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**Peroxynitric acid (HOONO<sub>2</sub>) is the key chemical species of plasma-treated water for effective and safety disinfection<sup>1</sup>**

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For the plasma disinfection of human body, sterilization in liquid is crucial. We found that the plasma-treated water (PTW) has strong bactericidal activity under low pH. Physicochemical properties of PTW is discussed based on chemical kinetics. Lower temperature brings longer half-life, and the bactericidal activity can be kept by cryopreservation. High performance PTW, corresponding to the disinfection power of 22 log reduction (*B. subtilis* spore), can be obtained by special plasma system with cooling. This is equivalent to 65% H<sub>2</sub>O<sub>2</sub> and 14 % NaClO, which are deadly poison. But, it is deactivated soon at higher temperature (4 sec. at body temp.), and toxicity seems low. Many researchers are interested in this area of PTW, where the waters are treated by their original devices. For scientific approach, we should discuss based on chemical species. Although PTW contains many chemical components, respective chemical components were separated by ion chromatography (IC). To examine the bactericidal activities of respective components, bactericidal assays were done with respective fractions of eluate. In addition to peaks of H<sub>2</sub>O<sub>2</sub>, NO<sub>2</sub><sup>-</sup> and NO<sub>3</sub><sup>-</sup>, a specific peak was detected and only this fraction had bactericidal activity. This means that active ingredient was successfully purified. Moreover, molecular nitrogen was required both in the ambient gas and in the distilled water used to prepare the PTW. We, therefore, propose that the reactive molecule in PTW with bactericidal effects is not a free reactive oxygen species but nitrogen atom-containing molecules that release O<sub>2</sub><sup>-</sup>•, such as HOONO (peroxynitrous acid) or HOONO<sub>2</sub> (PNA: peroxynitric acid). Considering the activation energy for degradation, we assumed that PNA is active ingredient. From IC analysis of chemical synthesized PNA, a same specific peak was seen. So we conclude that PNA is a key chemical species of cryo-preserved PTW with the reduced-pH method, while there is no report about sterilization by PNA.

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