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Cavitation Increases the Ratio of Ortho/Para-H_2O Isomers in Water and Reduces Its Viscosity

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Abstract

For the first time, we found that cavitation treatment of water increases the number of ortho-H_2O isomers by 12% - 15%, which was confirmed in experiments on a tomograph. From this, it was suggested that the O/P ratio is a key factor in reducing the viscosity of water. The most significant decrease in the viscosity of an aqueous suspension of hemoglobin molecules with an increase in its concentration was measured earlier in the vicinity of a temperature of 37˚C. The mechanism of the observed phenomena is discussed.

Keywords

Water, Ortho/Para Ratio (O/P), Water, Cavitation

1. Introduction

It is known [1] that the collapse of cavitation bubbles in water and aqueous solutions is accompanied by high-energy processes: dissociation and ionization of molecules (H_2, N_2, H_2O), as well as luminescence in a wide spectral range (up to 200 nm). Extreme conditions during this collapse: high temperatures (tens of thousands of degrees) and pressure (hundreds of atmospheres) ensure the synthesis of new molecules-nitrogen oxides ($HNO_{2(3)}$), hydrogen peroxide H_2O_2, etc. in a nanometer collapsing bubble reactor. The effect of these processes on the ortho/para (O/P) ratio of H_2O spin isomers remained unclear, which is the subject of this communication.

2. Experiment with Cavitation

Cavitation treatment [2] of distilled water (~0.5 ppm impurities) was carried out

by the collision of counter jets. After heating the water to 60˚C due to cavitation during multiple cycles of collisions, the water was cooled to 4˚C and stored in a container without an air bubble. The O/P ratio of spin isomers H_2O was studied by low-frequency polarization spectroscopy of rotational transitions of spin isomers during four-wave mixing (CARS technique) [3] of two colliding laser beams in a cell with water. A direct experiment on the change in the concentration of ortho-H_2O spin isomers molecules relative to distilled water was carried out on a tomgraph (MRT technology), which highlights the signal of ortho-H_2O spin isomers [4] by the relaxation of the magnetic moment of both protons.

Nonlinear laser spectroscopy has shown [3] that O/P = 1:1 in water at room temperature. This value is significantly less than the equilibrium value (3:1), to which water, as a non-equilibrium liquid, tends under any impact with an energy higher than the spin conversion. Thus, an increase in temperature to 60˚C increases O/P up to 2:1 [3]. Note that at 60˚C, the ice-like structures of the hydration shells of molecules of polyhedric alcohols are destroyed [5], and the viscosity of water also decreases [6] (**Figure 1**).

3. Results and Discussion

For the first time [3], as far as we know, we found that cavitation treatment of water [2] increases the number of ortho-H_2O isomers by 12% - 15%, which was confirmed in experiments on a tomograph [4]. It is essential that the achieved increase in the O/P ratio reduces the viscosity of water so that calcium oxalate kidney stones dissolve in this water [7] (**Figure 2**) by a factor of time: 0 (**Figure 2(a)**), 1 hour (**Figure 2(b)**) and 2 hours (**Figure 2(c)**), respectively.

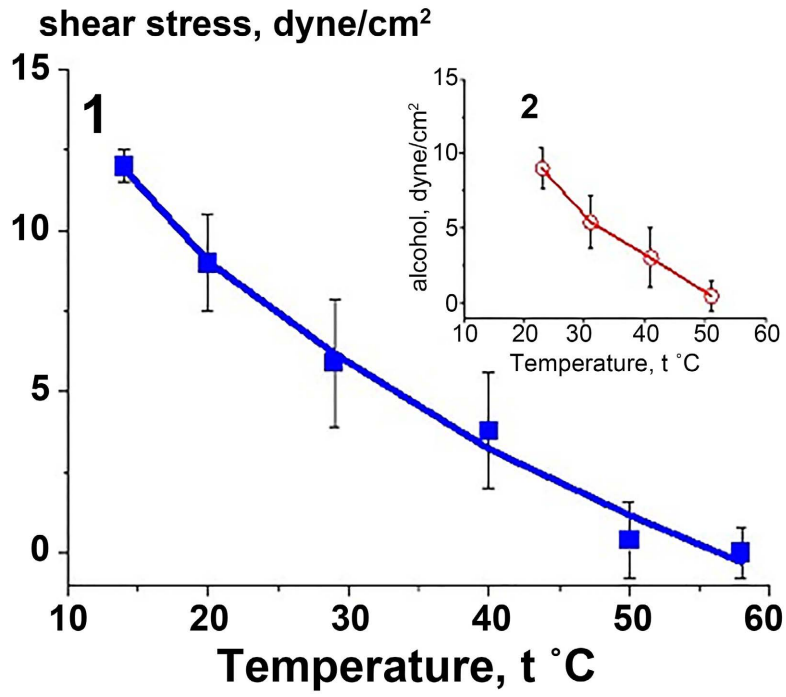
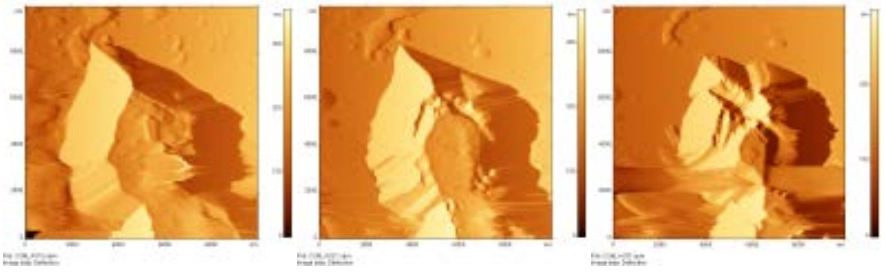
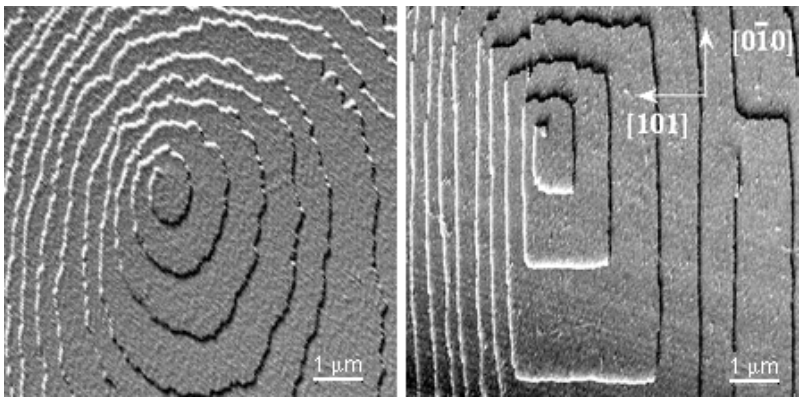


Figure 1. Decreased shear stress of water (1) and alcohol C_2H_5OH (2) vs the temperature.



(a) (b) (c)

Figure 2. Dissolve kidney stone in water increases the number of ortho-H_2O isomers by 12% - 15% [7].



(a) (b)

Figure 3. Lysozyme crystals with different morphology which depends on the water treatment before the application.

Interestingly note that the lysozyme crystal growth [8] depends on the water treatment before the solution preparation. **Figure 3(a)** shows the lysozyme crystals with the different structures and morphology: (a) the crystal grows in water solution with 12% - 15% enrichment by ortho-H_2O spin isomers and (b) in common distilled water.

From this, it was suggested that the O/P ratio is a key factor in reducing the viscosity of water. The most significant decrease in the viscosity of an aqueous suspension of hemoglobin molecules with an increase in its concentration was measured earlier by the group of G. Artmann, in the vicinity of a temperature of 37˚C [9]. The mechanism of the observed phenomena is discussed. Recently [10], in fullerene cells, single water molecules were cooled close to absolute zero and the temperature dependences of the ortho/para ratio (O/P) of H_2O spin isomers were measured. An interesting feature was discovered: in the vicinity of 0˚K, the ortho/para ratio (O/P) does not vanish and remains constant ~0.1.

The work [10] gives an interpretation of the experimental results, and a theory of the observed water anomaly is suggested.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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