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**“ INNOVATIVE AGRICULTURAL TECHNIQUES TO BOOST  
ENTREPRENEURIAL SKILLS OF FUTURE FARMERS”**

# **FARMERS FOR FUTURE**

**ERASMUS+ PARTNERSHIPS**

**PROJECT 2020-1-IT01-KA202-008505**



# Chemical Analysis of Water

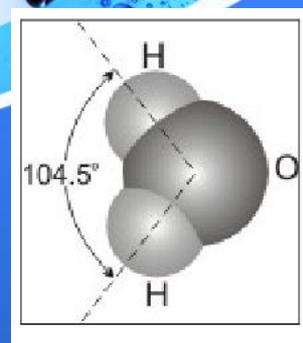


# Physical properties of water

- Water is a colorless, odorless, tasteless and liquid substance under normal conditions.
- It constitutes 70% of the human body and is the essential component for the function of cells, participating in all biochemical processes.
- Plants extract hydrogen from water for the process of photosynthesis



Each molecule of water consists of two hydrogen atoms and one oxygen atom. Water is actually a mixture of water molecules with different molecular weights.



The chemical bond held by the molecule is covalent, i.e. each hydrogen atom shares its free electron with the electrons of the valence layer of oxygen.

The angle between two bonds is 104.5 ° and the distance between the bond O-H is 0.96 Å.



- **Another characteristic property of water is its high solubility, due to its high dielectric constant, as well as the polarity of its molecules.**
- **Thus water is a good solvent for electrolytes and organic compounds with a hydrogen bond and a bad solvent for non-polar compounds.**
- **Dissolves a wide variety of ingredients from simple salts to minerals and rocks.**
- **It also plays an important role in the chemical disintegration of rocks where, together with natural and biological processes, it contributes to soil formation.**

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- Water is the only one of the usual compounds that in its solid form (ice) is lighter than liquid (ice density at 0 °C equal to 0.91659 kg / L and liquid density at 0 °C equal to 0.99980 kg / L ), resulting in the floating of the ice and the conservation of the aquatic fauna.
  - Density of water is affected by temperature, atmospheric pressure and the presence of various substances (salts, organic residues, etc.).
  - The coagulation temperature (0 °C) decreases and the boiling temperature (100 °C at 1 atm) increases if the water contains dissolved ingredients. In addition, the water molecule exhibits a high surface tension .



# Water sampling-Chemical analyzes

- The sampling of water samples must be representative of its area under study
- The sample water must be fresh
- Water should be collected in polyethylene bottles.
- Glass bottles should be avoided, as adsorption and ion exchange have been observed. The samples are stored in a refrigerator at 4 °C until transported to the laboratory. Chemical analysis results are more reliable when the time mediation between sampling and analysis is small.



# Physicochemical parameters of water

The main parameters of water are:

- Natural (temperature, color, turbidity, odor, radioactivity)
- Chemicals (pH, Conductivity, Hardness, Alkalinity, Reduction Potential)
- Main ions:  $\text{Ca}^{2+}$ ,  $\text{Mg}^{2+}$ ,  $\text{Na}^{+}$ ,  $\text{K}^{+}$ ,  $\text{HCO}_3^-$ ,  $\text{SO}_4^{2-}$ ,  $\text{Cl}^-$ ,  $\text{NO}_3^-$
- Secondary ions:  $\text{Fe}^{2+}$ ,  $\text{Fe}^{3+}$ ,  $\text{Mn}^{2+}$ ,  $\text{NH}_4^+$ ,  $\text{F}^-$ ,  $\text{CO}_3^{2-}$ ,  $\text{Al}^{3+}$  etc.
- Heavy metals:  $\text{Pb}^{2+}$ ,  $\text{Cr}^{6+}$ ,  $\text{Hg}^{2+}$ ,  $\text{As}^{3+}$ ,  $\text{Cd}^{2+}$  etc.
- Nutrients of N, P
- Proteins, Organic compounds, Gases ( $\text{O}_2$ ,  $\text{N}_2$ ,  $\text{H}_2\text{S}$ ,  $\text{NH}_3$ ,  $\text{CH}_4$ )



# Basic analysis of water

This analysis package certifies the suitability of water for human consumption. It contains a part of all the required analyzes included in the legislation

1. Physicochemical water control. Includes: pH, Conductivity, total solids, suspended solids, total hardness, total alkalinity, phenolic alkalinity, permanent hardness, carbonates, carbonates and chlorides
2. Microbiological water control in accordance with current legislation. Includes: Coliforms, Escherichia coli, Enterococci and others per case
3. Analysis for trace elements and contaminants. Includes: Nitrite, Nitrate, Phosphate, Ammonia, Potassium, Disinfectants, Fluoride, Hydrogen Sulfur, Hydrocyanic, Phenols or selected heavy metals per case.

**Water is perhaps the most valuable commodity for humans and living organisms. To be classified as potable, water is required to meet certain specifications based on its quality characteristics.**

**We emphasize the substances contained in the water and the concentration limits that must be observed so that the water can be consumed safely.**





# Quality characteristics of drinking water

## Sodium (Na +)

Sodium is an essential element for the human body. In healthy adults, excess sodium is automatically eliminated from the body. However, in susceptible individuals, such as those suffering from hypertension, infants, and the elderly, high sodium levels are a problem and a low-sodium diet is recommended. For daily consumption, bottled water with lower sodium levels than 150 mg / L and ideally less than 50 mg / L is recommended, while bottled water used to prepare baby food should contain as little sodium as possible.

**FOR OUR AREA: 4.9 - 5.9 mg / L**

A vertical decorative graphic on the left side of the slide. It features a blue background with a white border. The background is filled with numerous small, light blue water droplets of varying sizes. Several larger, dark red, biconcave disc-shaped structures, representing red blood cells, are scattered throughout the water droplets.

# Potassium (K +)

Although it is an essential element for the body, the human body finds it difficult to manage high potassium levels, resulting in kidney problems and even kidney failure. Although not considered toxic, long-term exposure to high potassium concentrations should be avoided and bottled water with a concentration of less than 12 mg / L is recommended for daily consumption.

**FOR OUR AREA: 2 mg / L**



# Chlorine (Cl<sup>-</sup>)

The upper limit for chlorine is 200 mg / L. Also, if bottled water is intended for the preparation of beverages, such as tea and coffee, it would be desirable to choose bottled water with the lowest possible chloride concentration.

**FOR OUR AREA: <10.0 mg / L**



# Sulphates (SO<sub>4</sub><sup>2-</sup>)

Magnesium sulfate and sodium sulfate are both powerful laxatives, so a sudden increase in their levels can lead to severe complications in this area. This can be especially serious for young children and sensitive adults, which is why bottled water with sulfate concentrations below 30 mg /L is recommended for daily use.

**FOR OUR AREA: 10.0 - 11.0 mg / L**



## Nitrite (NO<sub>2</sub>-) - Nitrate (NO<sub>3</sub>-)

They are part of the nitrogen cycle in nature, so they are present in natural waters, but the nitrate concentration is usually low. High concentrations are due to fertilizers, waste and animal or human waste. They are even present in the air due to air pollution, as a result of which they are carried away by the rain or deposited on the ground. Under aerobic conditions, nitrates penetrate the aquifer. Drinking water that contains large amounts of nitrates is likely to cause methaemoglobinemia in children due to their reduction to nitrite. Nitrite and nitrate, in the stomach environment, form N - nitroso compounds, which are carcinogenic.

**FOR OUR AREA Nitrite (NO<sub>2</sub>-) : <0,25 mg / L**

**FOR OUR AREA Nitrate (NO<sub>3</sub>-) : 2 – 7.2 mg / L**



# Acidity (pH)

PH expresses the concentration of hydrogen ions ( $H^+$ ) contained in an aqueous solution and is defined as the negative logarithmic concentration of hydrogen ions. The value of pH in water: (a) regulates the reaction mechanisms that control water quality, (b) in relation to the redox potential (Eh) determines the chemical form in which an element appears in water and (c) inhibits or accelerates biochemical processes, e.g. the cells of living organisms survive at pH values which range between 5 and 9.

**FOR OUR AREA: 7.6 - 7.9**

A vertical, curved strip on the left side of the slide shows a microscopic view of water. It is filled with numerous small, dark blue spherical bubbles of varying sizes. A few larger, elongated, lens-shaped structures are also visible, possibly representing larger droplets or biological cells. The background is a light blue gradient.

# Conductivity

Conductivity is one of the characteristic properties of matter which determines the ease or difficulty of diffusion within it of the various forms of energy.

Conductivity is therefore related to the resistance of matter to energy flow, which also depends on the losses that can be observed due to the conversion of the original into other forms of energy within the same material.

For this reason, the study of the structure and properties of materials is considered necessary. The most important conductivities used today in technology and especially in the calculation of insulation construction are acoustic conductivity (sound propagation), electrical conductivity (current propagation) and thermal conductivity (heat dissipation).

**FOR OUR AREA: 350 – 570  $\mu\text{S}/\text{cm}$  at 20°C**



# **Additional information for Kavala area water**

**The water supplied to the water supply network of D.E. Kavala comes from the springs of Voirani in Kefalari, Drama.**

**Its quality is such that it does not require any treatment other than disinfection.**

**The disinfection is done with chlorine gas, which is applied at the Central Pumping Station in Amisiana.**



Specifically, the Quality Control Office of DEYA. Kavala, which is certified with EN ISO 9001: 2000, from December 2006, with EN ISO 9001: 2008 from December 2010 and with EN ISO 9001: 2015 from September 2018, performs the parameter analyzes provided in

Group A (residual chlorine, turbidity, conductivity, pH, color, odor, taste, microbiological parameters) and outsourced, ISO 17025 accredited laboratories to control the parameters provided in

Group B (heavy metals, chlorinated derivatives, by-products) , polycyclic aromatic hydrocarbons, etc.) as well as radioactivity parameters.



Parameter	Parametric value	unit	water supply network 1 Tank/tunel	water supply network 2 Hospital	water supply network 3 Palio	water supply network 4 Karvali Highschool	water supply network 5 16 Primary school
			(04-03-2021)	(13-05-2021)	(20-10-2021)	(01-12-2021)	(16-12-2021)
Acrylamide	0,10	µg/l	<0,04	<0,04	<0,1	<0,1	<0,1
Antimony	5	µg/l	0,15	0,13	1,3	1,5	<1,0
Arsenic	10	µg/l	1,7	1,5	<1,0	1,6	1,5
Benzol	1,00	µg/l	<0,1	<0,1	<0,25	<0,25	<0,25
Benzo-a pyrene	0,01	µg/l	<0,0025	<0,0025	<0,0025	<0,0025	<0,0025
Boron	1	mg/l	0,0068	0,0072	<0,05	<0,05	<0,05
Bromine	10	µg/l	<0,6	<0,6	<5,0	<2,0	<2,0
Cadmium	5	µg/l	<0,035	<0,035	<0,1	<1,0	<1,0
Chromium	50	µg/l	0,37	0,44	<1,0	<1,0	1,3
Hexavalent chromium	50	µg/l	<1,0	<5,0	<5,0	<5,0	<5,0
Cuprum	2	mg/l	0,0019	0,0046	<0,01	<0,01	<0,01
Cyanide	50	µg/l	<5,0	<5,0	<10,0	<10,0	<10,0
1,2-dichloroethane	3,00	µg/l	<0,3	<0,3	<0,25	<0,25	<0,25
epichlorohydrin	0,10	µg/l	<0,03	<0,03	<0,1	<0,1	<0,1
Fluoride	1,50	mg/l	0,29	0,23	<0,2	<0,2	<0,2
Lead	10	µg/l	0,12	0,34	1,1	3,5	<1,0
Mercury	1	µg/l	<0,04	<0,01	<0,1	<0,1	<0,1
Nickel	20	µg/l	0,30	0,18	<1,0	1,1	<1,0
Nitrates	50	mg/l	7,0	7,0	2,0	6,4	7,2
Nitrite	0,50	mg/l	<0,02	<0,02	<0,03	<0,03	<0,03



# Hardness of water

The hardness of water is mainly determined by the content of dissolved calcium and magnesium salts it contains.

These minerals, when and when heated or cooled, react with carbon ions in water. They form calcium carbonate and magnesium carbonate and settle in solid form like salts layer.

Water with a hardness of less than 60 ppm is considered commercially soft.

**FOR OUR AREA: German grades 17.9**



# Radioactivity of water

Radioactivity of water is of natural or human origin. Natural comes from the radioactive elements that exist on earth or are created by the bombardment of the atmosphere with cosmic radiation.

The two main radioactive isotopes present in water are tritium ( $^3\text{H}$ ), carbon-14 ( $^{14}\text{C}$ ) and potassium-40 ( $^{40}\text{K}$ ).

Tritium is produced under its influence cosmic radiation in the oxygen and hydrogen of the atmosphere, thus producing water molecules with tritium in their molecule.

The isotope  $^{14}\text{C}$  and produced  $\text{CO}_2$  is trapped in water. The  $^{40}\text{K}$  isotope is produced from the earth's crust.

Carbon-14 is used for dating carbon-containing materials (wood, plants) and tritium for dating water.



Radioactive isotopes of uranium-238, thorium-232 and uranium-235 and their decay products radio-228 and radio-226 contribute to natural radioactivity.

Radioactive isotopes of human origin are mainly derived from their use nuclear weapons, as well as radioactive drugs and fuels.

The presence of radioactive isotopes in water makes them unsuitable for drinking, because they cause genetic mutations and teratogenesis.

# RADIATRIC PARAMETERS IN OUR AREA

Control Parameter	Date of Sampling	Sampling results	Maximum Permissible Parameter Value	Predicted Frequency Sampling per year	Applicable Frequency Sampling per year
Total radiation A (241Am)	22/11/2019	<40	100 mBq/l	1	1
Total B radiation (90Sr)	22/11/2019	<400	1000 mBq/l	1	1
Total indicative dose	22/11/2019	<0.1	0.1 mSv/year	1	1



# Integrated Information System of E.D.E.Y.A.

through which citizens can be informed about the quality of drinking water.

By following this link

<https://ydor.edeya.gr/labcheck/view>

and selecting DEYA Kavala, you can see the sampling points in our area and the results of the analyzes.

<https://ydor.edeya.gr/dashboard>

Organization

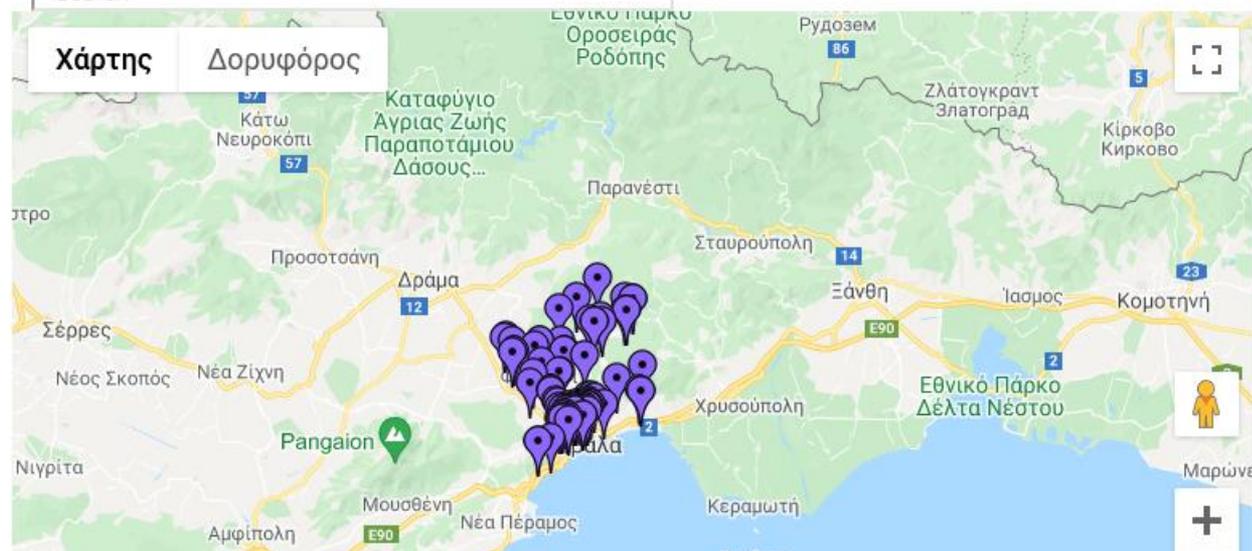
ΔΕΥΑ Καβάλας

Select Sampling Place

Search

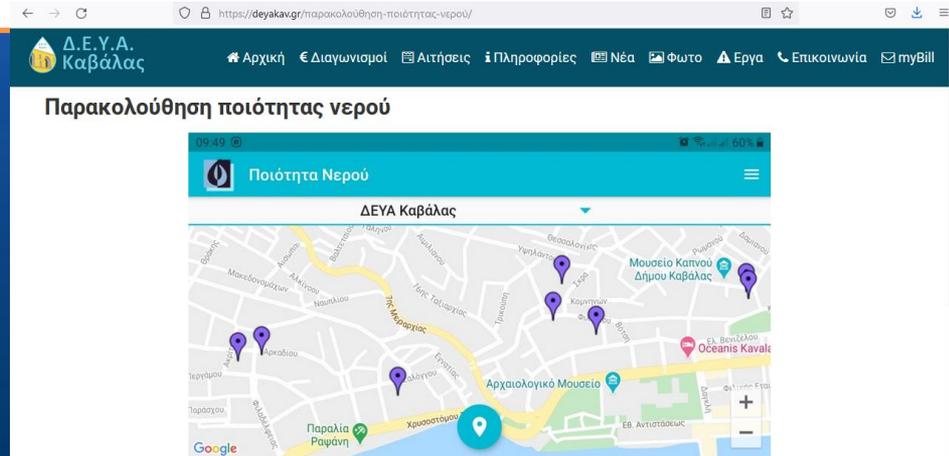
Χάρτης

Δορυφόρος



The results are also accessible through a special mobile application developed by EDEYA.

[https://play.google.com/store/apps/details?id=com.ots.edeya\\_waterquality\\_app](https://play.google.com/store/apps/details?id=com.ots.edeya_waterquality_app)





# OTHERS KINDS OF WATER ANALYSIS

## **Water salt control (physicochemical)**

**Includes: pH,  
Conductivity, total solids,  
suspended solids, total  
hardness, total alkalinity,  
phenolic alkalinity, e.t.c.**

## **Microbiological control of water legislation**

**With this analysis package, the  
presence or absence of  
pathogenic microbes is checked  
and applied to drinking water  
and bathing water. Includes:  
Coliforms, Escherichia coli,  
Enterococci and OMX.**



*Thank you for watching our  
presentation*

