

THE USE OF THE KLILOPTILOLIT AT THE WATER CALCINATION UNDER THE INFLUENCE OF THE ELECTRIC CHARGE

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ABSTRACT

In article researches of process of water treating from the fluorine at effect of the electric discharge barrier type are resulted. Processes of electrization of solid porous adsorbents are investigated. By the thermostimulated relaxations method it is revealed that accumulation of superficial and volumetric charge takes place in the specified materials. It is shown that electric discharge effect considerably increases the efficiency of adsorption treating of water.

It is shown also that the roentgen-phase analysis method allows researching the processes occurring in the adsorbent structure.

Keywords: clinoptylolite, adsorption, treating, electric charge, water calcinations,

I. INTRODUCTION

The fluorine is the most active metalloid, he creates the compounds with the majority elements. The fluorine is wide-spread in the nature. The water sources of some regions of Azerbaijan (especially underground), which are useable nowadays, are characterized by the high content of the fluorine ions. That's why the developing of the water defluorination methods is the actual and perspective task for the investigators.

The content of the fluorine in the nature water varies in the wide limits (from 0,01 to 12 mg/l). The fluorine excess in the drinking water (more than 1,5 mg/l) at its long use causes the fluoroz - the illness or the mottling of the enamel. That's why according to demands of SST 2874-73 "Drinking water", the maximum allowable content of the fluorine in the drinking water, 1,5 mg/l, has been established. The optimal concentration near 1 mg/l is considered the one.

The water defluorination methods, existing nowadays, can be joined into two fundamental groups.

The first group includes the methods of the ion exchange on the ionites which are selective in respect of fluorine - on the activated alumina, hydroxylapatite, strong-basic anionites, and also magnesia sorbents and activated coals.

The methods of the ion exchange are the most effective at the water defluorination of the groundwater, which aren't need in the other types of the purification.

The second group includes the sorption methods. They are based on the fluorine sorption with the above secreted residues of the hydrate of magnesium, aluminium and calcium phosphate. The sorption methods are well used for the defluorination of the surface water, when the defecation and decolouration of the water are needed simultaneously with its defluorination [1,3].

The authors mention, that the deep water defluorination is possible at the $\text{pH} < 7$.

Silje, Hart and Stander show, that [10] the device under the name "Saifos", obtained by the working of the superphosphate by the 5% solution of NaOH, can be used for the water defluorination.

The existing methods of the water defluorination, in the connection of their difficulty and diseconomy, didn't find the use in the water preparation practics.

The aim of the given work is the choice substantiation in the capacity of the absorbent of the fluoride-ions of the nodular zeolite - clinoptylolite, previously treated by the electric charge.

Nowadays the quartz sand is used mainly in the capacity of the nodular filtering material at the purification of the drinking water and the manufacturing water from the suspended particles. However, the deficiency of the needed fractions of the quartz sand (0,5-2mm), its high prize, the striving the increase of the mud trap capacity, caused the necessity of the search of the new, more cheep and wide-spread materials, characterizing by high enough mechanical strength, chemical stability and having the more developed specific surface and porosity in the comparison with the quartz sand. [5-7].

II. EXPERIMENTAL TECHNIQUE

The experiments on the studying of the possibility of the water defluorination on the different absorbents: quartz sand, haydite, and clinoptylolite, were carried out.

The absorbents were heat-treated at the different temperatures during five hours before the use. The clinoptylolite was treated with electrotreatment, then the defluorination was carried out. The change of the ion concentration is represented on the fig.1. The results of the

experiments showed the doubtless preference of the use of clinoptylolite, previously treated as the adsorbent.

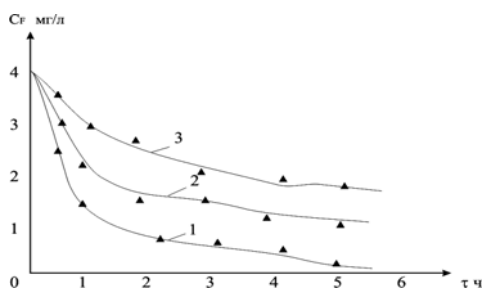


Fig. 1 Change of fluoride-ions concentration (C_F) in purified water during the purification time τ at the use of different adsorbents 1 – clinoptylolite, 2 – silica sand, 3 – haydite

The investigation results of the use of the natural zeolite of the clinoptilolite with a purpose of the intensification of the purification process, the ensuring of the guarantee water quality, the decrease of the cost price and the reagent expense are presented in the given work.

The experiments were carried out with the use of the clinoptilolite (zeolite are the natural molecular bolters), the abundant supplies of which are in the territory of Azerbaijan (Aidag deposit, situated in Taus region).

Adsorbent was previously treated by the thermal regeneration at $T=450$ C during 5 hours.

The investigations of the last years have been extended the range of the use of the natural zeolite, opened the new technical possibilities of this mineral. The adsorbent, ion-exchange possibilities of the natural zeolite to absorb the electric charged particles and its other properties define the wide range of its use in the scientific, technical and technological aims [3].

It is established, that the sputter-ion activation of the natural zeolites promotes to the more effective absorption of the impurities from the hydrocarbon liquids [4-6], the zeolites reveal the barrier role in the respect of the series of the substances: oil and oil products. The given properties of the zeolites, activated by the electric discharges, allow to use them for the purification of the manufacturing water.

The influence of the electric charge was carried out in the special glass reactor with the built-in electrode system, creating the configuration of the weakly nonhomogeneous electric field with the dielectric barriers in the interelectrode interval.

The electrical schematic diagram is represented on the fig.2.

The sputter-ion treatment of the adsorbent was carried out by the influence of the barrier discharge at the alternating voltage 15 kV, digit current 60 mA, the working time was 30 min. The natural zeolite, previously treated by the barrier electric discharge, was put into reactor. The electric treated and untreated samples of the natural zeolite were used in the experiments.

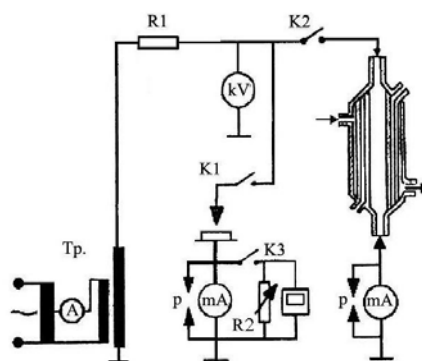


Fig. 2. Basic electric circuit

After purification of the water by the zeolite- clinoptylolite the adsorbent was carried out on the laboratorial device, which is represented on the fig.3.

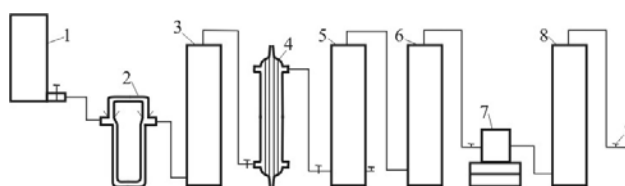


Fig. 3. Technological installation for water defluorination. 1-water tank, 2-theometer, 3 –settler, 4-ozonizer, 5- reactor, 6-reactor, 7-premp, 8-settler, 9-valves.

The water, including the fluorine, was passed through the reactor with the definite constant velocity. After the purification each sample water with the initial sample water (raw water) was treated by the chemical analysis on the content of the different impurities in them.

The obtained results of the analysis are given in the table.

The N_1 samples present the initial water, N_2 samples represent the water, purified with the use of the clinoptilolite, N_3 samples represent the water, purified with the use of the clinoptilolite, previously treated by the influence of the barrier electric charge.

It is seen from the table, that quantity of the impurities in the treated water has been decreased in the comparison with the initial water. The quantity of the fluorine decreases till the value, established by SST.

III. CONCLUSIONS

Thus, it is established in the work, that the electric charge creates in the adsorbent samples under the influence of the strong electric fields and discharges [8].

It is established, that the carrier injection through the electrodes is the dominant mechanism of the charge introduction in adsorbent volume at the electric charging of adsorbents.

The investigations of the mechanism of the intensification influence of the electric discharge on the sorption show, that the adsorbent charging, established in the work, plays the significant role in this process. The theoretical analysis of the charged state in the investigated porous dielectric adsorbents shows, that such charged state creates because of diffusion mechanism of the

charge introduction in the material structure. The diffusion coefficient values have been obtained, which are in the interval between the values of diffusion coefficient of the neutral materials in the investigated adsorbents, known from literature, and ion diffusion coefficient in the nonporous identical materials. This fact allows to propose the model of the adsorbent charging process, according to which the ions, captured by the external surface of the adsorbent diffuse deep into adsorbent along its pores, leading to its charging [11].

The method, worked out in the paper, allows to establish the fact of the intensification of the adsorbent processes experimentally at the given influences, revealing in the

change their selectivity in respect of different components and their maximum sorption ability.

Thus, the results of the carried investigations prove, that the quantity of the fluorine in the natural water till the values, established by SST, can be decreased by the adsorption methods at the definite modes of the adsorbent electrotreatment. The technology of the use of the described method has been worked out and carried out in the real conditions for the defluorination of the natural waters.

The supposed method presents the perspective technology of the purification of the natural water.

Table. Results of water probe chemical analysis.

	Parameter	Unit of measurement	YOST 2874-82	Composition		
				№1	№2	№3
1	Temperature	°C		0	0	0
2	Smell at 20 °C	grade		0	0	0
3	Smell at 60 °C	grade	2	0	0	0
4	Taste	grade	2	0	0	0
5	Color	degree	20(35)	9	9	5
6	Suspended particles	mg/l	1,5(2,0)	3,94	2,2	0,73
7	PH	---	6-9	7,95	7	6
8	Ammonium salts	mg/l	2,0	0	0	0
9	Hydrocarbonate	---		170	158,6	110
10	Iron (Fe)	---	0,3(1)	0	0	0
11	Calcium (Ca)	---		6,0	5,04	5
12	Magnesium (Mg)	---		18,2	18	15
13	Fluorine (F)	---	1,5	4	3	0,3
14	Mineralization (Eu)	---		448,6	426,6	422,6
15	Sodium+Potassium (Na+K)	---	200(Na)	56,8	52,1	48,5
16	Nitrates (NO_3^-)	---	45	0,95	0,95	0,5
17	Nitrides (NO_2^-)	---	3	0,029	0,012	0,003
18	Hardness	---	7(10)	4,02	4	3,5
19	Carbonate Hardness	mmol/l		2,6	2,6	0,5
20	Sulphides (SO_4^{2-})	---	500	127,3	110,5	100
21	Dry residue	---	1000 (1500)	368	346	300
22	Chlorides (Cl ⁻)	mg/l	350	47,8	36,9	30

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