

P-38: Use of ultrasonic cavitation for purification of alcohols productions waste – waters in the atmosphere of different gases

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Alcohol industries wastes are characterized by high content of both organic and biological contaminants. Waste water cleaning using cavitation is an actual problem.

Waste water from hardware department of Strutinsky distillery was the object of investigation. The singularity of ultrasonic chemical reactions is in their usual running in saturated with different gases water. Purification of water held in an atmosphere of helium, argon, carbon dioxide and oxygen with and without ultrasound at $T = 298\text{K}$, $P = 1 \times 10^5\text{Pa}$, $\nu = 22\text{ kHz}$. Our preliminary investigations showed that these gases have an influence on the destruction of microorganisms in the ultrasonic waves. But for various gases, this effect varies. To a large extent the speed of microbial death and decomposition of organic compounds depends on the nature of the gas, which saturate investigated water.

In an atmosphere of Ar, He and CO_2 microbial number decrease during the first 30 min. of sonication, and O_2 flushing during ultrasonic treatment recorded growth of microbial number during the first 30 minutes. Further joint action of O_2 and US leads to decrease of microbial number and finally the efficiency of flushing O_2 is much higher than CO_2 . The most disinfecting effect was achieved with flushing through the treated water argon. The coaction of US/Ar was achieved 2.5 times higher efficiency than the coaction of US/He. Processing of helium in acoustic cavitation leads to 2.3 times decrease of microbial number. O_2 and CO_2 are the last in this line of ultrasound destructive exposure.

Ultrasound effect on organic pollution measured by changes in Chemical Oxygen Demand (COD) values during the process. As a result of ultrasonic oxidation, investigated water is purified from bacterial contamination, leading to decrease the number of cells capable to form organic matter during their lifetime. Argon flushing through sonicated water 1.43 times decrease organic impurities, and argon flushing without sonication - 1.35 times compared with the initial value.

Flushing gas destruct microorganisms and organic materials from them get into solution. Using gases containing oxygen, CO_2 and O_2 , COD is growing in one hour flushing, with increase the number of damaged cells. In addition, the presence of aerobic bacteria with their life processes intensifies the formation of organic substances. The following COD value decreases with increasing time of the experiment.

The joint usage of US and gas leads to decrease the COD value. Usage of only gas shows less efficiency. Thus, using inert gases Helium and Argon during US treatment shows the highest harmful effect. The usage of containing oxygen gases shows less purification efficiency. The effectiveness of treatment using O_2 is 1.8 times less than with He, and the CO_2 - 1.5 times less compared to He. It should be noted that the strengthening effect of Helium on the processes of oxidation occurring in ultrasonic waves depends on the structure and characteristics of substances that react.

Oxidation of alcohol wastes in He and Ar aqueous solutions probably realize owing to the appearance of $\text{OH}\cdot$ radicals - products of decomposition of water molecules. In case of oxygen in the oxidation reactions are involved not only the $\text{OH}\cdot$ radicals, but also molecules of oxygen and OH_2 . In this case part of the oxygen molecules consumed in the formation of compounds that are subsequently difficult to decompose. Thus, it keeps the COD value in the higher limits than the US water treatment in an atmosphere of inert gases.

Investigation of ultrasonic treatment of alcohol production wastes shows that ultrasound intensifies the water treatment process, flushing of gas through sonicated solution enhances a deeper oxidation of organic matter, because gas bubbles play the role of additional cavitation nuclei, which increase the mechanical destruction of cells and tissues of organisms, intensify the formation of radicals, increase the level of disinfection and reduce the organic impurities content in wastewater.