HYDROXYL RADICAL (OH*) and HYDROGEN PEROXIDE (H_2O_2) METABOLITES FORMATION in WATER PROCESSED by CAVITATION: FOUR-PHOTON SPECTROSCOPY of THz RANGE

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Various treatments of water samples passed through distillation and cavitation procedures were studied by using Rayleigh wing four-photon spectroscopy in THz and subTHz range. The purified water was processed by ultrasonic fountain evaporation or by cavitation procedure accordingly to the US patent 6,521,248 (Penta). Earlier it has been shown that the morphological structure of white hen's protein lysozyme crystals grown in aqueous solutions prepared in distilled and cavitation treated waters differs significantly [1]. Then the dissolution of calcium oxalate monohydrate crystals was studied in distilled and cavitation water also. The dissolution rate was found to be 3 times higher in the cavitation water than in distilled water [2]. These data show that the cavitation treatment of water results in change of water specific properties not known before and can affect living organisms when used.

Four-photon spectroscopy has been used to study water properties. Low-frequency gas-like rotational resonances were observed in both water types. It was detected that the four-photon spectra of water passed through the cavitation process is enriched by resonance lines of OH* ((1.23 cm-1, X3/2) and H2O2 (1.47 cm^{-1}, 827-917; 2.75 cm^{-1}, 707-717; 3.88 cm^{-1}, 13013-13113). Unlike distilled water, it was established that the intensity of these lines increases by factor of ~ 2.2 after cavitation treatment of water. Additionally the intensity of the ortho-isomer H2O line (616-523) 0.74 cm-1 increases by factor of 2.4 after cavitation treatment of distilled water. It allows us to make the conclusion that relative concentration of OH* and H2O2 metabolites in cavitation processed waters is significantly increased compared to untreated waters. The chemical and physical processes following the cavitation process of water are rather poorly understood, however. Nevertheless we have suggested that the enrichment of the cavitation water by free rotation OH* and H2O2 and H2O molecules was achieved due to cavitation bubble collapse when the water passes through the supercritical state (high temperature and pressure). Thus the detection of the sharp lines of OH* and H2O2 molecules by four-photon spectroscopy show us that the cavitation treatment water is enriched by the new metabolites. Concentration of these additives is high enough to affect hydrogen bond network which results in change of the protein crystal structure and increase the calcium oxalate dissolution rate. Since OH* and particular H_2O_2 as the reactive oxygen species (ROS) are quite reactive metabolites it also raises safety concern when used for humans [3]. It was shown that the ultrasound at low diagnostic power caused a significant increase in intracellular H_2O_2 in presence of cavitation microbubbles [3].

НАРАБОТКА МЕТАБОЛИТОВ- РАДИКАЛОВ ГИДРОКСИЛА (OH*) И ПЕРЕКИСИ ВОДОРОДА (H_2O_2)- В ВОДЕ ПРИ КАВИТАЦИИ: ЧЕТЫРЕХФОТОННАЯ СПЕКТРОСКОПИЯ В ТГЦ ДИАПАЗОНЕ

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Обработка воды в кавитационном процессе посредством ультразвука или в специальной камере (Патент США 6,521,248) приводит к генерации метаболитов (активных форм кислорода) H_2O_2 и OH*.

References

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