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Problems and Solutions to Their Preparation of Drinking Water From Surface Sources Water Supply

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ABSTRACT: The article analyzes the existing technological processes for the preparation of drinking water from surface sources of water supply in Uzbekistan. Due to the significant volumes of water consumption in the interests of ensuring economic activity, the issue of disinfection of drinking water is acute. Along with traditional disinfection methods, significant attention of modern researchers is focused on the development of innovative technologies for this process. The features of the formation and qualitative composition of Boussouf water are studied with an analysis of the reliability of the existing drinking water treatment technology.

KEYWORDS: organic pollutants, carcinogenicity, changes in water quality, ozonation, drinking water purification technology.

I.INTRODUCTION

In recent years, our government has adopted a number of resolutions aimed, first of all, at improving the sanitary conditions of water bodies. These solutions are designed for the production and implementation of a range of activities. Very high demands are placed on the degree of preparation of drinking water and purification of waste water that is discharged into water bodies. To this end, the following measures are aimed at improving the sanitary treatment of reservoirs: construction of sewerage facilities, purification of drinking water; deep purification of drinking water; transition to the method of reusing purified water in industrial enterprises or reusing it for technological processes in industrial enterprises; do not completely drain wastewater into reservoirs by transferring water management at industrial enterprises to a completely related method; use of purified fresh water for irrigation, taking into account sanitary conditions; transferring technological processes at industrial enterprises to processes that do not use water.

The peoples of Central Asia, including city residents, have always received water from open water supply sources or special houses designed for collecting and processing water. By extracting water from natural sources, purifying it, as well as building a complex of engineering structures and installations that supply industrial enterprises, the population can be provided with water in the required quantities and under pressure.

Due to significant volumes of water consumption in the interests of ensuring economic activity, the issue of disinfection of drinking water is acute. Along with traditional methods of disinfection, significant attention of modern researchers is focused on the development of innovative technologies for this process. The features of the formation and qualitative composition of Buzsuv water were studied with an analysis of the reliability of the existing technology for the preparation of drinking water.

II. SIGNIFICANCE OF THE SYSTEM

The article analyzes the existing technological processes for the preparation of drinking water from surface sources of water supply in Uzbekistan. The study of methodology is explained in section III, section IV covers the experimental results of the study, and section V discusses the future study and conclusion.

III. METHODOLOGY

In recently published data on the study of the quality of natural and drinking waters, as well as the efficiency of water treatment at water treatment plants, much attention is paid to the increasing pollution of water supplies with

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industrial and domestic wastewater and the insufficient efficiency of water treatment facilities with respect to organic pollutants [1,2]. Moreover, the introduction of chemical reagents during the preparation of drinking water can lead to the formation of more toxic substances in it. In the literature [3], it is believed that in unpolluted natural waters the total content of organic compounds is about 1.0 mg/dm3, in polluted waters it is 10-20 mg/dm3, in heavily polluted waters it is 100 mg/dm3 and more. Of these, a significant part consists of organic compounds of natural origin - humic and fulvic acids, proteins, amino acids, carbohydrates and polysaccharides. But organic compounds of anthropogenic origin pose a much greater potential danger.

IV. EXPERIMENTAL RESULTS

According to the latest data [4], out of 2221 organic impurities found in raw water, 765 are present in drinking water. Of these, 20 are recognized as carcinogenic and 23 are suspected of carcinogenicity, 18 are carcinogenic pathogens, 56 cause mutagenic changes.

To obtain drinking water, natural waters are most often subjected to chlorination. Along with positive effects, such processing also reveals negative ones. It has been established that as a result of chlorination of drinking water, trihalomethanes (chloroform, dichlorobromethane, bromodichloromethane, bromoform) are formed, the concentration of which in water is much higher than the concentration of other organic compounds. Many works are devoted to this problem, both domestic and foreign scientists [1-6].

A review of carcinogens and organic compounds in US drinking water indicated [6]; that chloroform is present in all drinking water treated with chlorine. It is noted that chloroform in an aquatic environment is formed mainly by the interaction of free chlorine with humic substances [7, 8], and in the presence of bromide ions in water, bromoform is formed.

Experimental data on the chlorination of Rhine River water show [9] that with a chlorine dose of 2 mg/l, the concentration of chloroform increases from 2.3 to 7.3 µg/l, chlorobromine derivatives appear in the amount of 16 µg/l, and the total amount of THMs increases up to 42 µg/l.

Issues of seasonal changes in water quality were studied, and the process of formation of THMs in waters that had undergone chlorination was monitored [10]. In the summer months, a maximum content of total trihalomethanes in water is observed. It is also noted that the observed seasonal graphs of the peaks of total THM correspond to periods of increase in the content of total organic carbon in river water. The increase in the content of THMs and in particular chloroform in water in the summer is explained by many factors, the main ones being the dose of chlorine, chlorine capacity and the content of total organic carbon. A potential source of THMs during water chlorination, in addition to humic substances, are algae [11]. At the same time, the type of algae does not have a noticeable effect on THM production. It has been shown that the source of chloroform is not some specific substance, but many organic components of the cell. Therefore, it is advisable to remove algae from water before it is chlorinated, which is especially important during the period of water blooms.

Of all the potential replacements for active chlorine available today for the disinfection of drinking water (ozone, chlorine dioxide, chloramines), ozone is the most powerful biocide. It has long been used as a disinfectant in Europe [12, 13]. The oxidation potential of ozone is significantly higher than that of chlorine, so it has higher disinfecting properties, especially against viruses, and is more effective in discoloration and deodorization.

The removal of organic substances from water before chlorination can be done using activated carbon filters [16]. However, with a high initial content of total organic carbon, this purification method is relatively expensive.

The possibility of removing THM “precursors” by adsorption on manganese dioxide was studied [15]. Manganese dioxide in its pure form weakly sorbs humic and fulvic acids at a typical pH of 7.0 for natural water.

Most researchers have come to the conclusion that the best method of combating the formation of THMs is to replace preliminary chlorination with ozonation [6-16]. Ozone oxidizes organic substances, turning them into polar or charged molecules. It destabilizes humic acid, which also contributes to the coagulation of contaminants [16].

The literature [17] shows that COD values decreased by 45% after ozonation and sand filtration, and by 70% after a carbon filter. Preliminary ozonation with a dose of 4 mg/l increases the sorbability of organic substances by coal by 15-20%. In the literature [17], natural water purification schemes are proposed to reduce the content of organic substances and THMs in water. The water treatment scheme looked like this: water intake, reagent supply unit (aluminum polychloride, powdered activated carbon), flocculation chamber, settling tank, sand filter, ozonation stage, activated carbon filter, final bactericidal ozonation stage, purified water collector (before it is dosed into the pipeline sodium hypochloride). As a result of the operation of this scheme, the amount of flocculants used decreased by 1/3, the content of organic substances in purified water by 22%, and the content of THMs, ammonia nitrogen, total chlorine and salts also decreased. The authors consider the main reasons for improving the quality of purified water to be the destruction of

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bioresistant contaminants during ozonation, as well as the biological treatment processes occurring in the storage tank and filters with activated carbon.

A technology for purifying drinking water is described, where water from the Rhine River basin is used as the source [18]. Most water treatment plants have 7 to 10 stages of treatment, for example: pre-oxidation, microfiltration, double-bed filtration, neutralization, ozonation, adsorption on granular activated carbon, slow quartz filtration and chlorine dioxide disinfection before entering the water distribution system. At the stage of ozonation and adsorption, the highest effect of reducing organic substances is achieved. It is noted that despite the sharp decrease in organic substances, several types of chlorine derivatives are formed during chlorination. At the ozonation stage, organic and organochlorine substances are well removed, but aldehydes and ketones are formed. Practice has shown that with an ozone dose of 5 mg/l, better removal of organic and chlorinated substances is achieved than with lower doses, but the amount of aldehydes and ketones formed increases. At the stage of adsorption on granular activated carbon, the content of organic and chlorinated substances is reduced and aldehydes are completely removed.

The literature review materials provide an opportunity to see the sources of THM formation, the main of which may be the following:

-natural humic substances;
-discharge of industrial wastewater;
-organic components of algae cells;
- interaction of chlorine with organic carbon;
-high molecular weight polymers - coagulants used in the water treatment process;
-results of halogen interaction
substituted phenols and anilines with chlorine;

The most acceptable method of purifying water from organic contaminants and, in particular, THMs, as can be seen from the review, is ozonation. At the same time, water should be treated with ozone at the initial stage of purification.

The high efficiency of ozone and the impossibility in most cases of using chlorine as a primary oxidizing agent from a sanitary and hygienic point of view confirm the versatility, environmental friendliness and inevitability of its use.

The main industrial method for producing ozone is its synthesis from oxygen or air under the action of an electric discharge in ozonizers [1-4, 16]. An oxygen-ozone mixture with an ozone content of about 10% by weight is explosive [4]. In ozonation practice, one has to deal with very low ozone concentrations - from 0.15 to 0.93% by weight. Such mixtures are completely safe, even at pressures of several atmospheres.

Ozone is an unstable gas even in the absence of oxidizing substances and spontaneously decomposes into atomic and molecular oxygen, so it is impossible to store it for any period of time [1-4].

Many works have been devoted to the comparison of chlorine (the main reagent currently used in water supply plants) and ozone, and all of them give preference to ozone [1-4].

Table. 1

Chemical and bacteriological laboratory of GSKV LLC “Tashkent Shahar Suv Taminoti” for the month of November 2021 for water quality control in accordance with OZDst 951 2011 “Sources of centralized household and drinking water supply”

No.	Name of definitions	Units of measurement	Standards	Boz-su
1	Temperature	hail		11
2	Chroma	hail	no more than 30	21
3	Taste	point		2
4	Smell when 200/600	point	no more than 2	0/2
5	Turbidity	mg/dm^3	no more than 20	7,5
6	Hydrogen. index	pH	6,8-8,5	7,32
7	Rigidity	$mg\text{-}ec./dm^3$	no more than 7	2,44
8	Chlorides	mg/dm^3	no more than 250 to 350	2,95
9	Oxidability	mg/dm^3	no more than 7,0	0,36
10	Nitrite	mg/dm^3		0
11	Ammonia	mg/dm^3		0
12	Nitrates	mg/dm^3		1,79
13	Sulfates	mg/dm^3		17,4
14	Fluorine	mg/dm^3	no more than 0,7	0,181
15	Iron	mg/dm^3	no more than 0,3	0,063

16	Copper	mg/dm^3		0,071
17	Lead	mg/dm^3		0
18	Zinc	mg/dm^3		0
19	Arsenic	mg/dm^3		0
20	Molybdenum	mg/dm^3		0
21	Manganese	mg/dm^3	no more than 0,1	0
22	Polyphosphate	mg/dm^3		0
23	Surfactant	mg/dm^3		0
24	Dry residue	mg/dm^3		149
25	Number of coliforms	Number of coliforms in 1 dm^3 water	no more than 1000	<500

Table. 2
Standard concentrations for the discharge of treated domestic wastewater into an open reservoir.

Indicators	Standards (maximum concentrations)	After cleaning the Sergeli sewage treatment plant. (Tashkent)
1. Number of coli bacteria (coliforms), per 1 liter	1000	1200
2. Number of pathogenic enterobacteria, per 1 liter	Отс.	н/о
3. Suspended substances, mg/l	1,5	7,5
4. Hydrogen value (pH)	6-9	7,4
5. Dry residue, mg/l	1000	1560
6. Ammonium nitrogen (NH4+), mg/l	1,5	6,1
7. Nitrate nitrogen (NO_3), mg/l	45	92
8. Nitrite nitrogen (NO_2^-), mg/l	3	5,5
9. Total hardness, mEq/l	7	9,3
10. Sulfates (SO_4), mg/l	400	930
11. Chlorides (Cl), mg/l	250	395
12. BOD full , mg O_2/l	3,0	15,9
13. Manganese (Mn), mg/l	0,1	0,46
14. Copper (Cu), mg/l	1,0	2,2
15. Iron (Fe), mg/l	0,3	1,5
16. Zinc (Zn), mg/l	3,0	13,9
17. COD, mg O_2/l	15,0	75,0
18. Phosphates, mg/l	1,1	4,7
19. Aluminum (Al), mg/l	0,2	0,9
20. Cadmium(Cd), mg/l	0,001	0,005
21. Nickel (Ni), mg/l	0,1	0,29
22. Mercury (Hg), mg/l	0,0005	0,0009
23. Lead (Pb), mg/l	0,03	0,15
24. Chromium (Cr), mg/l	0,05	0,25
25. Butachlor, mg/l	0,04	0,1
26. Organochlorine compounds, mg/l	0,5	1,1
27. Dioxin, mg/l	0,3	0,6
28. Organophosphorous compounds, mg/l	0,3	0,7
29. Phenol, mg/l	0,06	0,1
30. Pesticidlar, mg/l	2,8	4,1

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V. CONCLUSION AND FUTURE WORK

From the above questions, it should be concluded that the problems of water purification and drinking water preparation in Uzbekistan are among the most pressing issues. The problems of preventing negative situations that arise during the design and operation of structures used in the technology of drinking water preparation have been studied.

A retrospective analysis of research work on the safety and reliability of drinking water supply facilities and the safe operation of drinking water supply facilities was carried out. The volume of water consumption and the process of saving it when repairing pipes in drinking water supply networks have been improved.

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