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Spin-Selective Interaction of Magnetic Ortho-H$_2$O Isomers
with Yeast Cells

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Abstract—Spin-selective interaction of magnetic ortho–H$_2$O isomers with yeast cells has been experimentally established. In particular, their growth in depleted (dietary) or normal nutrient aqueous solutions, enriched with 10 to 15% with ortho-H$_2$O spin isomers, is accompanied by an increase in the amount of carbon dioxide produced by the cells and an increase in their biomass. The mechanism of this effect is discussed. The processes observed are interpreted in terms of retardation of aging and increase in the cell division and reproduction rates.

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1. INTRODUCTION

Previously we found resonant lines in four-photon spectra of water [1–3] and assigned them to rotational transitions in ortho- and para-spin isomers of H$_2$O molecules. Recently the presence of H$_2$O monomers in water and ice was experimentally confirmed by X-ray scattering spectroscopy [4]. Then we revealed [5] spin-selective interaction of proteins and DNA with para-H$_2$O isomers during formation of hydrate shells in aqueous solutions (Fig. 1). The presence of proteins in solutions manifested itself in a decrease in the intensity of the para-H$_2$O lines (79.8 cm$^{-1}$, circles and squares) with a simultaneous increase in the intensity of the ortho-H$_2$O isomer lines (88.1 cm$^{-1}$, squares). This result indicated bonding of para-H$_2$O molecules in the hydrate shell and their conversion into ortho-H$_2$O isomers near proteins and DNA. In addition, it was found by nonlinear optical and NMR spectroscopies [6] that cavitation treatment of water (for example, cavitation-induced evaporation in an ultrasonic fountain) leads to enrichment in ortho-H$_2$O isomers by 15 to 17% in strong electric-discharge fields during cavitation bubble collapse. The NMR data for two water samples of the same mass are shown in Fig. 2 in the form of resonant lines. The area under the contours of these lines is proportional to the proton density; it is shown as an s-shaped curve, with the corresponding values below. The stable increase in the area under the water-line contours to 17% after the cavitation treatment in successive measurements (see Fig. 2, curves 3, 4) indicates enrichment in ortho-H$_2$O isomers, which form an NMR signal [6] due to their nonzero magnetic moment. It is of importance that the water enriched in ortho-H$_2$O isomers has higher permeability and mobility (as follows from the increased dissolution rate of kidney stones of calcium oxalate type [7]) and makes it possible to grow lisozyme crystals of other morphology from aqueous solutions enriched with ortho-H$_2$O molecules [8, 9].

It is noteworthy that the quantum differences between ortho- and para-H$_2$O isomers manifest themselves in their rotational spectra. For example, the ortho-H$_2$O molecule does not have zero rotational energy level [10]; therefore, this monomer always rotates. The energy of its first rotational level is 23.8 cm$^{-1}$ [10–12]. On the contrary, some of para-H$_2$O spin-isomer molecules do not rotate at room temperature and occupy zero level in correspondence with the Boltzmann distribution of population over energy states. It is physically clear that continuous rotation of ortho-H$_2$O molecules increases the solvency of water enriched with these isomers [7].

These quantum differences indicate also that it is energetically more favorable to form hydrogen-bonded complexes from the unrotating para-H$_2$O isomers. Indeed, it was theoretically and experimentally shown in [13] that the para-H$_2$O dimer has the
Fig. 1. Fragments of the spectra [2, 3] of (■) α-chymotrypsin protein solution (concentration 17 mg ml$^{-1}$) in the range of 73 to 91 cm$^{-1}$ and (○) Milli-Q water, after multiplication by eight. The rotational resonances of the ortho- and para-isomers of water molecule are indicated by thin and bold arrows, respectively.

Fig. 2. NMR spectra [6] of (1, 2) distilled water and (3, 4) cavitated water in proton density units, normalized to curve 1. The thin s-shaped curves are the integrated spectral lines with proton densities (1) 1.00, (2) 0.96, (3) 1.17, and (4) 1.17.

lowest energy state among all its other spin combinations. For the same reason, one can observe spin-selective adhesion of H$_2$O to hydrophilic surfaces, which manifests itself in a shift of the equilibrium ortho/para ratio to enrichment of H$_2$O vapor in ortho-isomers after its transmission through a porous absorbent [10]. The aforementioned hydrate layers of biomolecules [5] are another manifestation of the quantum differences between the ortho- and para-H$_2$O spin isomers. Note that hydrate layers most