OC-35: Ultrasonic Exposure on the Various Cells Type

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Modern and perspective physical method of water disinfection is ultrasound (US) action, which demonstrates a high efficiency of microorganisms destruction in a liquid (Drakopoulou et al., 2009; Stamper et al., 2008). Recent researchers have shown that US influence is an effective reagentless and highly ecological method of water treatment not only of microbiological components, but also organic ones. In our previous investigation the microorganisms inactivation effectiveness was explained by the cells membrane destruction during US exposure at frequency of 22kHz and power of 35W (Koval et al., 2011). But now we are interested in the next: does the effectiveness of cells destruction depend on their size? Exactly this subject was included into an aim of the given work.

The certain types of pure microorganisms cultures (*Diplococcus, Sarcina lutea, Bacillus cereus, Pseudomonas fluorescens* bacteria and yeast of *Saccharomyces cerevisiae*) were used for investigations. They are different in morphological, physiological and cultural features that are important for analyzing and evaluating of cells destruction under ultrasonic conditions. Gas bubbling (oxygen, argon, helium and carbon dioxide) during sonication also took place simultaneously in the same vessel. Studies the gas effect of different nature in the US field and studies behavior of a particular gas in the cavitation field could help to determine the most effective purification conditions of infected water.

Our results show that microorganisms destruction depends on the cells size. It was established that larger cells are easily destroyed under sonication conditions. Resistance of microoganisms type could be explained on the base of specific US effects on the various cells wall and their intergeneric difference in a cells wall structure. Dependences of effective rate constant of microorganisms destruction (k_d) of their sizes demonstrate increasing inactivation with increasing cell size. But k_d values in the argon atmosphere approximately in 1.5-2 times higher than k_d values calculated in the presence of oxygen, helium and carbon dioxide. It should be noted that the highest efficiency of cells inactivation during argon bubbling has been determined regardless of microorganisms type. Microorganisms inactivation processes correspond to the kinetic regularities are described by a reaction equation of the first order.

Hence, it was determined that effective rate constant of microorganisms destruction depends on the gas bubbling nature and the cells size. The highest efficiency of microorganisms destruction was achieved under the simultaneous Ar and US action that can be explained on the base of gas properties that can affect sonochemical activities. Dependences of k_d values of cells size could be successfully used not only for qualitative detection of general disinfection effectiveness but also for estimation of ultrasonic water treatment at the bubbling of investigated gas considering the cells size.

References

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