USE CLINOPTYLOLITE FOR CLEARING OF WATERWASTE AT INFLUENCE ELECTRIC DISCHARGES

M. A. Hasanov, E.I. Zulfugarov, N.F. Djavadov

Institute of Physics, Azerbaijan National Academy of Sciences, Baku, Azerbaijan
Azerbaijan State Cooperation University, Baku, Azerbaijan
Experimental – manufacture plant of the Azerbaijan National Academy of Sciences, Baku, Azerbaijan

ABSTRACT

The adsorption clearing of wastewater is investigated. Results of laboratory researches are presented on the basis of which the technology clearing of the enterprises wastewater is offered.

Keywords: wastewater, technology clearing, electric discharges, chemical analysis, clinoptylolite

I. INTRODUCTION

At present time in conditions of manufacture growth and an intensification of technological processes the problem prevention of air, ground and water pollution gets paramount importance. One of environment pollutants is the oil containing wastewater which formed at all technological stages of oil production and utilization. During collection, preparations and transportations of oil the wastewater not only pollute ground and reservoirs, but also are a source of oil losses because the drains on the main line. Absence of full reverse use of water at the enterprises and also storage and transport of mineral oil leads to inevitable dump of wastewater in an environment. Therefore problems of clearing industrial wastewater from oil get now an actual meaning.

Solving problems of nature conservation, rational use of natural resources, protection of an environment from any sort pollution represent an extensive scientific, technical and economic task.

The clearing of wastewater containing the mineral oil distinct by greater variety and complexity.

There are some methods of treatment wastewater containing mineral oil, depending on impurities structure.

Physical methods of clearing. The general attribute of these methods is that in their basis the gravitational separation of mineral oil and waters. There is number versions of such methods which essentially differ among themselves. These versions are following clearing methods:

- in usual gravitational sedimentation tanks having the form of extended pools;
- in the separators – sedimentation tanks with parallel inclined plates;
- in the separators working on a basis of coalescence of the mineral oil drops;
- in the separators working on a basis of air flotation of mineral oil (without application of the chemical reagents);
- in the separators working on a basis of wastewater filtration.

Physical and chemical methods of clearing. Include flocculation of mineral oil by means of chemical reagents and also application of adsorption. Following versions of physical and chemical methods of clearing differ[1,3]:

flocculation with following sedimentation;
flocculation with following air flotation.

Biological methods of clearing. Based on destruction of mineral oil on by means of bacteria. Versions of such methods:

Clearing by means of active silt; clearing by the filters with a biological filtering layer.

Adsorption of mineral oil by the adsorbents. The substances well adsorbing mineral oil are applied as adsorbents. Three kinds such adsorbents are used: natural, subjected to special additional processing and artificial.

The preliminary comparative analysis of various clearing methods is shown that any of them is not universal. Each group of methods has the application area in which it is the most effective. Areas of effective application of various methods are characterized by distinction of a mineral oil condition in waste water. Therefore the classification of mineral oil conditions in the wastewater is of fundamental importance.

Application of electrical methods is new and progressive direction in water treating technology. Really, as shows development of this direction, electrical methods possess essential advantages to traditional processing methods. First of all, they allow to refuse application of reagents and corresponding facilities [6,14-16]. Now at some stations the water-preparation by the 120-140 ton of coagulant per day is used, that enrichments of water by undesirable sulfates and chlorides.

As is known, in many technological processes the sorption methods are used for extraction of impurities from mineral oil [4,5].

The high requirements shown to adsorption processes cause researches of their further intensification and creation the control facilities for them during the technological operations. To those concern influence of γ and x-ray radiations, ultra-violet light, α and β radiations, effect by electric fields on adsorption processes [6,8].

II. EXPERIMENTAL DATA

In the present work results of researches the treatment of wastewater at effect of electric discharges are brought. Influence of electric discharges barrier and corona types on the treatment process for wastewater of the Baku city enterprises is investigated.

Earlier lead experiments have shown that adsorption clearing of liquids at effect of electrical discharge barrier type causes to more effective results than at effect of corona discharge. In this connection in the given work we used effect of a barrier electrical discharge.

The natural zeolite –clinoptylolite (zeolites is a natural molecular sieve) was used as adsorbent. The heavy stocks of this mineral exist in territory of the Azerbaijan republic (Aydag deposit located near the Tovuz city). Adsorbent preliminary was exposed to heat treatment with pumping at temperature T=400 °C during the 5 hours.

The principal electric scheme of adsorbent processing by the electric discharge of a barrier type is shown on fig.1.

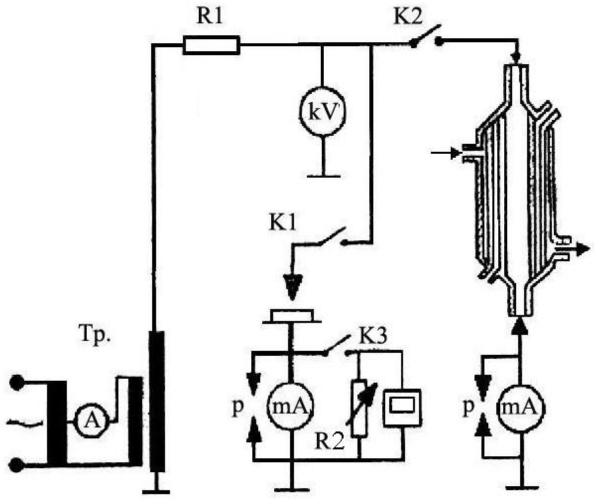

Fig.1. Schematic electric circuit

Effect of the electrical discharge was carried out by mean of the special electrode system forming in an interelectrodes interval a configuration of weakly not uniform electric field with the dielectric barriers. The experiment conditions: applied voltage 15 кВ, discharge current 80 мА, processing time 30 minutes. The natural zeolite preliminary processed by the barrier electrical discharge was located into a glass reactor and then the wastewater was passed through it. In experiences the electrically treated and not treated samples of natural zeolite were used. At all experiences the physical and technological parameters characterizing the clearing processes remained strictly identical, therefore the opportunity to compare results of various ways of wastewater treatment was represented.

On fig.2 the technological scheme of experimental installation is shown.

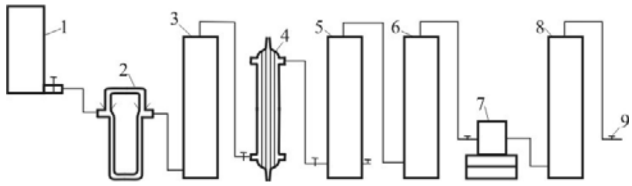

Fig. 2.
Technological installation for water defluonition.
1-water tank, 2-theometer, 3 –settler, 4-ozonizer, 5- reactor, 6-reactor, 7-premp, 8-settler, 9-valves

The wastewater was passed with the certain constant speed through an ozonizer and consistently included zeolite filter. After the clearing each test of cleared water together with initial (no cleared) water were subjected to the chemical analysis for obtaining the content of various impurities.

In the table the results of the chemical analysis of wastewater test are presented.

From the table it is visible, that impurity quantity in the cleared water (for example, NH_4, HCO_3, Ca, NO_3, rigidity, CI, SO^{2-}_4 and mineral oil) has essentially decreased in comparison with initial water.

III.CONCLUSIONS

Thus, as results of the lead researches it has been established that effect of electrical discharges intensifies the processes of adsorption clearing wastewater by the solid porous adsorbents (zeolite –clinoptylolite), leads to investigation of adsorbents selectivity and maximal adsorption ability. It is shown, that at barrier discharge in weakly not uniform electric field inside the adsorber the ionization and excitation of molecules take place in all gaps between the zeolite grains. Therefore the active zone of the barrier discharge is concentrated directly at the adsorbent surface. In our opinion, this physical feature in distribution the active zones of discharge determines more higher efficiency of the barrier discharge. Intensifying effect of the electrical discharge on these processes considerably above, than effect of an electric field up to discharge regimes.

Table. Results of water probe chemical analysis

.

№	Parameters	Unit	GOST 2874-82	Composition		
				No.1	No.2	No.3
1	Smell at 20°C	bal	0	>5	>5	>5
2	Chromaticity	degree	20 (35)	195	175	21
3	Turbidity	mg/l		106	79	2,7
4	pH	mg/l	6-9	6,95	6	3,6
5	Salts of ammonium (N-NH4) ($N\text{-}NH_4$)	mg/l	2,0	193,6	1993	1,68
6	Hydrocarbonates (HCO_3)	mg/l	-	781	781	0
7	Calcium (Ca)	mg/l		60	60	6
8	Magnesium (Mg)	mg/l		36,5	36,5	3,6
9	Mineralization ($\sum u$)	mg/l		4770	4748	155,1
10	Sodium+Potassium (Na+K)	mg/l	200(Na)	1183	1175	482,8
11	Nitrates NO^{-3}	mg/l	45	1,42	1,42	0,4
12	Hardness	mg-equi/l	7(10)	6,0	6,4	3
13	Carbonate hardness	mole/l		6,0	6,0	0
14	Sulfides (SO^{2-}_4)	mg/l	500	4235	4175	103,1
15	Solid residue	mg/l	1000(500)	2405	2390	166,8
16	Chlorides (Cl^-)	mg/l	350	112	110	20,2
17	Electrical conductivity	µS/cm	1500	6820	6800	105,7
18	Oil products	mg/l		43111,6	284,5	10,6

REFERENCES

1. *Glushenko L.I.* Clearing of petrocontaining sewage a method of pressure head flotation, Moscow, 1973. (in Russian)
2. *Rottgardt D.* Water Protection Against pollution by mineral oil in the Federal Republic. Journal of the Institute of Petroleum, vol 55, No.552, 1970.
3. *Witmer F.E., Collan A.* Determination of Concentration and Size Distribution in sehep Ballast Waters. Method and Representative Results. Environmental Science and Technology. 1973. vol 7, No.10.
4. *Mitrofanov M.G., Mirskiy Ja.V.* Synthetic zeolites. M.1962, with. 236-238
5. *Tarasevich J.I., Ovcharenko F.D.* Application of natural sorbents for clearing mineral oil and water. Adsorbents, their reception, properties and application./Under edition M.M.Dubinin 1976, p.848. (in Russian)
6. *Yermatov S.E.* Radiation - stimulated adsorption. Alma-Ata. 1973, c.224 (in Russian)
7. *Martynenko A.G., Konoplev V.G., Shirjaeva G.P.,* Clearing of mineral oil in an electric field of a direct current. M. Chemistry 1974. (in Russian)
8. *Dzhuvarly C.M., Dmitriev E.V., Kurbanov K.B., Mehtizade R.N., Gasanov M.A.* Formation of the charged condition in silica gels under influence of electric fields and discharges. // Electronic processing of materials, 1991, №4, p.46-47(in Russian)
9. *Karelin J.A., etc.* the Advanced methods and constructions for sewage treatment. M. Stroyizdat 1972. (in Russian)
10. *Mongajt L.L., Schiller M.E.* Foreign operating experience of sewer clearing constructions of the oil refining and petrochemical enterprises. Sulfurs. « Experience of designing of the oil refining and petrochemical enterprises ». Neftekhim. 1972.
11. *Culp R. L., Culp G.L.* «Advanced Wastewater Treatment» 1971.
12. *Eckenfelder W.W.* Manual of treatment processes (Water resource management ser vol. I. 1968)
13. *Gashimov A.M., Gurbanov K.B., Mehtizade R.N., Gasanov M.A.* Physical and chemical method of sewage treatment of tanning manufacture with application of electric influences. Surface Engineering and applied electrochemistry. Kishineu, 2004, No.5, pp.84-86(in Russian)
14. *Gashimov A.M., Gurbanov K.B., Gasanov M.A., Zakiyeva I.G.* Application of new electrophysical methods in processes of clearing of industrial sewage .Transactions of the Azerbaijan National Academy of Sciences, ser. Phys.-math. and techn.sciences, phys.and astronomy, 2003, No.2, pp. 81-83 (in Russian)
15. *Hasanov M.A.Tertiary* Sewage clearing at effect of the electric discharge. Power Engineering Problems. Baku, Elm, 2004, No.3, pp. 58-61(in Russian)
16. *Gashimov A.M., Gasanov M.A., Gurbanov K.B.* Intensification of sorption clearing of mineral oil with application of influences of electric discharges. Surface Engineering and applied electrochemistry. Kishinev, 2004, No.4, pp.44-46(in Russian)