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**DEVELOPMENT OF COMPLEX CLEARING OF POLLUTED WATER**

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We offer clearing technology of polluted water in consequence of malevolent acts (or waste water). The given method is based on results of research adsorptive-clearing of the polluted waters at used natural zeolite - clinoptilolite from Tauz depozit in Azerbaijan. New technology consists that with the purpose of increase adsorptive ability of natural zeolites was carried out their activation with processing in the barrier type electric discharge or hot hydrochloric acid. It is possible to keep activated adsorbents during long time without appreciable loss of ability to clearing of polluted water. According to the offered new filtration technology multicomponent waste water (or polluted in consequence of malevolent acts) is completely cleared as of metals, and other contaminants.

Water is essential to sustain life. Availability of water in quantities and of a quality sufficient to meet basic human needs is a prerequisite for both improved health and for sustainable development. The provision of secure drinking water for its citizens is an aim of every government. During times of war, there is always talk of threats of terrorism against public water supplies.

The pollution prevention in the water distribution system, reservoirs and other important hydroengineering systems of the drinking water supplies in Azerbaijan, requires an operational water quality monitoring system for detection and early warning of pollution incidents from intentional (sabotage, terrorism-related) and accidental chemical spills in the reservoirs.

**WATER QUANTITY IN AZERBAIJAN.**

From the water supply point, the Azerbaijan is considered to be one of the driest regions of the world. The total of water resources of Azerbaijan varies from 28.5 to 30.5 km<sup>3</sup>. The number is further reduced in arid years to approximately 27.0 and 22,6 km<sup>3</sup>. The water resources of Azerbaijan are limited in comparison with other countries in the South Caucasus and is only 15 per cent of all water resources in the region. Water per area and per person in Azerbaijan is 7.1 and 7.5 times less than in Georgia and 2.0 and 2.1 times less than in Armenia, respectively.

Baku is the biggest city in the Caucasus and Apsheron peninsula is the highest density of population and industry in the Caucasus. At peace time there are big problems with sufficiency of water-supply of Baku and Apsheron peninsula with four-million population. Today the nearest source of drinking water is on distance 150 km. You can't imagine the problems of water-supply in a

case of total terror. Therefore the creation and development of new clearing technologies will allow partially to solve these problems in the case of total terror.

Offered by us new technology the clearing of the polluted waters can be successfully applied to clearing of waste water at peace-time.

**RIGIDITY OF DEMANDS IN THE FIELD OF POLLUTED WATER CLEARING.**

In a new millennium protection of drinking water reservoirs from any type of poisoning and other malevolent acts are the major problem of human security (safety). During peaceful time the basic part of water pollution is made by industrial sewage and municipal sewer waters.

Numerous researches on increase efficiency of cleaning methods are carried out last years in Azerbaijan and abroad. Among existing methods one of the most widespread is adsorptive clearing method with use of various adsorbents.

The European Water Directive demands that industrial sewage must always be under more strict ecological control.

All these require a considerable increase of demands to the quality of purified sewage, necessity of development of more effective methods of sewage purification with application of the newest technologies.

The analysis of the literature has shown that traditional ways of waters clearing by chemical and also adsorptive methods are insufficiently effective.

According to offered new filtration technology multicomponent waste water (or polluted in consequence of malevolent acts) is completely cleared as of metals, and

other contaminants owing to the application of new technology not requiring use of additional reagents and alkali.

The offered project is based on results of research adsorptive clearing of the polluted waters at the use of natural zeolite - clinoptilolite from Taus deposit in Azerbaijan.

New technology consists that with the purpose of increase adsorptive ability of natural zeolites was carried out their activation with processing in the barrier type electric discharge. It is possible to keep activated adsorbents during long time without appreciable loss of ability to clearing of polluted water.

The first results of investigations showed the effectiveness of natural zeolites for purification liquid [1,2] and gas [3,4] matters.

Earlier was established, that after electric discharge activation zeolites effectively absorb impurity from hydrocarbon liquids, display a barrier role concerning a number of petroleum-products, such as, xylol, toluol, benzol, phenol etc [5-7].

At the preparatory stage of researches clinoptilolite was exposed to heat treatment with pumping out at temperature 700 C for 5 hours. Then samples of adsorbents were exposed to electric discharge activation. The electric discharge activation of adsorbents was carried out in the special discharge-chamber, design which allowed to raise in an interelectrode interval the barrier type electrical discharge. The processing by the barrier-discharge was carried out at a variable voltage 17 kV, discharge current 100  $\mu$ A, duration of processing time about 30 minutes.

From thermostimulated relaxation spectra follows that the electric discharge processing results in formation of volumetric electric charges of both marks in adsorbents.

After electric discharge processing adsorbents were separately loaded in special glass reactor and polluted water samples were passed through them (Fig.).

After purification each sample of the cleared and initial water (tanning industry waste water) was exposed to the chemical analysis for revealing various impurities in them. The results of the analysis of one such water sample are given on the table.

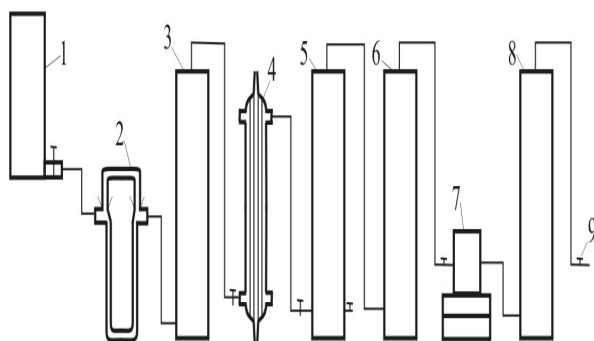


Fig.

## THE TABLE.

Results of the analysis of samples of the initial waste water of tanning industry and cleared water by use of activated clinoptilolite filter (one cycle).

Parameter	Unit	Waste water	After the clearing
pH	-	12,5	9
TDS (total dissolved solids)	Ppm (mg/l)	40600	2000
$\Sigma_{ionic}$ mineralization	mg/l	43188	3920
Dry matter (150%)	mg/l	36875	2500
turbidity (optic density)	mg/l	3.8	0.16
HCO <sub>3</sub> <sup>-</sup>	mg/l	18	0
CO <sub>3</sub> <sup>2-</sup>	mg/l	6000	2568
OH-	mg/l	272	0
Ca <sup>2+</sup>	mg/l	521	0
Na <sup>+</sup>	mg/l	17377	8000
NH <sub>4</sub> <sup>+</sup>	mg/l	875	0.66
NaHCO <sub>3</sub>	mg/l	10388	80
Na <sub>2</sub> CO <sub>3</sub>	mg/l	10388	90
NaOH	mg/l	196	90
Ca(OH) <sub>2</sub>	mg/l	593	0
NH <sub>4</sub> Cl	mg/l	2598	2
Sulphur comp. oxidable by iodine (by H <sub>2</sub> S)	mg/l	32846	0
S <sup>2-</sup>	mg/l	809	470
HS-	mg/l	5499	123
PO <sub>4</sub> <sup>3-</sup>	mg/l	130	1,4
Chloride, Cl-	mg/l	90000	213
Na <sub>2</sub> S	mg/l	167	60
SiO <sub>3</sub> <sup>2-</sup>	mg/l	8048	10

## CASE STUDY: CLEARING OF THE TANNING INDUSTRY WASTE WATER

The main feature of tanning manufacture is the using of very wide spectrum of chemical substances of various structure and origins. For processing 1tons of hide it is required 45-50 cubic meters of water, which together with fibers, suspended particles, compounds of trivalent, and sometimes, that is much more dangerous, six-valency chromium, sulphides, phenols, chlorides, dyes, fats, various organic compounds and many other substances form multicomponent waste water requiring deep clearing.

Thus, the clearing of tanning industry waste water is complicated by variety of substances contained in them. It causes necessity of simultaneous using of several methods of clearing.

Offered new technology considerably simplifies technological processes and raises efficiency of clearing of tanning industry waste water. The results of the chemical analysis of waste water and water, cleared by the offered way are given on the table.

From comparison of the data of analysis follows, that only for one cycle of clearing, contents of such impurity as NH<sub>4</sub>, S, HS, H<sub>2</sub>S, Cl, NaOH, Ca, NH<sub>4</sub>Cl, Ca(OH)<sub>2</sub>, Na<sub>2</sub>S, PO<sub>4</sub>, Na<sub>2</sub>CO<sub>3</sub> sharply decrease as a result of the offered clearing method.

As a result of preliminary electric discharge activation of clinoptilolite the speed of filtering makes 14 - 18 cubic meters in an hour. Term filter-cycle thus is increased to 30 - 50 hours.

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