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Study of Seasonal Changes In the Composition of River Water

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***Abstract**: This article presents the results of a study of the water of the Naryn River at the point of Kyzylravot in the Namangan region of the Republic of Uzbekistan. The issues of the influence of seasonal factors on the pollution of the source water, as well as the problems of water purification methods are considered.*

***Keywords:** water pollution, water purification, factors affecting the composition of water.*

Introduction

One of the important indicators determining the well-being of the population is water. In this regard, the problem of shortage of not only drinking water but also water in general is currently growing all over the world. It should be noted that today the population of Namangan region is 2 million 750 thousand people. Even though Kishlokichimliksuvtaaminot LLC, based on the principles of public-private partnership in the Chust, and Mingbulak districts, as well as in the Uychinsky, Kasansai, and Chust districts, work in this direction, most of the volume of services falls on Namangansuvtaaminot LLC.

This enterprise provides drinking water to more than 1 million 50 thousand residents living in 327 mahallas of Namangan city, district centers, and villages bordering them. Of course, there are many disadvantages and problems with drinking water, which are very important for the population. We can explain most of them by the fact that the technical capabilities do not meet the requirements of modernity, the system uses outdated technologies that perform their function. To improve the supply of drinking water to the population, it is necessary to build more than 300 kilometers of new networks, reconstruct 880 kilometers of networks, modernize 5 water intake structures, and we present the results of observations and experiments on the main one "Kyzylrovotsky water intake structure" [1].

Methods and analyses.

1) Analysis of methods of purification of source water in laboratory conditions;

2) Description of the application of water treatment and purification schemes and assessment of their effectiveness;

3) When studying the effect of temperature on the coagulation process;

4) Study of seasonal and annual changes in the composition of the source water;

5) Study and comparison of the existing coagulation process when removing small floating particles during a seasonal increase in turbidity; [4].

A direct or indirect calculation method is used to calculate substances [8]. The direct calculation method is used in the presence of observational data on hydrochemical and hydrological indications. The formula is used for the calculation:

$$G = \sum_{i=1} W_i^M C_i \qquad (1)$$

where G- is the amount of transferred substance for the billing period, thousand tons;

m is the number of billing period intervals;

Wi – the volume of water runoff for the i-interval of the billing period, km3;

C_- i is the average concentration of the substance over the i–th interval, mg/l or mcg/L.

The use of this formula is legitimate if there is a close relationship between the concentration of a substance in water and water consumption.

In the absence of such a connection or its weak manifestation, the following formula is used for calculation:

$$G = WC^I \qquad (2)$$

where: W- is the volume of water runoff per year, km3; C is the average concentration of the substance per year, mg/l.

In the absence of information on the relationship between the concentration of the substance and the water flow, the formula (8) should also be used for calculation.

An indirect calculation method is used in the absence of information on the content of pollutants in the water and the availability of data on water runoff. In this case, the river is selected analogous and comparable to the water flow, and the amount of pollutants transferred is calculated using the formula:

$$G = \frac{G_A W}{W_A} \qquad (3)$$

where G and G_a- a are the amount of substance transferred by an unexplored river and an analog river during the billing period, thousand tons; W and W_a - a are the volumes of water runoff of an unexplored river and an analog river for the estimated period, km3.

The transport of pollutants calculated by the indirect method is indicative if the chemical composition of the water in the river for which the calculation was made has not been studied.

The criterion for the reliability of determining the transfer of a substance is the relative error calculated according to the generally accepted provisions of the error theory:

$$S_{G_I} = \sqrt{S_{W_I}^2 + S_{W_{K_I}}^2} \qquad (4)$$

Where S_{GI} - is the relative error in determining the transfer of matter over the i–interval of the calculation period; S_{WI} - is the relative error in determining the water flow over the i-th interval of the calculation period; S_{KI} - is the relative error in determining the average concentration of a substance for the i-th interval of the calculation period.

The relative error in determining the water flow depends on the conditions and the details of the observations. This error is approximately 10% in the case when the sampling and the hydraulic solution are combined. The relative error in determining the average concentration of a substance is found by the formula:

$$S_{K_I} = \sqrt{\frac{1}{n}(V_B^2) + \frac{V_C^2}{k}} \qquad (5)$$

where n- is the number of water samples for the calculation period interval; V_B is the average relative error of the time series of average concentrations of matter in the river; V_C - is the average relative error of a single determination of the concentration of matter in the river; k - is the number of samples in the river section. Error rate

$$V_B = \frac{\sigma_B}{C} \quad (6)$$

where σ_B - is the mean square deviation of the time series of average concentrations in the river section; C- is the average concentration of the substance over the calculation period.

Concentration:

$$\bar{C} = \frac{\sum C_j}{n} \quad (7)$$

where C_j - is the average concentration of the substance in the river section according to the data of the jth sampling,

$$\bar{C} = \frac{\sum C_j}{k} \quad (8)$$

Deviation

$$\sigma_0 = \pm\sqrt{\frac{\sum(C_j + \bar{C}_i)^2}{n-1}} \quad (9)$$

Error rate

$$V_c = \sqrt{V_a^2 + V_k^2} \quad (10)$$

where V_a - is the relative error of the analysis method; V_k - is the relative error of the concentration of the substance in the river section associated with the number of samples taken.

Error rate

$$V_K = \sqrt{\frac{\sum \sigma_0^2}{n\bar{C}}} \quad (11)$$

where σ_0 — is the mean square deviation of a single determination of the concentration of a substance in the river,

$$\sigma_0 = \pm\sqrt{\frac{(C_i + \bar{C}_j)^2}{k-1}} \quad (12)$$

If sampling is performed at one point in the section, formula (5) has the form

$$S_k = \sqrt{\frac{V_B^2 + V_a^2}{n}} \quad (13)$$

Multiplying the relative error G_i and S calculated by formula (4) and the value of the transfer of pollutants obtained by formula (1), the error in determining the transfer over the calculated interval is calculated in absolute terms

$$\Delta G_i = \pm G_i S \tag{14}$$

where G_i - is the amount of transferred substance for the i -interval of the calculation period, thousand tons. The error in determining the transfer of matter per year is obtained using the sum of errors for individual intervals of the calculation period:

$$\Delta G_{год} = \sqrt{\sum_{i=1}^{m} \Delta G_i^2} \tag{15}$$

where m - is the number of billing periods. The transfer error for the year in relative terms is calculated using the formula,%

$$S_{G_{год}} = \frac{\Delta G_{год}}{G_{год}} * 100 \tag{16}$$

where G_{year} - is the amount of transferred substance per year, thousand tons [8].

In Figure 1, the water content entering the Kyzylravatsky water intake node in the period 2019-2022 is calculated using the formulas given above and the results of observations of the water content.

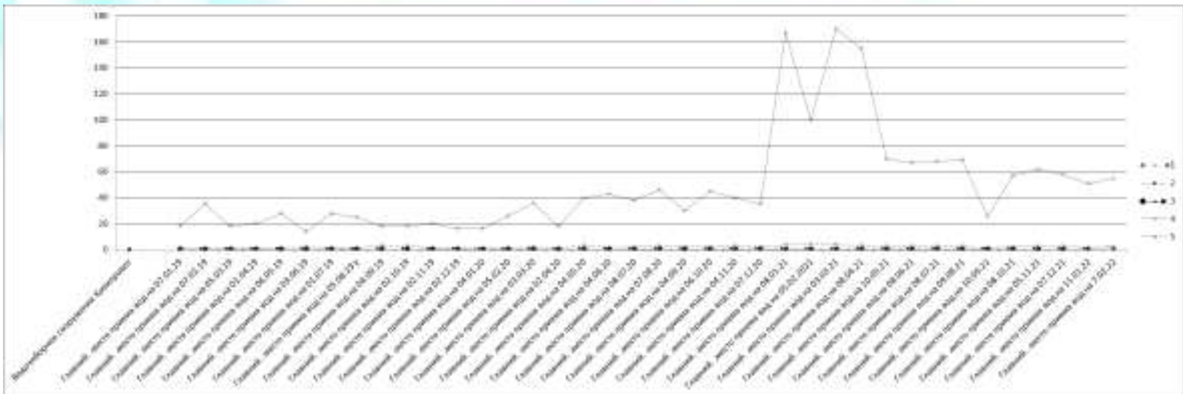

Figure 1. The content of water pumped from the Norin River at the Kyzrilrovot water intake (in 2019-2022). 1-iron(Fe); 2- copper (Cu); 3-fluorine (F); 4-chlorides(Cl) mg/dm3; 5- constant hardness.

In addition, as can be seen from the diagram above, seasonal factors enhance the chlorination process to neutralize turbid water, which leads to an increase in the amount of residual chlorine in drinking water. We calculated the efficiency of the coagulation process during a period of increased turbidity of water divided by temperature, taking into account the method of calculating the hydraulic particle size of the particle deposition rate in standing water (T = 10°C), presented in table 1 below, and graphically illustrated the results obtained.

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Table 1.The rate of precipitation of particles in standing water at t =10 °C
Particle settling rate in stagnant water at t=10°C

Particle name	By hydraulic size mm/s	Immersion time by 1.0 m
1. Coarse-grained sand d= (0.5-1) mm	100	10 seconds
2. Medium-sized sand d = (0.25-0.5) mm	53	19 seconds
3. Fine sand d= (0.1-0.25) mm	6,9	2,4 minutes
4. Clay	1,7	9,8 minutes
5. Fine particles of impurity clay	0,07	3,9 hours
6. Clay impurities at a rate	0,08	2,3 days
7. Fine clay particles at a size	0,0007	16,2 days
8. Colloidal particles	0,000007	367 days

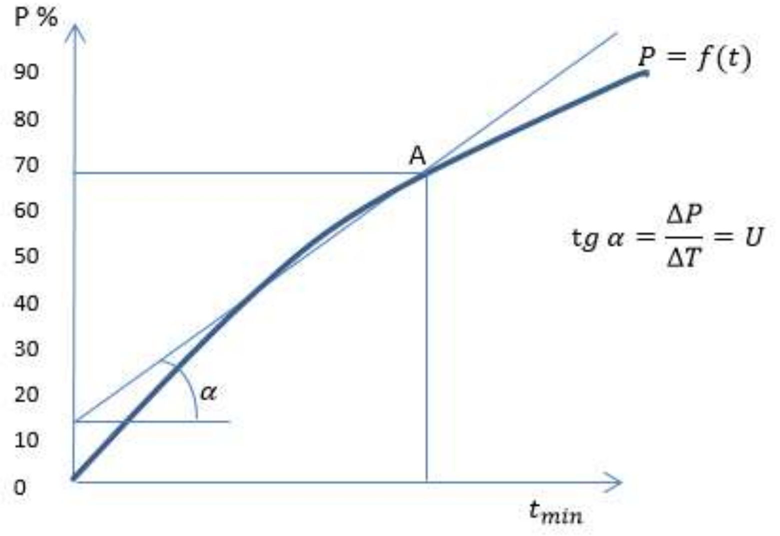

Figure 2. Haze settling curve over time
$P = f(t)$ *Allows you to determine the rate of sedimentation of turbidity.*

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The results of the studies conducted based on the above research methods, changes in the composition of the source water at the Kyzylravatsky water intake node in the period 2019-2022, and the influence of seasonal factors are presented in the following diagrams.

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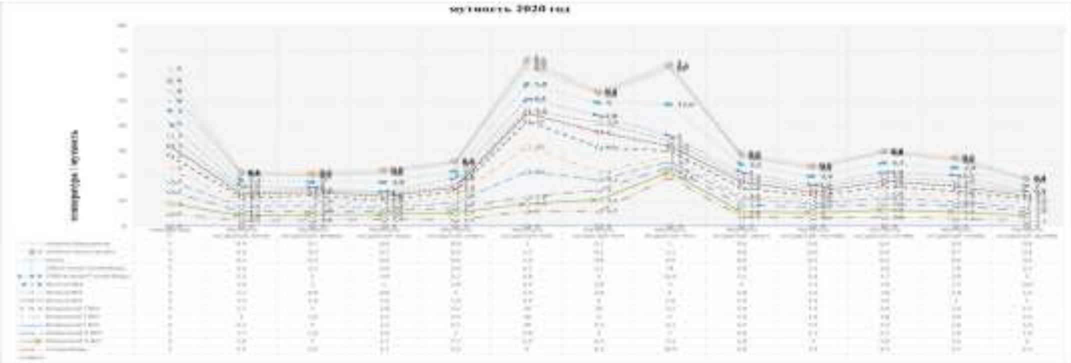

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Figure 3. (The amount of turbidity at different temperatures in one fund of the object for the period 2019-2022)

Results and discussion. The experiments have shown that to assess the water quality of rivers and reservoirs, their pollution levels are based on a range of specific combinatorial indicators of water pollution, significant pollution indicators of which depend on the amount of minerals in the water. When a coagulant (reagent) is added to water, its structure changes, the value is determined by the frequency and excess of significant pollution indicators for several indicators and can vary from 1 to 16 in waters of varying degrees of pollution, the particle deposition rate is influenced by their size, shape, and properties of water movement, water viscosity, temperature, and other factors. In addition to the usual pressure forces of liquids, tangential coupling forces, motion patterns, volumetric flow rate and temperature dependence of viscosity of liquids have been determined theoretically and experimentally. The above-mentioned studies and analysis show that due to the increase in the scale of problems associated with the deterioration of water quality in the Narin River under the influence of seasonal factors (precipitation, turbidity in spring and autumn), there is a need to improve and modernize the primary drainage and filtration equipment of the Kyzylravatsky Water Intake.

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