

A.K. Muratova, I.A. Kyrgyzalina, B.R. Nussupbekov, A.Zh. Satybaldin, Z.K. Aitpaeva

*Ye.A. Buketov Karaganda State University, Kazakhstan  
(E-mail: zamik1981@mail.ru)*

### **Innovative method of processing oil products**

In this article possibility of management electrohydraulic effect for the heterogeneity degree changing of work environment, the electroconductivity influence and dielectrical environment penetrability is suggested. Dielectrics differ from other substances in strong communications of the electric positive and negative charges which are their part. Measurement of dielectric permeability of the liquid environment is carried out thanks to the installation intended for measurement conductivity of the liquid environment, and comparison of measurement results of electrophysical characteristics of the Kumkol field oil. The dielectrical environment penetrability is decreasing from the liquid temperature increase and following frequencies. With increase in dielectric permeability's temperature value of oil changes in slightly. The results of experimental studies on the effect of electrohydropulse shock waves on dielectric permeability on two component media are important for scientific understanding of the physics of impulse phenomena in heterogeneous media. By results of the carried-out tests the new single-stage technique of oil processing was offered by electrohydraulic effect which leads to oil clarification from harmful to impurity, gives the chance to get the most economical, available way of extraction of the purified oil and an opportunity for development of innovative and technical progress in the country.

Keywords: electrohydraulic effect, oil clarification, dielectric permeability, temperature, frequency, hydrogen sulfide, polarizability, thermodynamic coefficient, oil products, heterogeneous environment.

These days there is a need for definition under the set conditions of the most perfect criteria of an assessment, such as polarizability, dielectric magnetic permeability, a tangent of angle losses, painting polarizability, the dipolar moment, thermodynamic coefficient of stability and some other characterizing electrophysical parameters of liquids [1].

In this regard, developing regulation methods of electrohydraulic effect except electric parameters of the unit influence of conductivity and dielectric permeability of the environment is necessary. As a result, there was a possibility of electrohydraulic effect management at change of heterogeneity degree of working environment and influence of conductivity, dielectric permeability of liquid [2, 3].

Installation intended for measurement dielectric permeability of the liquid environment as working part the measuring cell is made. The cell is filled with studied liquid. Measuring electrodes fall to studied liquid connected with R-4833 devices are intended for measurement electric resistance of this environment. By means of plate it is possible to generate electric current of high frequencies [4].

The general scheme of installation is submitted in Figure 1.

Research of dielectric permeability of  $\epsilon$  on studied material tension from the generator via the measuring resistor and store of capacities moves. Tension on the measuring resistor proportional current to  $I$ , passing through a sample is registered by means of the graph plotter,  $Y$  entrance. Current through a measuring cell the turn is proportional to its electric capacity (the scale of  $Y$  graph plotters is calibrated by reference capacities). On entrance of the  $X$ -th graph plotter the signal of the thermocouple proportional to temperature of cell is given. Thus,  $\epsilon$  is determined by formula [5]:

$$\epsilon = C / C_0, \quad (1)$$

where  $C_0$  — cell capacity without studied substance.



Figure 1. Measuring cell

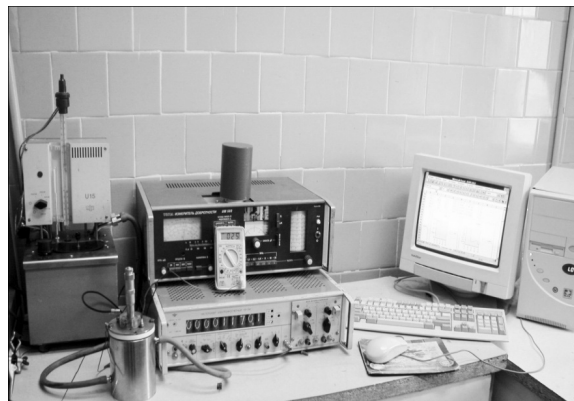


Figure 2. Electric circuit of installation

Cell formed installation was collected for oil processing by electrohydraulic effect [6–8] (Fig. 2).

The cell consists of two electrodes, one of them represents a steel core, and the second is executed a type of the cell case [6] (Fig. 3).



Figure 3. Cell for processing of oil and oil products

As showed numerous experiments, electrohydraulic processing of oil and oil products intensively lose any harmful impurity, and first of all sulfur. Sulphurous connections actively are removed from oil or in the form of flying connections – hydrogen sulfide, or drop out in a deposit.

In the subsequent experiments dependence of dielectric permeability of water on various temperatures was received. Apparently at the room temperature the importance of dielectric permeability of water makes (Fig. 4) 81,5. With increase in water temperature dielectric permeability of the environment decreases and at achievement 90 °C makes 59.

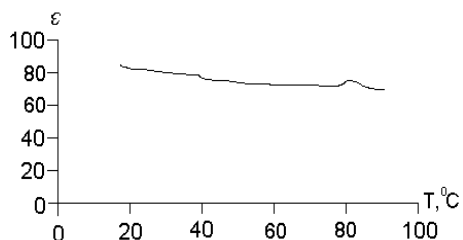


Figure 4. Dependence of dielectric permeability of water on temperature

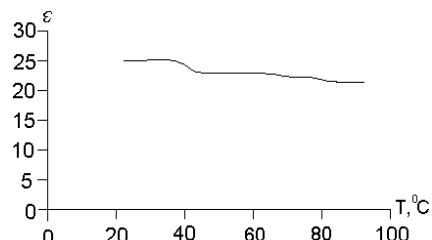


Figure 5. Dependence of dielectric permeability of ethyl alcohol on temperature

Moreover, we researched the dielectric permeability of ethyl alcohol on various temperatures. Apparently at 20 °C the importance of dielectric permeability of ethyl alcohol shows (Fig. 5) 24,8. With increase in temperature dielectric permeability of ethyl alcohol decreases.

In further experiments dependences of dielectric permeability of solution water — ethyl alcohol from temperature with various concentration was searched. Investigated concentration water of 10 % + ethyl alcohol of 90 %, water of 30 % + ethyl alcohol of 70 %, water of 50 % + ethyl alcohol of 50 % of solution.

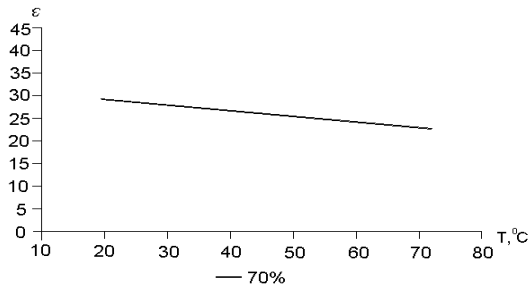


Figure 6. Dependence of dielectric permeability of solution water - ethyl alcohol from temperature at various concentration

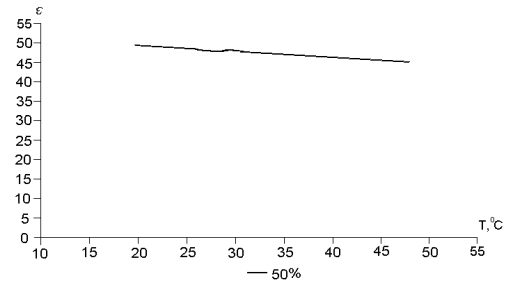


Figure 7. Dependence of dielectric permeability of solution water-acetone from temperature at various concentration

In ethyl alcohols (Fig. 6) increase in concentration of the water, the received schedules come nearer to value of dependence of dielectric permeability of water from temperature. At 90 % the content of ethyl alcohol comes nearer to value of dielectric permeability's dependence of ethyl alcohol. From Figure 7 it is visible similar dependences of dielectric permeability of solution water acetone from temperature with various concentration.

In the following series of experiments (Fig. 8, 9) dependences of dielectric permeability of glycerin and transformer oil from frequency are received at various temperatures.

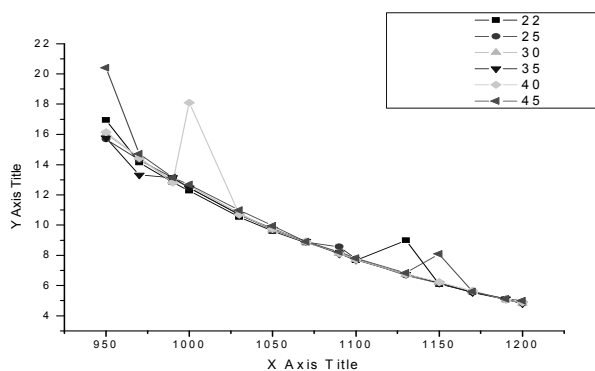


Figure 8. Dependence of dielectric permeability of glycerin on frequency at various temperatures

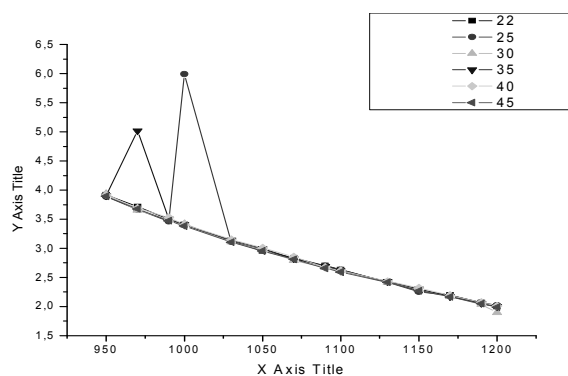


Figure 9. Dependence of dielectric permeability of transformer oil from frequency at various temperatures

In the subsequent experiments we took readings of dielectric permeability of Kumkol oil field, and after processing by electrohydraulic effect.

In Figure 10 the dependence schedule dielectric permeability of oil before processing by electrohydraulic effect is shown at distances between electrodes of 2, 3 mm at 980 kHz.

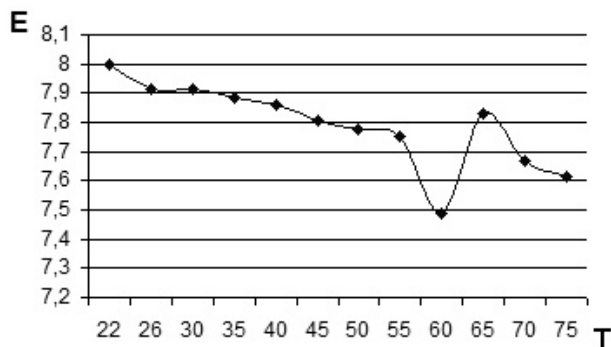


Figure 10. Dependence of dielectric permeability on temperature at various distances between electrodes with a frequency 980 kHz

In Figure 11 the dependence schedule dielectric permeability of oil after processing by electrohydraulic effect is shown at distances between electrodes of 2,3 mm at 970 kHz.

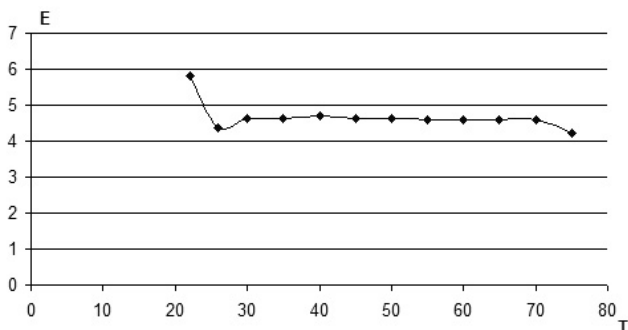


Figure 11. Dependence of dielectric permeability on temperature with a frequency 970 kHz after processings by electrohydraulic effect

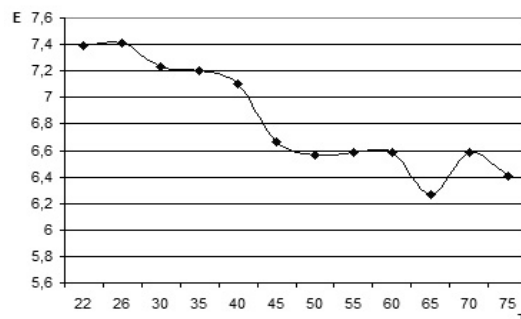


Figure 12. Dependence of dielectric permeability on temperature with a frequency 970 kHz after processings by electrohydraulic effect

Apparently from value schedules dielectric permeability after processing by electrohydraulic effect decreased to 7,4–6,2 cm/m (Fig. 12). And with increase in temperature of value of dielectric permeability changes in slightly.

Drawing conclusions from the received results, we established that application of this experimental technique of oil processing by electrohydraulic effect led to oil clarification from harmful to impurity.

1. Dielectrical liquid penetrability dependences were received and they depends from the temperature and frequencies. The dielectrical environment penetrability is decreasing from the liquid temperature increase and following frequencies.

2. The dielectrical oil penetrability was received from Kumkol deposit for treatment on the electrohydraulic effect.

3. Results of experiments are received that at electrohydraulic processing of oil and oil products any harmful impurity are intensively lost, including is sulfur.

The experimental investigation results «The electrohydraulic impulse and temperature influence at the electrophysical characteristics two-component liquids» are very important for scientific comprehension the physic impulse occurrences in the heterogeneous environments.

Conducting researches of theoretical and practical plan for definition the general and frequency regularities, for liquids of various class we reached a goal, the new way of oil processing was found. In conclusion, electropulse influence on oil processing and oil products processing in the electrohydraulic way gives the chance to get the most economical and available way of cleared oil production. This theme was developed for production more economic equipment of oil processing, development of innovative and technical progress in the country, to use the cleared oil without harmful impurity, sulfur and water. The offered mechanism is a new contribution to areas of equipment and the developed electrohydropulse method is new technology of oil processing easily built in classical process.

## References

- 1 Адамчевкий И. Электрическая проводимость жидких диэлектриков / И. Адамчевкий. — Л.: Энергия, 1972. — С. 7–19.
- 2 Наугольных К.А. Электрические разряды в воде / К.А. Наугольных, Н.А. Рой. — М.: Наука, 1971. — С. 12–15.
- 3 Арсентьев В.В. К теории развития импульсного электрического разряда в жидкой среде / В.В. Арсентьев. — Л.: Энергия, 1964. — 206 с.
- 4 Арсентьев В.В. К теории импульсных категорий в жидкой среде / В.В. Арсентьев // Журнал прикладной механики и технической физики. — 1965. — № 5. — 51–57 с.
- 5 Усиков С.В. Электрометрия жидкостей / С.В. Усиков. — Л.: Химия, 1974. — С. 23–27.
- 6 Нүсіпбеков Б.Р. Электроимпульсті қондырғының басқару пультінің жаңа сұлбасын жобалау / Б.Р. Нүсіпбеков, А.Қ. Хасенов, Н.С. Жакиев, Г. Абдыкова // Вестн. Караганд. ун-та. Сер. Физика. — 2015. — № 2 (78). — С. 56–60.
- 7 Baikenov M.I. Investigation of the influence of electrohydroimpulse technology on physic-chemical characteristics of oil sludges / M.I. Baikenov, A.Zh. Satybaldin, Z.K. Aitpayeva, A.B. Karimova, N.Zh. Rakhimzhanova // Вестн. Караганд. ун-та. Серия Химия. — 2017. — № 3. — С. 131–136.
- 8 Baikenov M.I. Determination of optimal electrophysical parameters of the process of degradation of Zhanaozen oil sludge with the help of electrohydraulic effect / M.I. Baikenov, A.Zh. Satybaldin, Z.K. Aitpayeva, A.B. Karimova / Theoretical and experimental chemistry. Abstr. Of the VI<sup>th</sup> Intern. Scien. Conf. — Karaganda, 2017. — P. 113.

А.К. Муратова, И.А. Кыргызалина, Б.Р. Нусупбеков, А.Ж. Сатыбалдин, З.К. Айтпаева

### Мұнай өнімдерін өңдеудің инновациялық тәсілі

Мақалада электр-гидравликалық тиімділікті басқару мүмкіндігі гетерогендік жұмыс ортасының дәрежесі электр-өткізгіштік ортаның және диэлектрлік сұйықтықты өткізуінің әсері ұсынылып отыр. Диэлектрикер, өзге заттарға карағанда, өте мықты электрлік оң және теріс зарядтардың байланысымен ерекшеленеді. Сұйық ортада диэлектрлік өткізуді анықтау және Құмкөл кен орны мұнайының электрофизикалық сипаттамаларының нәтижелерін салыстыру үшін қондырғы жинап жасалынды. Сұйықтық температурасы көтерілген сайын берілген диэлектрлік өткізгіштік жиілік ортасы азаяды. Сұйықтық температурасы көтерілген сайын мұнайдың диэлектрлік өткізгіштік жиілік ортасы өзгермелі болады. Тольққанды өнім алу үшін мұнай мұнай қышқылдары, шайырлар, күкіртті және қанықпаған қосылыстардан тазаланады. Қос компонентті сұйық ортаның электрофизикалық сипаттамаларына электрогидроимпульстің әсері гетерогенді ортадағы электрогидроимпульстік құбылыс физикасының ғылыми түсініктерін терең зерттеу үшін өте маңызды. Жүргізілген сынақ нәтижелері бойынша авторлармен мұнайды зиянды қоспалардан тазартып алуға ең үнемді, қолжетімді тазартылған мұнайды өндіруге және сатып алуға мүмкіндік беретін, мемлекеттің инновациялық-техникалық прогресін дамыту мүмкіндігін арттыратын жаңа бірсағылы мұнайды электр-гидравликалық тәсілмен өңдеу әдісі ұсынылды.

*Кілт сөздер:* электр-гидравликалық тиімділік, жиілік ортасы, мұнай өңдеу, өңдеу әдісі, гетерогенді орта.

А.К. Муратова, И.А. Кыргызалина, Б.Р. Нусупбеков, А.Ж. Сатыбалдин, З.К. Айтпаева

### Инновационный способ обработки нефтепродуктов

В данной статье предложена возможность управления электрогидравлическим эффектом при изменении степени гетерогенности рабочей среды, влиянием электропроводности среды и диэлектрической проницаемости жидкости. Диэлектрики отличаются от других веществ прочными связями электрических положительных и отрицательных зарядов, входящих в их состав. Измерение диэлектрической проницаемости жидкой среды осуществляется благодаря установке, предназначенной для измерения проводимости жидкой среды и сравнения результатов измерения электрофизических характеристик нефти Кумкольского месторождения. С увеличением температуры жидкости и подаваемой частоты диэлектрическая проницаемость среды уменьшается. С увеличением температуры значение диэлектрической проницаемости нефти меняется незначительно. Для получения полноценного продукта погон нефти подвергается очистке от нефтяных кислот, смол, серы и ненасыщенных соединений. Результаты экспериментальных исследований по влиянию электрогидроимпульсных ударных волн на диэлектрическую проницаемость на двухкомпонентную среду важны для научного понимания физики импульсных явлений в гетерогенных средах. По результатам проведенных испытаний была предложена новая одностадийная методика обработки нефти электрогидравлическим эффектом, которая приводит к очищению нефти от вредных примесей, дает возможность приобретать самый экономный, доступный способ добычи очищенной нефти и развивать инновационно-технический прогресс в стране.

*Ключевые слова:* электрогидравлический эффект, диэлектрическая проницаемость, температура, частота, сероводород, поляризуемость, термодинамический коэффициент, нефтепродукты, гетерогенная среда.

## References

- 1 Adamchevsky, I. (1972). *Elektricheskaya provodimost zhidkikh dielektrikov [The electrical conductivity of liquid dielectrics]*. Leningrad: Enerhiia [in Russian].
- 2 Naugolnykh, K.A., & Roy, N.A. (1971). *Elektricheskie razriady v vode [Electric discharges in water]*. Moscow: Nauka [in Russian].
- 3 Arsentyev, V.V. (1964). *K teorii razvitiia impulsnoho elektricheskoho razriada v zhidkoi srede [To the theory of pulse electric discharge channel development in the liquid environment]*. Leningrad: Enerhiia [in Russian].
- 4 Arsentyev, V.V. (1965). K teorii impulsnykh katehorii v zhidkoi srede [To the theory of pulse categories in the liquid environment]. *Zhurnal prikladnoi mekhaniki i tekhnicheskoi fiziki — Applied mechanics and technical physics magazine*, 5, 51–57 [in Russian].
- 5 Usikov, S.V. (1974). *Elektrometriia zhidkosti [Electrometrics of liquids]*. Leningrad: Khimiia [in Russian].
- 6 Nussupbekov, B.R., Khasenov, A.K., Zhakiev, N.S., & Abdykova, G. (2015). Elektroimpulsti kondyryhynyn baskaru pultinin zhana sylbasyn zhubalau [Designing a new scheme controller electro-installation]. *Vestnik Karahandinskoho universiteta. Seriya Fizika. — Bulletin of the Karaganda University. Physics series*, 2 (78), 56–60 [in Kazakh].
- 7 Baikenov, M.I., Satybaldin, A.Zh., Aitpayeva, Z.K., Karimova, A.B., & Rakhimzhanova, N.Zh. (2017). Investigation of the influence of electrohydroimpulse technology on physico-chemical characteristics of oil sludges. *Vestnik Karahandinskoho universiteta. Seriya Khimiya — Bulletin of the Karaganda University. Chemistry series*, 3, 131–136.
- 8 Baikenov, M.I., Satybaldin, A.Zh., Aitpayeva, Z.K., & Karimova, A.B. (2017). Determination of optimal electrophysical parameters of the process of degradation of Zhanaozen oil sludge with the help of electrohydraulic effect. Theoretical and experimental chemistry: VI<sup>th</sup> International Scientific Conference. (p. 113). Karaganda.