

Effect of manufacturing processes on the properties of Structured Water

GunWoong Bahng¹*, Suh Hyung Park¹, Young Tae Kim², Seong Gu Hwang³, Junyeon Hwang⁴

Abstract

Structured water has been prepared by two methods. First, distilled water was mixed with hydrophilic powder, 0.1 % and 1.0 % each, and then it was shaken for 5 minutes and centrifuged for 30 minutes at 3500 rpm (Water 1). The other one has been prepared by the treatment only with self developed vortex technology (Water 2). Both water showed decreased absorption (increased transmittance) for the broad range of $2.86 \mu\text{m} \sim 3.33 \mu\text{m}$ while the Raman spectrum of Water 1 showed decreased intensity of the main scattering peaks. The absorption peak around $3 \mu\text{m}$ coincides with the O-H stretching vibration and the Raman scattering peak of water is also known from the O-H vibration. These results imply that the O-H bond becomes stable and the crystallinity of water has been increased due to the change in water structure. Additionally, Water 1 showed very strong absorption peak for the wide broad range from 220 nm to 280 nm while that of the Water 2 showed very weak absorption peak near 220 nm. There was no change in Raman spectroscopy of Water 2. These results indicate that the structure of Water 1 is well developed compare to Water 2. This has been confirmed again from the observation of cryogenic SEM observation. However, both water showed decreased oxidation reduction potential (ORP), in other words, increased reduction capability. Cell culture experiment using culture media prepared with both water showed similar effect on cell proliferation rate. Increased proliferation rate of RAW 264.7 macrophage cell was observed for both waters and it reached to two fold after 72 hours. On the other hand, it showed suppression of cancer cell, MCF-7 to the level of 60 % range. Even though other properties including optical properties and electrical properties of the Water 1 showed strong signals compare to Water 2, they showed similar biological effects, i.e., two fold increase of the RAW 264.7 cell proliferation rate. In conclusion, it has been found that biological property is very sensitive even to the slight change of water structure. Since Water 2 has been produced by physical process only without adding anything, it is safe to drink. Considering the fact that it has better anti-oxidant potential after vortex treatment, it was expected to be helpful in reducing the free radical in a body by drinking. Actually, it was found that it was effective to reduce free radical by drinking Water 2 in a couple of weeks.

*corresponding author, <gwbahng@sunykorea.ac.kr>

1) Dept. of Mechanical Eng., The State University of New York, Korea, Korea

2) R&D Center, KP Energy Co. Ltd., Korea

3) Dept. of Animal Life and Environmental Sci., Hankyong National University, Korea,

4) Carbon Composite Materials Research Center, KIST Jeonbuk, Korea