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Wave Treatment of Oil Emulsions of Prykarpattya in Order to Decrease Oil Losses

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Abstract

The object of research of this work is to improve the technology of oil decrease losses during oil collection, preparation and transporting in the Prykarpattya regione (west Ukraine) deposits at the action of low intensity wave field. The laboratory researches of influence of the wave field of different intensity and frequency on stabilizing of oils of region with the aim of their decrease losses were conducted. Ultrasonic treatment of emulsions was conducted with the use of magnetostrictor radiator with the aim of degassing and deemulsation of oil emulsions of different kind for oil decrease losses. Laboratory researches determined that application of wave treatment on oils deposits of Prykarpattya can be an effective alternative to chemical treatment.

Keywords: technological oil losses, low intensity wave field, Prykarpattya, Ukraine

One of indexes of the effective use of hydrocarbon resources at the oil extraction is size of technological oil losses at collection preparation and transporting from a hole to the commodity park. Ineffective distribution of hydrocarbons between gas and liquid phases during the process of oil collection and transporting, imperfect system of industrial oil separations, absent technology of the industrial oil stabilizing are the basic lacks of this system. Basic losses on deposits take place at collection transporting and industrial preparation of oil. These losses are in raw material reservoirs due to the ineffective separation of oil on trades, losses of oil during preparation on oil processing unit and losses with stable emulsions. These losses are conditioned by physical and chemical properties of oil deposits of Prycarpattian region: the majority of Prykarpattya oil is high-gravity oils but at the same time these oils are characterized by strong concentration of paraffin 6%–8%. As a result the solidification temperature of oils is 10°C–20°C. It stipulates existent problems during separation, transporting and preparation of oils. For preparation of such high-paraffinaceous oils to the commodity indexes on oil processing unit deposits these oils forcedly heat to higher temperatures of melting of paraffin 55°C–65°C for their effective dehydration and desalting, but wide light hydrocarbon fraction (WLHF) of oil is lost (C3 — C5) so as a boiling point of oils with WLHF is 30°C–40°C. WLHF is valuable hydrocarbon raw material that is used for the production of motor oils and for petrochemical enterprises.

The deepest analysis of the reasons of light hydrocarbons losses for today is given in Tronov's and Persiyantsev's work. Tronov (2002) in his work makes examples of researches and analysis of oil losses on the deposits of Tatarstan and USA. So the light fraction oil losses in the USA counted 35 millions dollars per year and light hydrocarbons losses in the one of the biggest deposits of that time — Romashkinske in 70th made 2,65–3,1% mass parts. Tronov points that in the USA 1% of light fraction oil losses results in oil density decreasing on a 0,40 unit, and at oil density decreasing on a 10 unit the cost of oil changes on the average to 25 cents according to the data of institute of API (USA). It is necessary to take into account that the calculation of oil and its sale abroad is carried out in volumetric units and in the most CIS countries in mass (tones).

Persiyantsev (1999) pays great attention to the problem of hydrocarbons losses in world practice and analyses the hydrocarbons losses in the "Orenburgnaftogas" deposits. It is resulted that the

light fraction oil and gas losses in the former USSR in 80th of XX century were about 50 millions tone per year. It was equivalently to the annual extraction in one of oil-extracting regions. Also 1% of light fraction oil losses result in changing of octane number of petrol unit. Hydrocarbons losses also take place after oil refinery. 60% of these losses are from reservoirs.

Bykov (1988) also deserves attention where he writes about the industrial hydrocarbons losses, methods of its determination, and technologies of losses decrease. Researches on determination of hydrocarbons losses of more early time are available in other works.

Not all technologies of oil decrease losses can be effective in the Prykarpattya field productions conditions because the oil extraction in Prykarpattya stably goes down. The power descriptions of deposits change. Therefore the technology of industrial oil collection and oil preparation that uses fundamentally other process which effectively influences as on the processes of oil stabilizing so on its deemulsation is necessary. Taking into account that oil losses are also an ecological problem, negatively influence on the environment, result in its destruction and negatively influence on man health the actuality of oil decrease losses problem is not subject to the doubt. As a result research, application and introduction of new methods and technologies of oil decrease losses (WLHF) is an actual task for oil industry of Prykarpattya. The importance of these problems requires new technological decisions that will give an opportunity to decrease oil losses on a way from an extractive mining hole to oil refinery. Modern technological processes and technical equipments for oil decrease losses during collection, transporting and preparation of well products are aimed at perfection practically of all constituents of the iterative system of extraction and industrial preparation of oil, gas and water.

One of the effective ways to operate on oils of Prykarpattya deposits can be technology of the oil-gas-watered emulsions and oils wave treatment with the aim of oil decrease losses during oil collection, transporting and preparation. The object of research of this work is to improve the technology of oil decrease losses during oil collection, preparation and transporting on the Prykarpattya deposits at the action of low intensity wave field. Applications of the wave field in the system of preparation, collection and transporting of oils on Prykarpattya deposits with the aim of oil decrease losses are not enough explored. Practically all data on research of efficiency of stabilizing of high-paraffinaceous oils at the action of low intensity wave field is absent as in literary sources so in laboratory researches. Researches on separations and deemulsation of high-paraffinaceous oils at the action of low intensity wave field intensity conducted in small quantities. Dependences of parameters of the wave field (frequency, intensity, sound energy density, time of action) on efficiency of realization of technological operations are also absent. The question of oils degassing, stabilizing and deemulsation at presence of water in oil emulsions at the action of low intensity wave field is not enough explored.

In majority of technological processes the wave field is set by the acoustic vibrations of ultrasonic frequency — ultrasound. It is possible to take to the features and differences of the wave field of ultrasonic range: short length of waves that allows to focus oscillation and to form the directed radiation, these vibrations can spread in any material environments (in transparent and opaque environments, explorers and dielectrics); power of ultrasonic vibrations is proportional to the square of frequency it can reach to hundreds of kilowatts, and intensity of 1–1000 W/cm^2.

The efficiency of ultrasonic operating on different technological processes was confirmed by numerous researches. Application of ultrasonic vibrations provides the frequent acceleration of processes that pass between heterogeneous environments (dissolution, cleaning, depriving of fat, degassing, painting, growing, impregnation, emulsification, demulsication, crystallization, polymerization, prevention of incrustating, homogenization, erosion, chemical and electrochemical reactions shallow). The use of ultrasonic vibrations allows to carry out technological processes that are not realized or are difficult to realize by traditional methods. Ultrasound action on liquids generates plenty of effects of secondary order, that, in turn, also provide intensification of technological processes. These circumstances led to an ultrasonic action that has the most wide distribution during realization of the technological processes related to the liquid state of environment and reagents. It is very topical for oil-extracting industry (Khmelev et al. 2010).

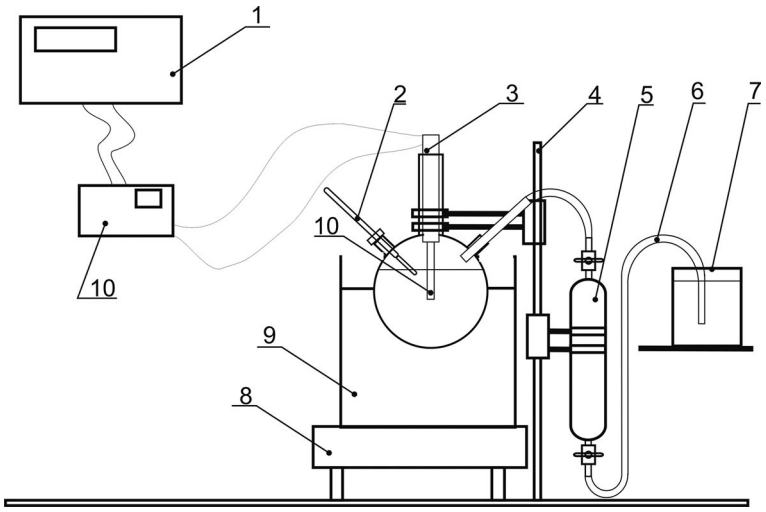

Fig. 1. Fundamental scheme of the laboratory-scale plant

The laboratory researches of influence of the wave field of different intensity and frequency on stabilizing of oils of Prykarpattya with the aim of their decrease losses are conducted. A fundamental scheme of laboratory-scale plant is pointed on figure 1. The equipment of this plant foresees possibility of acoustic treatment of petroleum emulsions of different component composition in the wide range of frequencies. Ultrasonic treatment of emulsions was conducted with the use of magnetostrictor radiator with the aim of degassing and deemulsation of oil emulsions of different kind for oil decrease losses. The result of acoustic treatments of emulsion depends on influence of many factors (time of treatment, intensity of treatment, parameters of the acoustic field and etc.). The laboratory-scale plant that is pointed on figure 1 allows to process emulsions at different descriptions of the acoustic field. It is possible to regulate the temperature of emulsion and change its range from 20°C to 70°C with the help of this plant. The laboratory-scale plant consists of generator of acoustic vibrations (*1*) that works in the range of frequencies from 3 Hz to 3 MHz, acoustoelectronic amplifier (*11*), magnetostrictor radiator (*3*), working retort (*10*) and ancillaries thermometer (*2*), stand (*4*), gasometer (*5*), pipe hose (*6*), capacity with the salted solution (*7*), electric stove (*8*), capacity with water "water bath" (*9*).

As an example it is possible to point research for oil stabilizing of Starosambirske deposit. Efficiency of oil stabilizing was determined by a chromatographic method (tab. 1). Oil emulsion (40% water) was processed by the wave field with set managed intensity and frequency. In Table 1 cited data of chromatographic analysis of Starosambirske deposit before and after wave field treatment as compared to thermal treatment. WLHF can be excluded from gas by zeolites of different types after wave field treatment of oil emulsion. Laboratory researches determined that application of wave treatment of corresponding intensity and frequency on oils deposits of Prykarpattya allows:

- to stabilize oil by excluding of WLHF,
- to intensify the process of oil emulsions destruction,
- to decrease the expense of emulsifier,
- to decrease the prime prices of oil preparation,
- to improve ecological situation in the way of oil decrease losses.

Tab. 1. Component composition of oils before and after oil watered treatments, mass part

Starosambirske Deposit	**CH_4**	**C_2H_6**	**C_3H_8**	**i-C_4H_{10}**	**n-C_4H_{10}**	**i-C_5H_{12}**	**n-C_5H_{12}**	**C_6H_{14}**	**C_7H_{16}**	**ΣC1-C7**
Before treatment	–	0,260	0,796	0,462	1,365	1,091	1,106	1,607	1,695	8,382
Thermal treatment, heating	–	0,114	0,304	0,228	0,799	0,771	0,841	1,158	1,208	5,443
Wave treatment	–	–	–	–	0,346	0,455	0,566	0,954	0,895	3,216

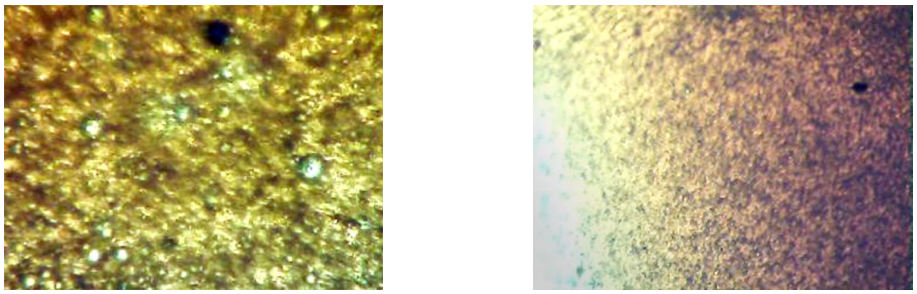

Fig. 2. Oil watered emulsion of Starosambirsk deposit before (left) and after (right) wave field treatments

Wave treatment of the oil watered systems can be an effective alternative to chemical treatment. On the figure 2 oil watered emulsion of Starosambirske deposit is pointed before and after wave field treatments. Modern development of technique and technologies of wave influence on liquids requires a deep study with the aim of further introduction in industry.

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