
# Study of the Distribution and Physico-Chemical Properties of Deep Groundwater in Some Areas of the Altiaryk and Besharik Districts of the Fergana Region and Their Rational Use


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**ABSTRACT**

This article deals with the distribution of deep groundwater, their physicochemical properties, practical significance, methods for determining the composition of deep groundwater brought from different regions of the region, as well as methods of water hardness and hard water softening, solid minerals (Ca and Mg elements) data on the negative effects of rich waters on plants and their prevention.



**Keywords:** Deep Groundwater, Their Physicochemical Properties, Practical Significance, Transient, Permanent And Total Hardness Of Water, Analysis, Calcium And Magnesium, Chloride, Residue, Sulfate, Carbonate Ions, The Negative Effects Of Hard Water On Plants.


**Relevance:** At present, the demand for deep groundwater is increasing every day, which leads to a decrease in surface water, which in turn creates new problems in the irrigation of agricultural products, engineering and consumption due to lack of water. Therefore, it is important to organize the rational use of groundwater and explain its impact on flora and fauna based on the results of scientific experiments.

## Introduction

Today, the development of technology, the excessive use of oil and products of the oil and gas complex, the growth of factories and factories, as well as their pollution, cause a negative change in the air climate. Specifically, it causes the air to heat up to a certain degree. For example, due to the use of motor vehicles in Tashkent 500-600 tons of oil and gas products per month and the increase in air temperature in the city to +3 ℃ or +4 ℃ compared to other regions due to a large number of industrial premises, surface water evaporates, water decreases and 25-30 per cent of the total number of trees in the city die prematurely due to rising temperatures. (This is especially true of Fergana.) [1-3]. If we consider the origin of such droughts in the example of cities around the world, then under

the influence of artificial heating of the earth, surface waters dry up day by day, causing various droughts and low water [3-7].

As a result, large seas and lakes dried up prematurely, and the salts that had accumulated over the years under the dried seas and lakes were scattered by the winds to different settlements, destroying the environment and causing the extinction of some species of flora and fauna. Therefore, the rational use of groundwater remains one of the daily topical issues due to the depletion of surface water, which is currently disappearing. However, when using groundwater, it is necessary to pay attention not only to the abundance of organic and inorganic substances, the properties of chemical elements or substances but also to the requirements for the properties and quality of water that are of practical importance [5-8].

Water is one of the most complex and unusual substances, although it consists of a synthesis of simple substances. The famous Uzbek hydrogeologist A.S. Khasanov, in one of his works on hydrogeology, noted that the value of water is more important than such valuable elements as gold and platinum. Indeed, water is a priceless commodity. Water is a very important substance not only for humans but also for flora and fauna. In particular, water contains the most minerals, i.e. industrial elements, as well as solids.

We know that solids play a negative role in the uptake of water by plants. Moreover, almost all biochemical reactions of every living cell are reactions occurring in aqueous solutions. Water acts as a raw material and energy carrier for constant consumption or for leaching processes. Considering that water is a very important substance in our daily life and in other areas, we need to pay attention not only to its chemical properties but also to its physical properties. Other important properties of water are its density, temperature, colour, transparency (compatibility), taste and smell [7-9].

The water temperature depends mainly on the ambient temperature, the speed of water movement and other external or internal factors, and the turbidity of water is measured in units of mg/dm$^3$ and is characterized by the presence of small inhomogeneous particles in the water. The chemical properties of water are directly determined by reactivity, precipitation, oxidation, and salt composition.

## Materials and methods

In the laboratory, using a special spectrophotometer, the physicochemical properties of deep groundwater brought from different regions of the Fergana region were studied, the number of chemical compounds and elements in the water was studied, and normal values of the level were determined on average per 1 litre of water (Tab.1).

**Table 1. Physical and chemical properties of deep groundwater**

| No. | Laboratory number | Area examples | Sample time | Dry residue | $HCO_3$ | $SO_4$ | Cl | $NO_2$ | $NO_3$ | Ca | Mg | Na | pH | General hardness |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | mg/l | mg/l | mg/l | mg/l | mg/l | mg/l | mg/l | mg/l | mg/l | | |
| | | | Experiment | Mg equiv/l | Mg equiv/l | Mg equiv/l | Mg equiv/l | Mg equiv/l | Mg equiv/l | Mg equiv/l | Mg equiv/l | Mg equiv/l | | |
| | | | Mg equiv/l | % eq | % eq | % eq | % eq | % eq | % eq | % eq | % eq | % eq | | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1729 | Oltiarik district MFY | 29.10.2021 | 500 | 153 | 144 | 99 | | | 56 | 37 | 58 | | |
| 2 | | | | 470 | 2,50 | 3,00 | 2,80 | 0,10 | <0,01 | 2,80 | 3,00 | 2,50 | 7,0 | 5,80 |
| 3 | | | | | 30 | 36 | 34 | | | 34 | 36 | 30 | | |
| 4 | 1730 | Oltiarik district Sharq yulduzi | | 680 | 183 | 269 | 96 | | | 96 | 49 | 58 | | |
| 5 | | | | 659 | 3,00 | 5,60 | 2,70 | <0,01 | <0,01 | 4,80 | 4,00 | 2,50 | 7,3 | 8,80 |
| 6 | | | | | 27 | 50 | 23 | | | 42 | 35 | 23 | | |
| 7 | 1731 | district Oltiariq Kapchigay | | 970 | 244 | 370 | 149 | | 6 | 162 | 56 | 76 | | |
| 8 | | | | 941 | 4,00 | 7,70 | 4,20 | 0,10 | 0,10 | 8,10 | 4,60 | 3,30 | 7,9 | 12,70 |
| 9 | | | | | 25 | 48 | 27 | | | 50 | 28 | 22 | | |
| 10 | 1732 | Besharik district. Poultry farm | | | 220 | 576 | 50 | | | 166 | 85 | 53 | | |
| 11 | | | | 1090 | 3,60 | 12,00 | 1,40 | <0,01 | <0,01 | 8,30 | 7,00 | 2,30 | 8,0 | 15,70 |
| 12 | | | | 1058 | 20 | 68 | 8 | | | 47 | 40 | 53 | | |

Based on the experiments described above, the normative level of groundwater in the regions was analysed. When studying the results of the analysis, it was found that the hardness of the water sample imported from some regions was relatively high. In particular, it was found that the total hardness of water imported from some areas of the Besharyk and Altyaryk districts of the Fergana region ranges from 12 to 16 mg/eq. Therefore, it is necessary to pay scientific attention to ways to reduce the use of drinking water in these areas for technical purposes. Water hardness is associated with the dissolution of various salts in it, especially salts containing calcium (Ca) and magnesium (Mg) ions. Water hardness - the amount of calcium (Ca) calcium / (Mg) dissolved in 1 litre (or 1000 ml) of water is determined as follows. $[Ca^{+2}] + [Mg^{+2}] = mCa^{+2} + m\,Mg^{+2}$ (g/eq).

We know that there are basically three types of water hardness, and if you separate the temporary hardness from the total hardness, you get the permanent hardness of the water, namely: Transient hardness is formed from salts dissolved in water and is therefore called carbonate hardness since they contain many carbonate compounds. Temporarily hard water can be softened. Permanent hardness is due to salts dissolved in water. This hardness does not disappear even when boiled. The total stiffness is the sum of the permanent and temporary stiffness. Water hardness 0-4 mg/eq.*l. if so, it

is called very soft water. Such water will be suitable for consumption. Such waters include drinking water and water of some rivers and lakes. Hardness 7-14 mg/eq.*l. the hardest water. Such hard waters can be softened in several ways, in particular:

1. Boiling method; The hardness remaining after boiling water is called permanent hardness and forms chlorides and sulfates of calcium and magnesium.

2. A water softening method is used by adding soda or its substitute sodium hydroxide to the water.

When boiled, the carbonates in water are separated as a precipitate, forming a precipitate. When we use constantly refilled hard water from household tanks, we can see white or yellowish, reddish (depending on the amount of calcium, magnesium and iron) elements of calcium and magnesium carbonates in the form of residues at the bottom of the tank: For example;

$Ca(HCO_3)_2 \rightarrow \downarrow CaCO_3 + H_2O + CO_2$

$Mg(HCO_3)_2 \rightarrow \downarrow MgCO_3 + H_2O + CO_2$

When soda is added to hard water, it ends up in the water as a result of the precipitation of carbonates into the water;

1. The amount of (Ca) calcium/(Mg) magnesium ions decreases;

2. $Ca(HCO_3)_2 + Na_2CO_3 \rightarrow \downarrow CaCO_3 + \downarrow 2NaHCO_3$

3. $Mg(HCO_3)_2 + Na_2CO_3 \rightarrow \downarrow MgCO_3 + \downarrow 2NaHCO_3$

4. Water hardness can be reduced by 0.5-0.08 mg * eq/l.

5. Another way to soften water is to add hydroxide to hard water, i.e. we can also observe the precipitation of metal ions that cause water hardness;

$Me(HCO_3)_2 + 2OH^- \rightarrow MeCO_3\downarrow + 2H_2O$

6. Apparently, water can also be softened by phosphating by ion precipitation;

With the addition of salts or the interaction of phosphate acids with the metal;

$NaHPO_4$ , $K_2HPO_4$ ,$NaH_2PO_4$ ёки ,$KH_2PO_4$ ,$Na_3PO_4$ , $K_3PO_4$;

$3Me^{+2} + 2H_2PO_4^{-2} \rightarrow Me_3(PO_4)_2\downarrow + 4H^+$

$3Ca^{+3} + 2H_2PO_4^{-2} \rightarrow Me_3(PO_4)_2\downarrow + 4H^+$

$3Mg^{+2} + 2H_2PO_4^{-3} \rightarrow Me_3PO_4\downarrow + 4H^+$

If the chemical process is carried out in this way, the hardness is 0.1-0.09 mg*eq/l. i.e., the amount of dry substances by this method is reduced to 0.1-0.09mg*eq/l.

From the above chemical reactions, it can be seen that obtaining water from deep groundwater suitable for drinking and industrial needs is directly related to environmental and economic values that require large labour and financial resources. Therefore, we must use water economically and intelligently in any production process and in everyday consumption.

## Conclusion

As a solution to the problem, it can be said that when using deep groundwater, it is possible to soften the water to a certain extent by exposing it to the chemical compounds mentioned above. Alternatively, special water containers can be prepared and boiled at high temperatures to partially soften the solids by precipitation.

The consumption of hard water may not have a negative effect on organisms in general, but the fact that high water hardness adversely affects the process of salt metabolism in the body is biologically justified. From a technical point of view, this creates several problems. Therefore, when using any water, it is recommended to boil it. It should be noted that boiling water with various ions and turning it into pure water is scientifically justified, however, boiling large amounts of water can cause technical problems.

Therefore, given that the climate of Uzbekistan has more than 280 sunny days a year, hard water contains elements such as Mg and Ca, which are partially softened by the sun for some time, i.e. enriched with macro and micro fertilizers, it is more expedient to mix the water part with fertilizers with macro and micro fertilizers, such as nitrogen, phosphorus, potassium, zinc, copper and iron, and use them in crops.

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