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THE ULTRASONIC SOUND IN ADSORPTIVE PROCESSES

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This article deals with the implementation of the ultrasonic sound which is essential for the improvement of the quality of oil refining adsorption processes. The ultrasonic sound is used particularly for the process effectivization, it means, for the intensification of the speed in adsorption processes as well as duration reduction.

It was stated that acoustic vibrations effect on the processes of mass exchange greatly. For example, in most research papers [1, 2] it is shown that heterogeneous processes that exist in the diffused area, in the acoustic area are much more intensive than if these processes are mixed with the help of the blender [3].

Mass exchange processes (crystallization, extraction, absorption, adsorption, distillation, drying) which play the great role in the chemical industry, are characterized by long duration. The speeding of these processes, in particular their ultra super sonic intensification, has a very important meaning for the oil refining industry.

Still, not much is known about the impact of the acoustic vibrations on the adsorption process, which is, on all counts, is very important.

Adsorption is the division process, which is based on the elective absorption of gases, vapors or of the substances dissolved in liquids. This adsorption is carried out by the solid porous absorption vessel which is capable to adsorb one or few substances or mixtures [4].

There exist lots of experiments where the process of ultrasonic adsorption has been carried out on different laboratory facilities. But one must know that the greater part of these experiments is empiric, that means, the experiments analyze mostly the mechanisms of ultrasonic adsorption and the main problems that can emerge during these processes.

For example, in the research work made by O. Rochmanov [5], it is shown that the implementation of ultrasonic sound during the adsorption process allows improving greatly the quality of purification paraffin hydrocarbon, in comparison with non-ultrasonic sound actions.

As the sorbing agent one uses increasingly the sorbents of natural origin (such as clay materials, zeolite, sand), as they are not so expensive and are generally available [6].

It is well known that depending on its mineralogical and chemical structure, clay adsorbents have different size and void content; that is why their stuffing needs the right selection of the ultrasonic vibration rational frequency.

Achromatize ability of the clay adsorbents depends on the conditions of their contacting with the paraffin hydrocarbon. In this respect the vibration frequency of ultrasonic sound during the process of paraffin hydrocarbon's purification has not the least role. Thus, O. Rochmanov analyzed the influence of the ultrasonic sound vibrational frequency on the degree of conformity at 80–85 °C. Herewith the length of the experiments was about 60 minutes and the number of the added clay adsorbents was equal to 4% of the paraffin hydrocarbon's bulk.

The results of this research have made it possible to state that the ultrasonic sound implementation helps to improve and advance the efficiency of the processes of paraffin hydrocarbon purification.

It is a well known fact that the implementation of the ultrasonic vibration leads to the development of the cavitation process. That means to the formation of microscopical explosions (cavities) in the liquid (paraffin hydrocarbon), these explosions are closed during the compression phase, thus leading to the local impulsive pressure which comprises hundreds and thousands of atmospheres. These short large hydraulic impacts drive to the demolition of the solid surface, their dispergating, etc.

Melted paraffin hydrocarbons, used in chemical industry, are purified with the help of galvanic method on the basis of polar and non-polar adsorbents. These adsorbents, as it has been stated above, have different size and void content and are filled more intensively in the presence of ultrasonic sound cavitation, in comparison to the common phase mixture [7].

The ultrasonic sound implementation helps to improve the quality of real-time existing paraffin hydrocarbons and to increase the speed of their filtration. It can be added that the implementation of ultrasonic effect while adsorption purification process improves the purification quality as well [8].

The mechanisms of the ultrasonic sound vibration on the implied adsorbents can be explained with the help of the penetration effect, it means, the sorption of the fluctuating bubbles (sorbates) into holes and splits of solid particles. "The Sound Wind" causes intensive mixture of adsorbents thus leading to the increase of the sorbate activity [9].

The experiments carried out by A. Chmutov and I. Alekseev show that the speed of fat acids adsorption in the finely porous coal improves greatly if the ultrasonic range is frequented by 2 MHz [10].

To sum up, we would like to say that it is evident that the thorough investigation of the theories of elastic vibration actions during the adsorption process gives many opportunities for their further intensification in the chemical industry.

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