Original Article

Biphasic response of biological objects on variation of low deuterium concentration in water.

Valentin I. Lobyshev¹

¹ Faculty of Physics, Lomonosov Moscow State University. Moscow, 119991 Russia. E-mail: lobyshev@yandex.ru

Abstract

Background: Natural water consists of various isotopic forms of water molecules produced by stable isotopes ^{16}O , ^{17}O , ^{18}O , ^1H , ^2H . Relative content of the most representative isotopes ^2H (D) and ^{18}O in natural waters is at average 0.015% (150ppm) and 0.2%. Due to natural phase transitions of water isotopic content may vary in the range of 0.0079 – 0.0195% and 0.1887 – 0.2083%. As the electronic state of isotopes is the same, it is impossible to expect any effect on chemical reactions from classical point of view. Nevertheless, we obtain both kinetic and equilibrium isotopic effects in pure heavy water (D_2O) based on quantum principles. Pure heavy water was recognized as a poison for living organisms since 1933, but several papers demonstrated unexpected activation effects under small additional concentration of deuterium.

Aims: to demonstrate the abnormally large biphasic response of biological objects on small deviations of stable isotope deuterium containing in natural water; to prove biological activity of water with small variations of deuterium content; to find reasonable explanation for activating effect of melting ice water.

Methods: used are optical spectroscopy, microscopy, mass-spectrometry and weighing.

Results: The results show that small increase of natural content of deuterium in water causes great increase of hydrolytic activity of Na, K-ATPase and Ca, Mg-ATPase, but does not influence ATPase of myosin. This amazing effect exists at physiological temperature and is absent at low temperature. The analogous effect is shown for the process of regeneration of marine hydroids *Obelia geniculata*. Original experiment produced on the drifting ice station in Arctic Ocean shows that during summer both small increasing and decreasing of deuterium in melting ice relative to deuterium content in ocean water lead to activation of micro algae growth. The observed phenomena explain the burst of life on the border of melting ice. Deuterium depleted water containing 4ppm of deuterium does not influence enzyme activity of Na, K-ATPase, but the activity decreases in water with 30 ppm of deuterium. Using the model of *Amaránthus albus* seed germination we get also the biphasic response on variation of isotopic content of deuterium. Growth of *Methylobacterium organophilum* increases in water slightly enriched by deuterium.

Conclusion: For the first time we study the effects of deuterium for various alive and model biological systems on a wide scale of deuterium concentration including water depleted of deuterium. All the data have statistical significance better than 0.05. Mechanisms of the observed phenomena are discussed.

Keywords: water, deuterium, single-cell algae, marina hydroids, Na, K-ATPase, Ca, Mg-ATPase, seed germination.

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