

Rethinking Natural Water

Eshel Ben-Jacob
Tel Aviv University
e-mail: eshelbj@gmail.com

Nanoparticles are detected in almost all natural water sources including oceans water, atmospheric water, well water, spring water, and treated drinking water. During last decade we have witnessed a rapid increase in research efforts devoted to the identification and characterization of nanoparticles immersed in natural water. Consequently, it is now realized that aqueous nanoparticles can affect the physical and chemical characterization and behavior of water. Most of the research efforts have been directed towards identification of metallic (and metal rich) nanoparticles and the assessment of their possible toxic effects. I will report our detailed investigation of several types of natural water solutions. We found that natural waters, including spring mineral water and tap water from springs and wells, regularly contain (or doped with) naturally-occurring nanoparticles. More specifically, dynamic laser scattering (DLS) measurements reveal that the natural waters contain low, yet significant density of nanoparticles – about 10^{11} - 10^{12} particles/ml. These observations are also supported by Cryo-SEM observations using rapid freezing. High Resolution TEM measurements unveiled the existence of special naturally-occurring globular (NOG) nanoparticle in the natural water. These particles have spherical shapes with typical size of 10-50nm (although larger particles of the order of 100-200nm are also observed). The main chemical content of the nanoparticles is calcium carbonate (CaCO_3) with some additional trace chemicals. The measurements also indicate that the NOG nanoparticles are homogeneously spread in the natural water solutions with about 0.5 μm -1.5 μm mean distances between particles (the exact density can depend on the water source). I will present detailed studies of the existence of the nanoparticles on physical chemical and biological properties and reflect on the hypothesis that these effects are mediated via the formation of a network of nanoparticles and nanobubbles and a consequent emergence of water order.