. underground) and on the content of impurities. **The most complicated** are usually **the surface resources** located in agricultural areas where **cyanobacterial bloom** usually develops.

The scheme of two-stage water treatment



The most common technological processes in surface water treatment are the following:

Pre-treatment of water properties – Most often it is an adjustment of **water pH**. This is usually done by dosing **lime water** to increase the pH or **sulfuric acid** to decrease the pH.

Dosing of coagulant – Coagulation reagent, most often in the form of **aluminum** or **ferric sulphate**, is added to the water for the purpose of **coagulation**, which leads to the "bonding" of pollutants into larger removable aggregates.

Formation of suspension – mixing – **Flocks** (aggregates) are formed by coagulation of pollutants with coagulant. It takes place in **mixing tanks** due to the intensive mixing of water. The water is mixed **mechanically** (paddle stirrers, hyperboloid stirrers, etc.) or **hydraulically** (perforated walls, flocculation channels, etc.).

Separation of suspension – Flocks formed by coagulation must be removed from the water. This is usually done in two steps. The first is **sedimentation** (settling flocks at the bottom of a sedimentation tank) or **flotation** (separation of flocks by air bubbles to the surface of the flotation tank), and the second is **sand filtration**, which removes residual flocks that were not removed in the first separation step.

Additional techniques of water treatment – If the water treated by coagulation is not of satisfactory quality, an additional treatment step is required. The most commonly used processes are adsorption onto activated carbon, membrane processes or ion exchangers. These processes usually remove residual concentrations of non-coagulated organic substances (cyanobacteria and algae products) or micropollutants (pesticides, etc.)

Water disinfection – The last step of water treatment is the elimination of pathogenic microorganisms (bacteria or even viruses), mostly by dosing of chlorine compounds. Subsequently, water is distributed to water tanks and households.

95% of the Czech population

is connected to the public water supply system. Others usually have their own water source – a well.

In 2017,

the total water consumption was 131.7 litres per person and a day. The consumption of households was 88.7 l/person/day. The highest consumption was in Prague (173.3 l/person/day), the lowest in the Zlín Region (113.3 l/person/day.)

Why should we prefer tap water over bottled water?

- *Tap water is always fresh. It stays in the water mains only for few hours, or days at maximum. By contrast, the time between the tapping and packaging of bottled water and its consumption is usually weeks to months. Additionally, the quality of bottled water may be threatened by improper storage.*
- *Tap water is much cheaper (average price is CZK 0.07/l), it is more than a hundred times less than bottled water.*
- *The quality of tap water is controlled more often and subjected to stricter standards. Daily water analysis is carried out at water treatment plants.*
- *Bottled water is a huge burden on the environment. The production of plastic bottles is energy intensive, and even more energy is spent on transporting and subsequently on the disposal of PET packaging. Most of the bottles will end up in landfills, where they will remain for thousands of years.*

The highest share of population

supplied with drinking water from the public water supply system (in 2017) was in the Karlovy Vary Region (100%), in Prague (100%) and in the Moravian-Silesian Region (99.9%). The lowest share of population supplied by the system was in the Plzeň Region (85.0%) and the Central Bohemian Region (86.4%).

There are more than 439 drinking water treatment plants in the Czech Republic.

The Káraný water treatment

plant is unique because it uses natural infiltration of water from the Jizera river into the surrounding gravel sands, thereby self-cleaning. Then, the water is collected into 685 wells in total, and from there it is pumped to water treatment plant.

The largest water treatment plant

*in the Czech Republic and one of the largest in Central Europe is Želivka, which supplies Prague, the Central Bohemian Region, and the Vysočina Region. Another source of water **for Prague is the water treatment plant in Káraný.***

Cyanobacteria in the water reservoir Vrchlice

Water treatment plant Želivka - sampling object

Mixing and settling tanks at the water treatment plant U Sv. Trojice in Kutná Hora

Ferric flakes of coagulating agent

VODA