APPLYING OF OZONE IN SYSTEMS OF PREPARATIONS OF DRINKED WATER

B.B.Davudov, N.A.Mamedov, Sh.Sh.Alekberov
Baku State University,Baku, Azerbaijan

D.N.Alieva, N.N.Naumova
SSPI "SUKANAL",Baku, Azerbaijan

ABSTRACT
This paper presents the results of experimental studies on influence of ozone on the water of southern-east water take installation of Jeyran-Batan reservoir including the stability of ozone in open and closed systems and its bactericide effects. Recommendations on cleaning of the water under research up to drinking quality are given.

Keywords: ozone, drinking water , electric discharge, water quality, ozonization process.

I.INTRODUCTION

In last years very often applying of ozone instead of chlorine in the systems of water supplying drinking water of people. This is this is connected with its great oxidizing character in comparison with chlorine and its wide spectrum effect, also thanks to technical achievement in area of reduction of energy of expenses for its synthesis in present time [1].

In spite of known advantages of ozone studying of its action to drinking water of Azerbaijan carrying out first time. Connection with that its necessary to determine not only specifically feature of influence of ozone to the surface and underground water, but also check of general low of process of ozoninig of each of these waters in separately and in different times of year.

The task of present research is determining of whole number of important parameters of process of ozonization-concentration of residual ozone in water, dose and time of contact of ozone with water, loosing of ozone to the atmosphere, time of spontaneous disintegration of ozone, specific expenses of ozone in dependence from different factors and with taking into account season changes of quality of water.

II. RESULTS AND DISCUSSIONS

Researches carried out by an ozonizer with the dual-barrier discharge, created in SS Problem Laboratory ”Ozone generators” of BSU [2,3]. Dual-barrier discharges are the most effective generators of ozone [4]. On the other hand, in these ozonizers is excluding erosion of electrode materials and providing of cleanliness of the ozone-air mix, intended for clearing of drinkable water.

The doze of ozone is usually, correcting with change of size a stream of air, forwarding in a discharge gap. But at the different streams changes also conditions of barbotage, i.e. conditions of contact of ozone with water, that is undesirable. With the purpose of exception of the given lack in our experiments concentration of ozone was regularized by the management of frequency of a voltage submitted in a discharge gap in limits 250÷1000 Hz. In this range of frequency concentration of ozone in a ozone-air mix varied in an interval 1,5÷6,96 mg/l.

In present paper brought of results of experiments of ozonization of natural water from reservoir of Jeyran-Batan of

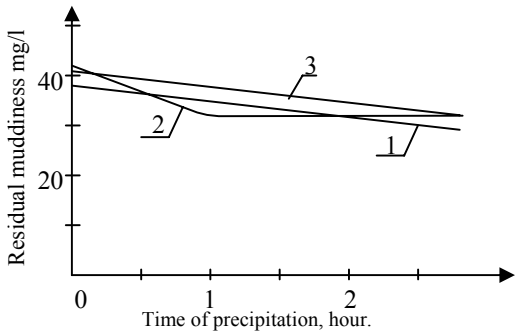

Fig.1. Dependence of residual muddiness the water of Jeyran-Batan water reservoir from time of precipitation at initial (control) muddiness 41,8 mg/l at temperature 23 ^{0}C, 1-before ozoning (control curve), 2-time of contact with ozone 5 min, 3- 15 min, 4- 20 min.

Azerbaijan Republic. Studied influence time of contact of ozone to the muddiness and efficiency of clarification of water in process of upholding and filtering. At the some dozes the ozone does not improve, but worsens clarification of muddy waters. It is probable connected with that, in the Jeyrabatan water are absent colloidal particles (micelle) of organic substances, which can be destroyed by ozone with formatting of filtered particles. Weighed fine dispersal particles of turbidity in water have a mineral origin. Ozone does not influence a mineral suspension as known [5-7], that is visible also from our results (fig.1, cur.2). Clarification of water with control muddiness 41,8 mg/l by during 3 hours comparing with clarification of water with same time upholding with different time of exposition of influence of ozone. Investigation show, that at small exposition act of influence of ozone to muddiness no at all essential. (fig.1, cur.1, 2). With increasing of time of contact of ozone with water residual muddiness is growing, muddiness of water after ozonization during 15 min increasing from 41,8 mg/l up to 49,3 mg/l, but at the during 20 min up to 73,9 mg/l, i.e. to 1,2 and 1,8 times grows degree of dispersity of the suspended particles (fig.1, cur.3, 4). It's should to note, that efficiency of influence of ozone to clarification, obvious,

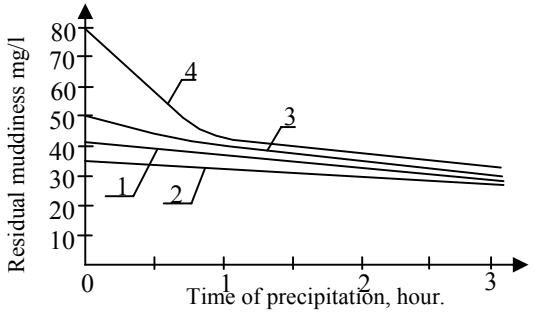

Fig.2. Dependence of residual muddiness the water of Jeyran-Batan water reservoir from time of precipitation at initial (control) muddiness 41,8 mg/l at temperature 7 ^{0}C, 1- time of contact with ozone 1 min, 2- 2 min, 3- 3 min.

happening only till its full decomposition. This time as seeing from fig 1 and 2 in our experiments approximately equal to 20-30 min.

Repetition of these experiment even at 7 ^{0}C with duration of contact of 1-3 minutes shown, that at the less exposition of act ozone don't influence to the muddiness of water (fig.2). Lets note, that the choice of this temperature is not accidentally, so at the temperature 7 ^{0}C dissolution of ozone in water is maximum.

On fig. 3. is shown dependence of efficiency of clarification of water at upholding from duration of ozonization of water at temperatures of water 7 ^{0}C and 23 ^{0}C. With increasing of time of contact of water with ozone efficiency of upholding decreases. Negative influence of ozonization amplifies at duration of contact till 30 minutes.

Obtained results well agree with published data of authors [5,6].

According also data of works [7], over ozoznization gives effect only at the carefully chosen dose and exposition of ozozne. That for different waters these parameters could be different. Because above mentioned experiments

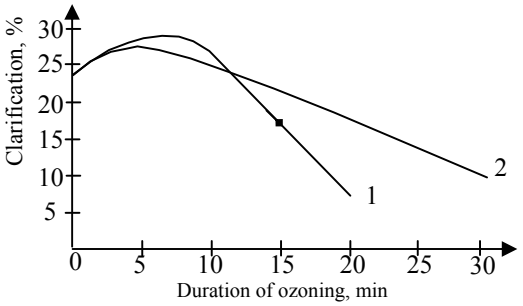

Fig.3. Dependence of efficiency of clarification water of Jeyran-Batan water reservoir from duration of ozoning at the temperature 7 ^{0}C (1) and 23 ^{0}C (2).

must be done in each concrete case. Processing of results of experiments for determining of stability of ozone in water show, that in closed and opened systems stability of ozone is distinguish. So, for expamle, if in opened system for the 30min consisting of ozone in water reducing from value 0,85 mg/l till zero, so in closed system for 35 min till value 0,78 mg/l. That is in water communications residual ozozne could store sufficient long time (fig.4).

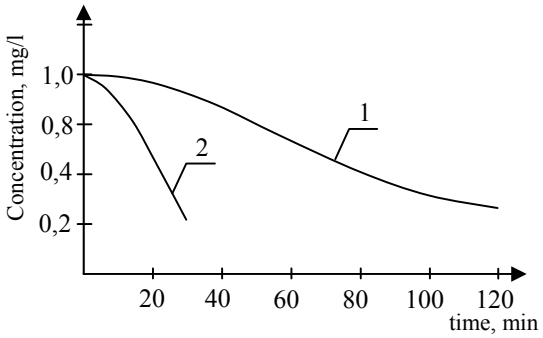

Fig.4 Spontaneous decomposition of ozone in closed (1) and opened (2) systems with (in) water of Jeyran-Batan water reservoir.

Bactericidal act of ozone has been studied in technical water from Jeyrana-Batan reservoir. If in initial water at 8,4 mg/l muddiness the microbe number is 445 unit/ml (MAC - 100 unit/ml) then after five minutes blowdown by ozone – air mixture containing 1,5 mg/l ozone the quantity of microbes has decreased to 97 unit/ml and after 15 min till 0.

At the muddiness of water 1,0-1,5 mg/l and microbes number 157, last one decrease till 1 unit/ml after 3 minutes ozoznization. That is the less muddiness of water, the required less time for its contact with ozone for disinfecting at the same equal conditions.

In course carrying out of researches, in which for mixing of water with ozone used column with water, through which from bottom to top blown ozone-air mixture, established, that in such mixer the coefficient of effective utilization of ozone is very low. For determining of this coefficient in air outlet of column there was mounted a bottle with absorbing solution. Thanks this it was established, that in outlet air flow contains 90% of initial given ozone. Taking into account that the usual content of ozone in the given ozone-air flow is 4%, maximum attention should be given to the issue of dissolution of ozone in water. The results of experiment are presented in table.

Table. Treatment of Jeyran-Batan water with applying of ozone

No	Muddiness M, mg/l	Time of contact, min	Microbe number, unit/ml		Ozone		
			Initial	After contact	Dose mg/min	Residual content, mg/l	In outlet flow, %
1	8,4	5	445	97	1,5	1,04	69,7
2	16,7	10	500	103	1,5	0,2	57,6
3	39	5	600	340	1,5	0,2	84,1
4	78,8	30	850	95	1,5	0,37	90,5
5	1-1,5	3	157	1	1,5	0,15	73,6

III. CONCLUSIONS

- Established, that at the small expositions of contact of ozone with water of Jeyran-Batan water reservoir don't observe decreasing its muddiness, but at increasing of time contact till some value even increasing.
- Shown, that efficiency of clarification essentially depends on temperature of treated water.
- Bactericidial act of ozone to the water of Jeyran-Batan water reservoir of Azerbaijan Republic with muddiness till 1,5 mg/l appear after three minute contact. At the high muddiness time of contact must be increased.
- In closed systems with Jeyran-Batan water the stability of ozone reaches two hours and more. In open systems ozone completely decomposes during 30 min.
- Water of Jeyran-Batan water reservoir could easily be driven up to drinking quality by the help of according filters and offered in work of ozone technology.

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