SUBJECT: BACTERIOLOGICAL COMPOSITION OF GROUNDWATER

Plan:

1. Bacteriological pollution of waters

2. Water quality for drinking and irrigation assessment purposes

3. Chemical analysis of underground water and forms of expression of results

List of main literature:

1. G.U. Yusupov., B.M. Holbaev "Geology and Basics of hydrogeology" Tashkent-2003

2. GU Yusupov, BM Holbayev "Geology and Basics of hydrogeology" Tashkent-2005.

List of additional literature:

1. G.U. Yusupov., S.E. Nurzhanov "Geology, hydrogeology and geomorphology" Tashkent-2007

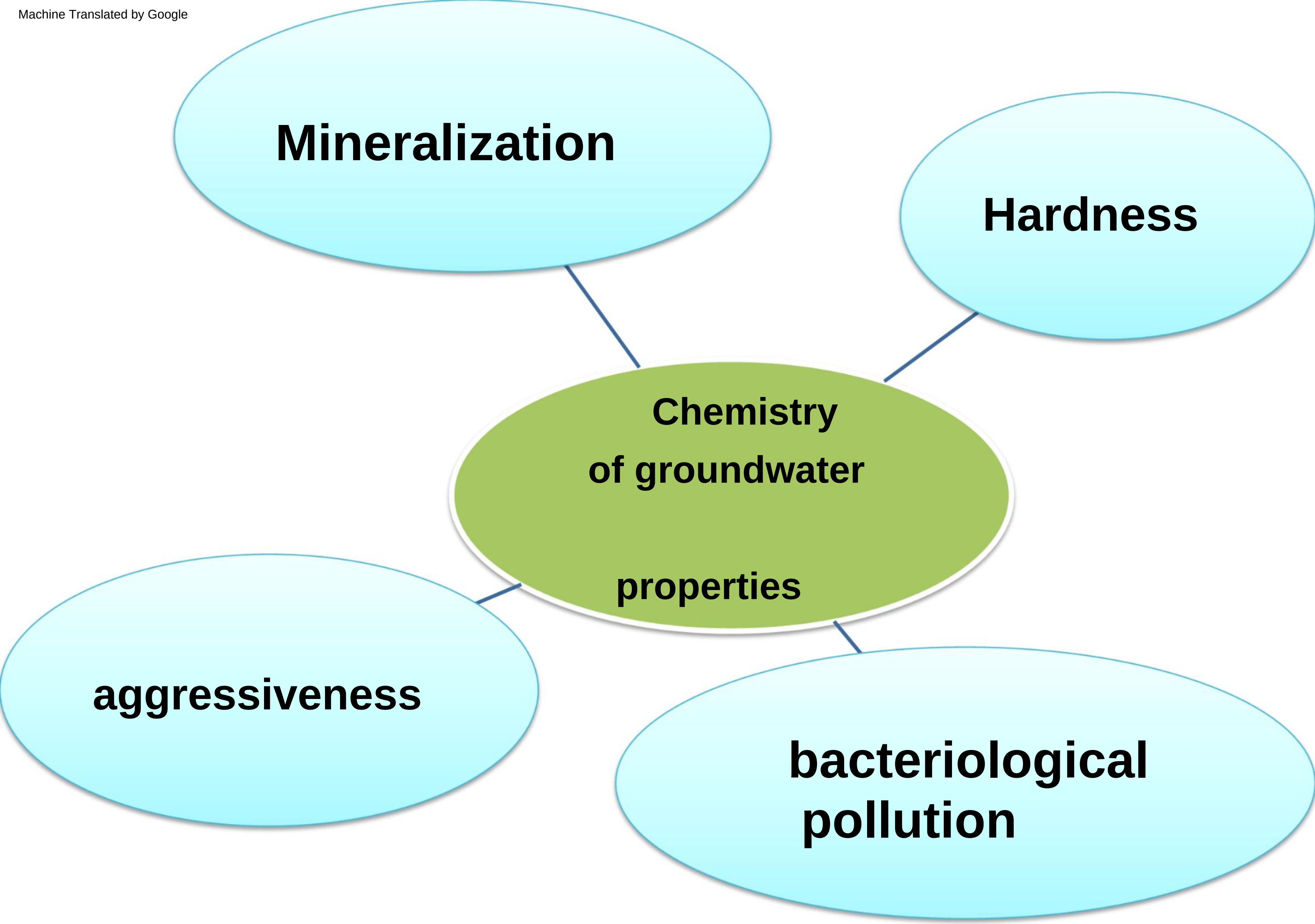
Chemical properties of groundwater

in the composition . of ions, Water Mineralization the sum of molecules and various compounds is his shows mineralization. Mineralization of waters is dry chukma orkal is expressed. The amount of dry chukma is water It is analyzed by boiling and drying (1100C) the part that fell into the chukma . It contains dissolved minerals and organic substances in water substances and colloids.

Kuruk chukma milligram liter, gram liter, or shur and Nomocopic waters are expressed in milligrams, grams.

Depending on the amount (mineralization) of dry chukma O.A. Alyokin divides natural waters into five classes:

Classes	*Dry powder, g/ l*
1. Fresh waters 0 – 1	
2. Brackish waters	***1-3***
3. Brackish	***3-10***
waters 4. Strong brackish waters 10 – 35	
5. Nomokop waters	***>35***


Mineralization
Hardness
Chemistry
of groundwater
properties
aggressiveness
bacteriological
pollution

Water hardness. *Water hardness of* *Sa2+ and Mg2+ ions contained in it depending on the amount.* ***Degree of hardness according to O.A. Alyokin natural waters into the following classes:***

1. Very soft waters <1.5 mg.eq/ l

2. Soft waters 1.5-3.0 mg. eq/ l

3. Hard water 30 - 60 mg.eq/ l

4. Hard waters 6.0-9.0 mg. eq/ l

5. Very hard waters > 9.0 mg. eq/ l. Used for drinking purposes total hardness in water is from 7 mg-equiv/l should not exceed.

Aggressiveness of waters. The ability of underground water to destroy rocks and reinforced concrete structures *is called aggressiveness of water.* ***There are different types of aggressiveness: carbonic acid (SO2), dissolving, general acid, sulfate, magnesium, oxygen.***

Due to *the aggressiveness of carbonic acid (SO2),* water dissolves calcium carbonate (SaSO3) in concrete and rocks , destroying concrete and rocks.

$$CaCO_3 + H_2O + CO_2 < Ca^{2+} + 2\ NSO_3^-$$

The equilibrium between the amount of bicarbonate ion (NSO3) and certain amounts of calcium carbonate (SaSO3) in a certain amount in the free state carbonic acid (SO2). If the amount of carbonic acid in the free state exceeds the required for equilibrium, as a result of the action of such water, solid SaSO3 begins to dissolve. The melting process continues until a balance is reached between the quantities. Consumption of free carbonic (SO2) acid by reacting with SaSO3

The corrosive part is called aggressive formic acid. To determine aggressiveness, the amount and mineralization of NSO3 in water is taken into account, as well as the conditions under which aggressiveness occurs (structure thickness, filtration coefficient, structure pressure, type of cement) . In hazardous conditions, the amount of SO2 should not exceed 3 mg/l, and in low-risk conditions, it should not exceed 8.3 mg/l.

Dissolution aggressiveness is seen in the leaching of calcium hydrate oxide from the concrete composition due to the dissolution of calcium
amount of carbonate . If the amount of is very small and the equilibrium SO_2 is less than the equilibrium amount of SO_2 in the atmosphere , such dissolve $SaSO_3$ with their ions. This process $^{2-}$ and NSO_3 - waters always occurs because the waters are not saturated with SO_3. Groundwater becomes aggressive in conditions where the amount of NSO_3 is very low
(0.4-1.5 mg.eq) . **Acid aggressiveness (pN)** depends on the amount of free hydrogen ions in water . If the pH value is 5.0-6.8, the water is

aggressive. **Sulfate aggressiveness** occurs when the amount of sulfate ions in water is increased. When water enters the pores of concrete, salt ($SaSO_4$ *$2H_2O$) is formed as a result of crystallization of sulfate, and concrete is damaged by the force of crystallization. To evaluate the aggressiveness of sulfate, the conditions of water exposure to the structure and the
amount of chlorine ions are taken into account. If sulfate-resistant of cement is used for the structure, it can become aggressive when the amount mg/l, if ordinary cements are used with an amount of SO_4 - exceeds 4000 of 250 mg/l, the aggressiveness of water begins with the increase of SO_4 - .

Magnesium aggressiveness occurs when the magnesium ion is found in too much water. Taking into account the type of cement, construction and working conditions of the structure, as well as the amount of SO4, magnesium aggressiveness appears when the amount of magnesium exceeds 750 mg/l.

Aggressiveness of oxygen affects the relationship with dissolved oxygen in water and metal structures. In order to determine the aggressiveness of different types of concrete as a result of the chemical analysis of the aggressiveness of water, the selection of the type of cement and the concrete

is studied to increase its durability.

If there is some kind of aggressiveness in relation to the type of cement selected during the construction , then concrete strength is ensured by special measures (waterproofing, reduction of aggressiveness level, drainage).

Bacteriological pollution of waters. Bacteriological inspection works to evaluate the waters from a sanitary point of view is lost. The main indicator of water pollution bacterium (Solis) that spreads intestinal diseases is used.

One piece of Soli to assess the sanitary condition of drinking water a certain volume of water contaminated with bacteria is analyzed (Coli-titre).

How much water contains one Coli bacterium? so good quality. Water Coli - according to the titer divided into classes:

Bacteria Coli ***the number***	**Water volume, ml**	**Water quality**
1	100	healthy
2	1	almost healthy
3	10	suspicious
4	0.1	unhealthy
5	0.01	absolutely unhealthy

Bacteriological content of water is assessed by three indicators: 1) the number of bacterial colonies that develop (grow) when 1 cm3 of water is added to the nutrient medium; 2) according to the coli titer, i.e. depending on the amount of *water in which the rods of bacteria that spread intestinal diseases (CoIis) develop ; 3) according to the coli index, that is, according to the number of bacilli of intestinal disease-causing bacteria in 1 liter of water.* The spores of

these bacteria are safe (harmless) for the human body , but their presence in water indicates the presence of dangerous disease-causing bacteria in the water.

Used in centralized water supply
water quality must meet the following requirements:

1) the total number of bacteria in 1 milligram of unmixed water should not exceed 100; 2) the number of

bacilli causing intestinal diseases should not exceed 3 per liter (coli-index) or the volume of water contaminated with one bacillus should not exceed 300 milliliters (coli-titer).

Natural waters are often enriched with organic substances produced by the decay and decay of animals and plants, so a large amount of organic substances in water indicates that the water is polluted. Cl- produced by organic matter is absorbed

into the wastewater from wastewater and fecal waste. Therefore, it is necessary to determine not only the pure amount of chlorine in water, but also the process of its formation .

Nitrate ion (NO_3^-) is very rare in water. In large quantities, it is formed from the breakdown of organic compounds with organic matter and nitrogen. The presence of NO3 in water indicates ancient pollution.

Nitrite ion (NO_2^-) in faecal waste near water indicates contamination.

The amount of **potassium (K^+)** ion in some cases is 10 mg/l If there is an excess, it indicates that the water is contaminated.

Chemical analysis of groundwater

Chemical analysis of groundwater in hydrogeological investigations is divided into the following types: field, reduced, deep and special analyses.

Physical properties and pH of water during field analysis, Cl^-, SO_4^{2-}, NO_3^-, HCO_3^-, $^{2-}$, Ca^{2+}, Fe^{2+}, Fe^{3+}, CO_2, H_2S, O_2 are oxidized. CO_3 The sum of Na^+ + K^+ mineral, Mg^{2+} temporary hardness and substances is calculated by calculation .

_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ The total and $^{2-}$, NO_3^-, CO_3^{2-} . _ _ _ _ _ , Fe^{3+}, by the temporary hardness and aggressiveness of SO_2 are determined calculation method . *Full analysis* physical properties of water pH, Eh, Cl^-, SO_4^{2-} Ca^{2+}, Mg^{2+}, Fe^{2+}, NO_3, Na^+, K^+, Fe^{3+}, SiO_3 HCO_3^{2-}, CO_3, NH_4^+, NO_2^- oxidation of chukmawas -, CO_2, H_2S, N_2, anicized. From the result of the analysis, general and temporary as well as aggressive SO_2 is determined.

Special analysis is carried out on a separate assignment with a specific purpose in mind.

O.A. Alyokin's classification is based on the rule of considering the quantitative relationship between anions and cations.
received.

The basis of the classification is the milligram of the six main ions - equivalent is obtained.

All natural waters are divided into three classes depending on the amount of anions:

1. Hydrocarbonate and carbonate (NSO3 - ,SO3 -); 2. Sulfate ($SO4^{2-}$);
3. Chloride (SI-).

Hydrocarbonate waters include river and fresh ash waters with low mineralization, and this class also includes the main part of underground waters and some ash waters with expected mineralization.

Mineralization **of chloride waters** includes ash waters of the upper sea, estuary, koldic and dry areas, and underground waters of the saline desert and semi-desert regions. According to the

distribution and mineralization **of sulfate waters**

It is intermediate between hydrocarbonate and chloride waters.

The classes, in turn, are divided into three groups according to the amount of cations $Na^+ + K^+$) (Sa^{2+} , Mg^{2+}) . *Each group is divided into 4 types based on the mutual quantitative ratio of ions in milligram-equivalent.*

1 type $NSO_3^- > Ca^{2+} + Mg^{2+}$ this type of water is slightly mineralized;

2 types include $HCO_3^- < Ca^{2+} + Mg^{2+} <$ $^{2-}$ to this type of water is small and $HCO_3^- + SO_4$ mineralized underground, river and ash waters; 3

types $HCO_3^- + SO_4^{2-} < Ca^{2+} + Mg^{2+}$ this type of water is strongly mineralized, mixed and metamorphosed. These include oceans, seas, harbors and freshwater bodies of water. 4 types $NSO_3^- = O$, this type of water is sour,

belongs to sulfate and chloride class as well as Sa^{2+} , Mg^{2+} group.

Classification of O.A. Alyokin anion to the base and based on the rule of consideration of the quantitative relationship of cations.

Class	Group	Type
Hydrocarbon **(NSO_3^-)**	Calcium (Sa)	I. $NSO_3^- > Ca^{2+} + Mg^{2+}$
Sulphated **(SO_4^{2-})**	Magnesium (Mg)	II. $HCO_3^- < Ca^{2+} + Mg^{2+} < HCO_3^- + SO_4^{2-}$
Chloride **(SI-)**	Sodium (Na)	III. $HCO_3^- + SO_4^{2-} < Ca^{2+} + Mg^{2+}$
		IV. $NSO_3^- = O$

DAVST 2874-82, UzDAV 950-2000 are used for the purpose of assessment of centralized water supply of groundwater in MDX . According to this DAVST,

the dry content of water for centralized water supply should not exceed 1000 mg/l, and the total hardness should not exceed 7 mg/eq.l.

Drinking water can be used in places with tanks, with a mineralization of 1500 mg/l and a total hardness of 10 mg/eq.l, but for this, it is necessary to agree with the sanitary-epidemiological service before drawing water . Of these, mercury in drinking water is hexavalent

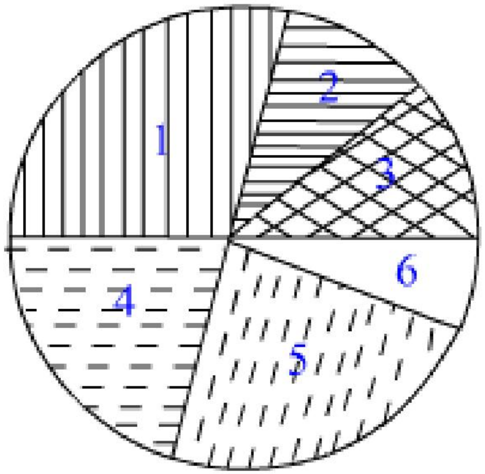
chrome, barium and others should not be.

As mentioned above, underground water contains a large number of microorganisms, the number of bacteria in 1 cm3 of water can be from several hundred to several million.

Special bacteriological analyzes are carried out to evaluate drinking water from a sanitary point of view.

In order to organize the results of chemical analysis, *the chemical composition of underground water is depicted in a graphic (circle, square, triangle, formula) view.* In the circle method of N.I. Tolstykhin, the

diameter of the circle indicates the amount of mineralization of the water (Fig. 1). The circle is divided into two parts by a horizontal line. **Figure 1. Circle the chemical composition of water**



diagram

1-Ca2+ , 2-Mg2+ , 3-Na++K+, 4-CO3 2-+HCO3 2- 6-Cl-, 5-SO4 2- upper In the part, on the scale from left to right, Sa2+ , Mg2+ and Na+ +K+ are placed.

In the lower part of the circle, SO3 +NSO3 and 2- Cl- are 2- , SO4 2 removed in this order.

In the last hours, the cyclogram is depicted in the form of two concentric circles.

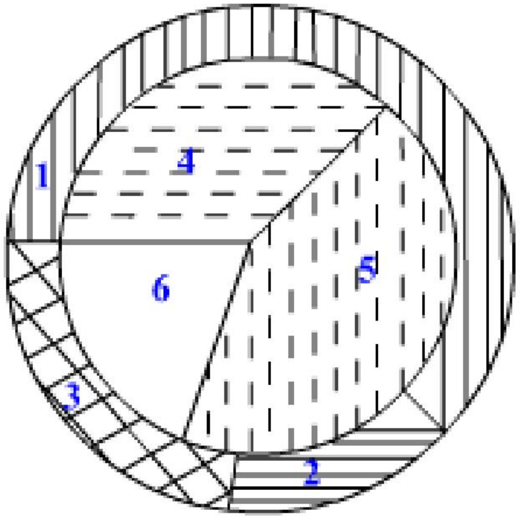
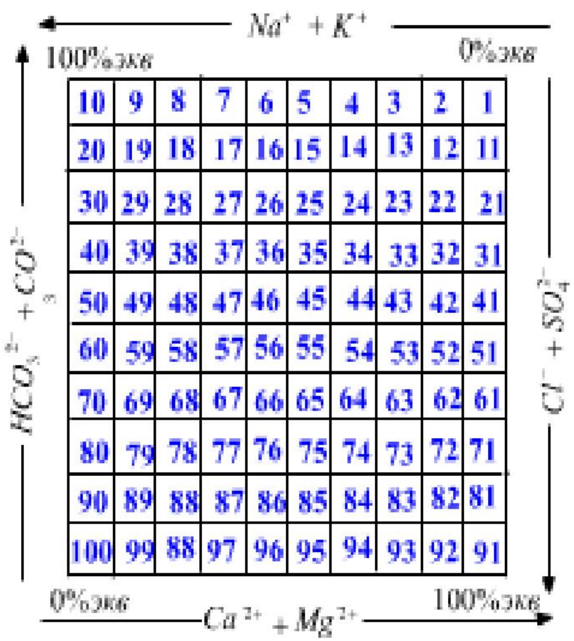


Figure 2. N.I. Tolstykhin's circle diagram depicting the chemical composition of natural waters

Anions are depicted in the inner circle and cations in the outer circle. The scale of the circle diameter indicates the amount of mineralization. N.I. Tolstykhin gave the results of the numerical analysis is depicted in the form of a square.



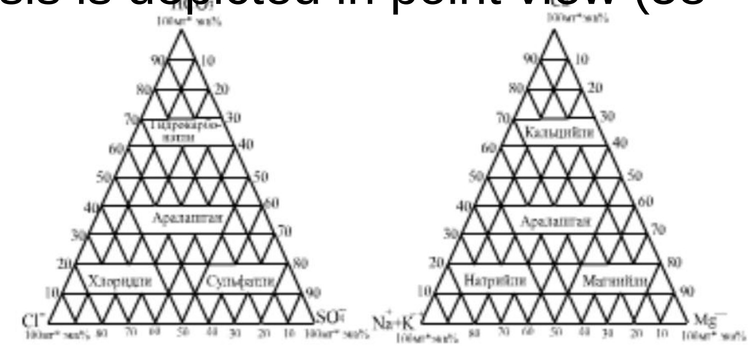
Each side of the square is divided into 100 equal parts (%). Cations (% eq) are placed on the horizontal sides of the square. Anions are lowered to the vertical sides.

N.I. Tolstykhin suggests using ordinal numbers to determine the location of water analysis in a square. The square graph is divided into 100 small squares and each of them is assigned a serial number.

The triangular graph is drawn separately for cations (Sa2+, anions (Cl- , SO4) $^{2-}$, HCO3^{2-}Mg 2+, Na++K+) and). The percent-equivalents of the ions shown on each side of the triangle are burned and the chemical analysis is depicted as a dot view

Graph of triangles

Triangular graph cations (Sa^{2+}, Mg^{2+}, $Na^{+}+K^{+}$) and anions (Cl^-, SO_4^{2-}, HCO_3^{2-}) are drawn separately for The axis of the triangle the percentage-equivalents of the ions shown on one side are burned and chemical analysis is depicted in point view (58



Most experts express the chemical composition of water in the form of the Kurlov formula.

In Kurlov's formula, in the image of the fractional line, the amount of anions in the percentage-equivalent form is written in the order of decreasing, and in the denominator, cations are written in this order. Ions less than 10% equiv. are not indicated in the formula.

The amount of gases and mineralization (M) in gram/liter form is written on the left side of the decimal line. On its side, the water temperature (T) and flow (D, l/s) are written

$$CO_2 * M_{0.67} \frac{HCO_{46} * Cl_{36} * SO_{18}}{Ca_{45} * Na_{34} * Mg_{20}} * pH_7 * T_{40} * D_{1000}$$

Evaluation of water for irrigation purposes

When evaluating water for irrigation purposes, attention is paid to the total possible amount of salts, chemical composition of water, natural and artificial drainage of land, irrigation method, hydrogeological and physical properties of soil and ground, salinity of land, salt resistance of plants . If the salt concentration of irrigation water exceeds 1 g/l, the lands should be provided with irrigation systems, irrigation should be carried out in "wash mode" and agrotechnical measures should be carried out in a qualitative manner. According to A.N. Kostyakov, in the water used for irrigation

the amount of salt (dry chukma) should not increase by 1-1.5 g/l.

If the amount of dry chukma is more than 1-2 g/l, the composition of salts in underground water, mechanical composition of soil, availability of land with natural and artificial ditches, climatic conditions, agrotechnical methods of land cultivation should be specially studied. The most harmful for plants are sodium

salts. If the concentration of Na+ ion increases in the water used for irrigation, the soil is salted with soda salt.

I.N. Antipov-Karataev and G.M. According to the equation for determining the quality of water used for irrigation , depending on the Kader ion exchange coefficient (K) recommend:

$$K = \frac{rCa^{2+} + rMg^{2+}}{rNa^{+} + 0.23C}$$

S - water mineralization, g/l; rCa2+ , Mg2+ , rNa+ - equivalent amount of cations in water. If K>1, the water is suitable for irrigation, if K<1, it is considered unsuitable for irrigation.

Experiments have shown that under certain natural and economic conditions, water can be used for irrigation when the mineralization of water reaches 8-15 g/l (I.S. Rabochev, N.G. Minashina, G.A. Ibragimov, F.M. Rakhimbaev, N .M. Reshyotkina, H. E. Yakubov and others). Therefore, in order to determine the quality of water in any specific conditions, the composition, characteristics of the soil, provision of natural and artificial ditches, irrigation regimes and others should be taken into account. This issue is especially important in the republics of Central Asia, where water resources are scarce, due to high mineralization on a large scale and the use of well water. For example, in Uzbekistan, 18-20 km3 of drainage water per year is used, and 3.36 km3 of this water is used for irrigation. If these waters are used for irrigation on a large scale without proper evaluation, the soils in the irrigation areas will be polluted and the productivity of agricultural crops will decrease sharply. Therefore, it is necessary to carry out irrigation in irrigation areas in the "washing mode", to organize preventive and permanent capital irrigation, and to carry out melioration measures such as increasing the supply of land with artificial ditches.

The demand for water quality is very high in the USA. When the amount of Na^+ in irrigation water is up to 60% of the amount of dissolved cationic salts, the total concentration of salts should not exceed 0.5 g/l. Water with high mineralization can be used only when the water permeability of the soil is very high, and when the land is fully supplied with ditches and irrigation is carried out in the "washing mode". American classifications are analyzed based on Gapon's formula.

sodium adsorption ratio (SAR)

$$SAR = \frac{Na^+}{\sqrt{\frac{Ca^{2+} + Mg^{2+}}{2}}}$$

where: ,

is , there mg of Mg2+- cations. concentration in eq/l: Ca2 + Na+ if SAR<10, little risk of soil salinization; SAR=10-18 is considered to be a moderate risk of pollution, SAR=18-26 is considered to be a high risk of pollution, and SAR>26 is considered to be a very high risk of pollution.

Thank you for your attention!!!