Investigation of the effect of the transfer of properties of a homeopathic preparation on saline Deuteron Magnetic Resonance Spectroscopy

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Introduction

Currently, there are many publications devoted to experimental research, practical and clinical application of the phenomenon of transfer of the properties of homeopathic medicines to various carriers [1].

Earlier, we showed the possibility of revealing the effect of an alternating magnetic field on a physiological solution by the method of nuclear magnetic resonance (NMR) spectroscopy (conference 2009, St. Petersburg).

Purpose of work: by the method of high-resolution NMR spectroscopy experimentallyto fix the effect of transferring the properties of a homeopathic preparation to the aquatic environment.

Water molecules H_2O are composed of hydrogen and oxygen atoms. The NMR method can be used to "observe" the aqueous medium on three isotopes: protons (^1H), deuterons (^2H) and oxygen-17 (^{17}O). The easiest way to observe NMR signals on protons, since the natural (natural) content of protons is almost 100%, while for deuterons and oxygen-17, the natural content is 0.0115% and 0.038%, respectively. In addition, the spin of the proton is 1/2, and the spins of the deuterons and oxygen-17 are 1 and 5/2, respectively. Protons have only a magnetic moment, and deuterons and oxygen-17, in addition to magnetic moments, have an electric quadrupole moment. Thus, magnetic fields act on protons in an aqueous medium, while magnetic and electric fields act on deuterons and oxygen-17.

Our attempts to record NMR spectral changes in the parameters of the signal of protons of H_2About depending on the impact on the aquatic environment were unsuccessful. This is apparently caused by the very high sensitivity of the signals of water protons to fluctuations in the spatial homogeneity of the magnetic field of the spectrometer, despite the nuclear stabilization of the magnetic field. The sensitivity of the spectral parameters of the signal of deuterons to fluctuations in the uniformity of the magnetic field of the spectrometer is almost an order of magnitude less than for protons, since the magnetic moment of the deuteron is 6.51 times less than the magnetic moment of the proton.

Similar experiments to measure changes in the spectral parameters of oxygen-17 water depending on the impact on the aquatic environment also proved to be unsuccessful. Apparently, this is due to the fact that the electric quadrupole moment of oxygen-17 is 8.944 times greater than the quadrupole moment of the deuteron, and the spin-spin and spin-lattice rates of the quadrupole relaxation are proportional to the square of the quadrupole moment. Thus, the rate of quadrupole relaxation (the line width at half maximum of the signals in the NMR spectra) for oxygen-17 is 80 times higher than for deuterons. Such a large quadrupole broadening of signals in the magnetic resonance spectra of oxygen-17 molecules of H_2O masks the expected small changes in spectral parameters.

Thus, the most successful method for recording changes in the NMR spectral parameters of H_2O as a result of the effect of the transfer of the properties of homeopathic preparations to the aqueous medium, the method of high-resolution magnetic resonance deuteron spectroscopy (NMR ^2H).

experimental part

To register small changes in the NMR spectral parameters of water deuterons at

the influence of the transfer of the properties of a homeopathic preparation to a physiological solution against the background of stochastic (random) noises, we increased the number of experimental samples of the aquatic environment (up to 66 samples). This made it possible to increase the signal-to-noise ratio by approximately 8 times.

The study of the NMR spectrum was carried out on a standard 0.9% physiological aqueous solution of sodium chloride with the addition of heavy water D2O (7% by volume) to increase the NMR sensitivity to deuterons. The prepared one was poured into individual five-millimeter NMR-calibrated ampoules for NMR studies.

The transfer of the properties of the homeopathic preparation Sulfur in potency D30 was carried out on the device "IMEDIS-BRT-A" in the "Transfer" mode for 2 minutes into an ampoule with an aqueous medium (group BRP).

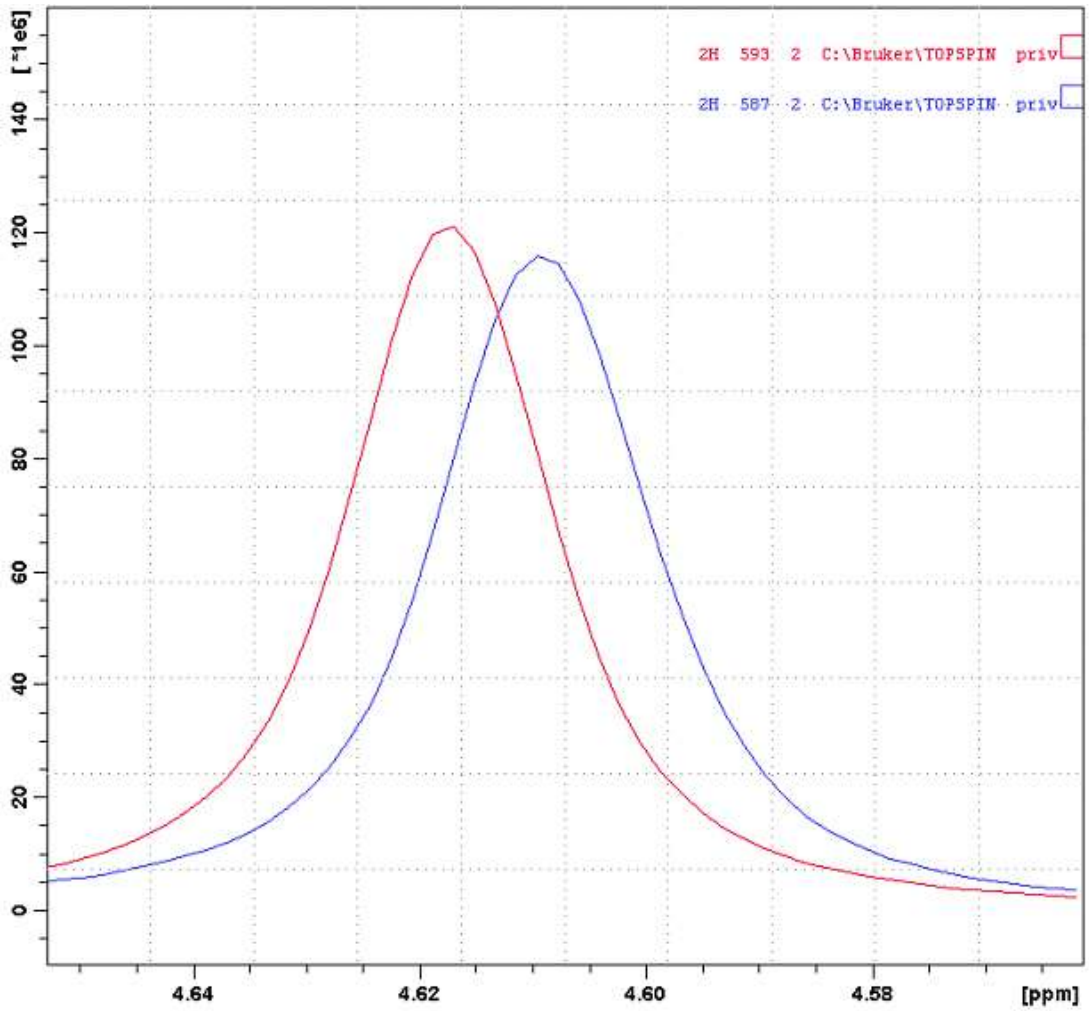
To isolate the specific effect of the homeopathic medicine, the effect on the result of the "idle" of the apparatus, group XX, as well as the effect of "placebo", pure homeopathic grains as a source of transfer of properties, group PL.

For each ampoule in the corresponding groups (K - control, XX - idle, PL -placebo, BRP - homeopathic medicine) NMR spectra were recorded before and aftertransfer of properties.

NMR spectra recording ^2H was performed on a Bruker AVANCE-300 spectrometer according to the standard single-pulse program. The recording time for one spectrum was 1 minute. NMR recording parameters^2H are as follows: resonance frequency - 46.08 MHz (magnetic field strength of the spectrometer H_O = 7.05 T), the duration of the radio pulses of excitation is 4 μs, the repetition period of the pulses is 1 s, the number of accumulations of scans is 32.

Results and its discussion

For each group: K, BRP, XX and PL are derived from series 66 control and experimental spectra. A total of 396 NMR spectra were recorded^2H from 198 samples A series of 66 spectra of each group. In fig. 1 shows two averaged spectra: the right spectrum corresponds to the averaged 66 control spectra and, accordingly, 66 physical samples. solution and the left spectrum corresponds to the same 66 samples of physical. solution influenced by the transfer of properties of the homeopathic remedy for the groupBRP. Both averagedthe spectra were modeled in the form of a Lorentzian line using an iterative procedure within the framework of the spectrometer software. The obtained parameters of the Lorentzian lines (chemical shifts δ in ppm - ppm and in hertz - Hz and line width at half maximum Δ√ in hertz - Hz) for the control spectra and the corresponding spectra in the BRP group are given in table. 1. From the table and fig. 1 it follows that the effect of the transfer of the properties of the homeopathic preparation to the physiological solution in the groupBRP increaseschemical shift of the water deuteron signal by 0.008 ppm (0.38 Hz) and reduces the line width at half maximum ($\Delta\sqrt{} = 1 / \pi T_2$where T_2 Is the spin-spin relaxation time of deuterons of water molecules) by0.042 Hz.



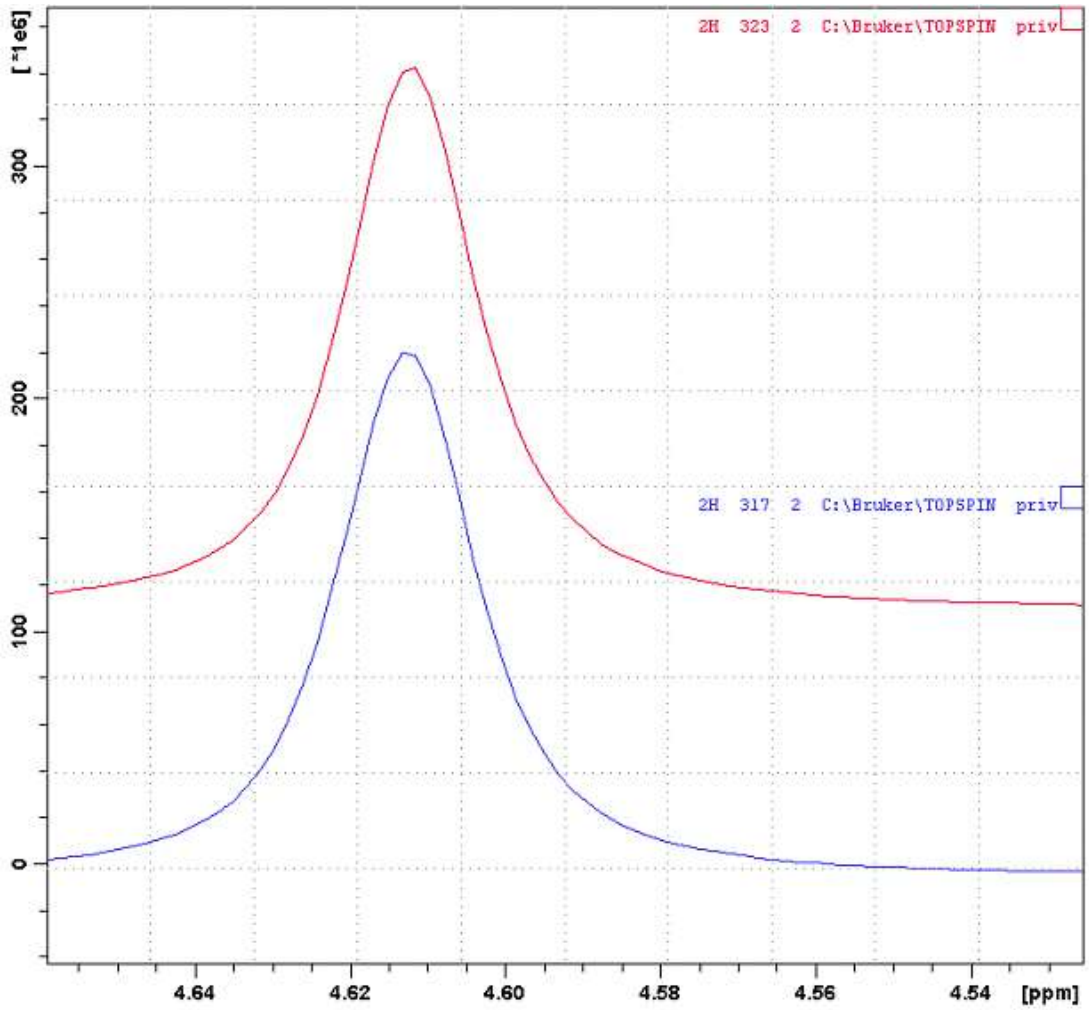
Rice. 1. Averaged over66 samples NMR spectra ^2H (46.08 MHz) saline with the addition of heavy water (7% by volume D_2O): 1) control samples K (spectrum on the right) and 2) experimental samples in groups BRP (spectrum on the left).

Table 1

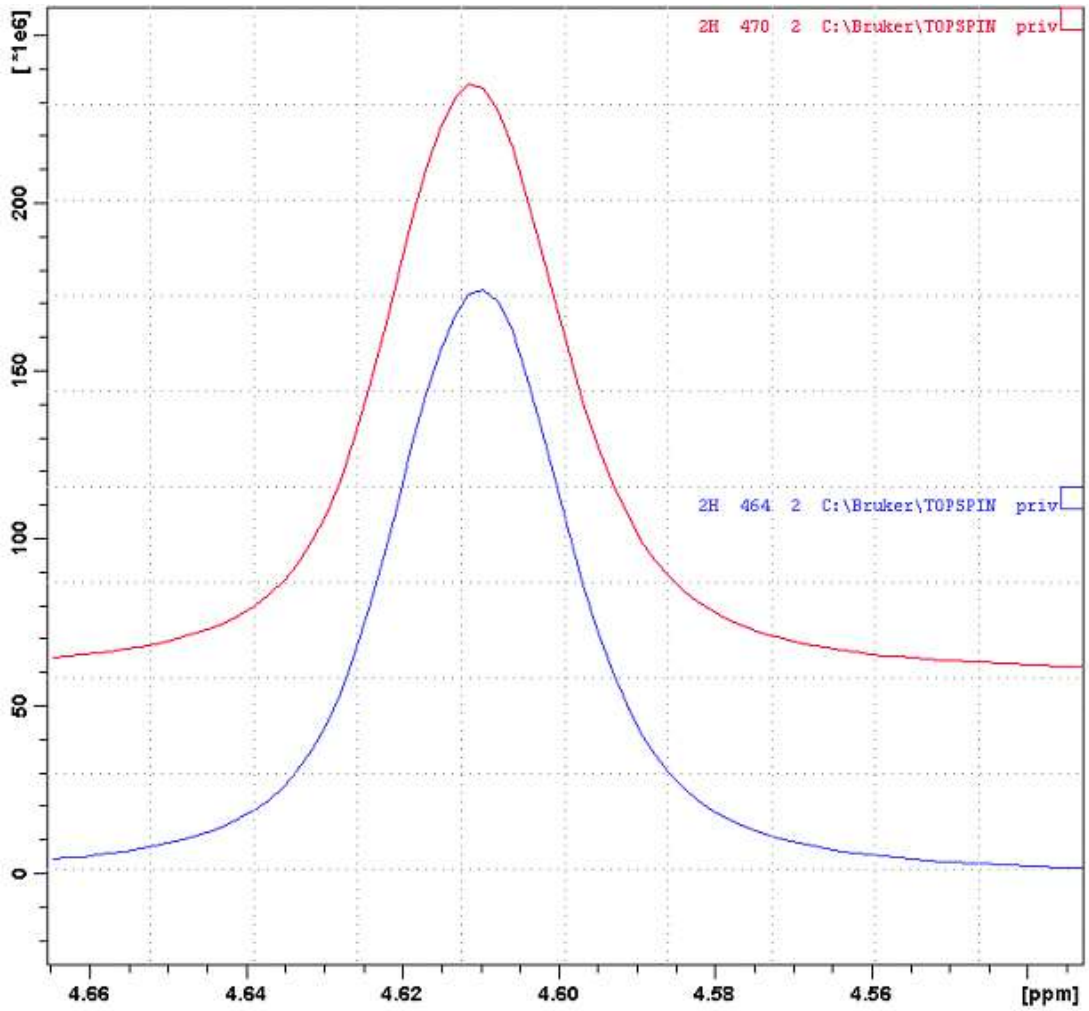
Parameters of the averaged 396 NMR signals ^2H-spectra 198 physiological samples solutions with the addition of heavy water (7% by volume D_2O) with individual processing of idle control samples (XX), placebo (PL) and with the influence of the transfer of properties of the homeopathic preparation saline solution (BRP)

Samples	NMR 2H parameters of the averaged signals of physiological solutions	
	Chemical shifts δ (ppm) (Hz)	Lorentzian line widths at half height Δ√ (Hz)
1) Control. 2) Mode BRP.	4.610 212.45 4.618 212.83	0.943 0.901
3) Control. 4) Mode XX.	4.610 212.45 4.609 212.40	0.900 0.868
5) Control. 6) Mode PL.	4.610 212.45 4.610 212.45	1,082 1,076

In fig. Figures 2 and 3 show the averaged control spectra2H and corresponding spectra 2H samples nat. solutions influenced by the transfer of the properties of the homeopathic drug to physiological saline for idle groups XX and placeboPL.



Rice. 2. Averaged over66 samples NMR spectra 2H (46.08 MHz) saline with the addition of heavy water (7% by volume D2O): 1) control samples K (lower spectrum) and 2) experimental samples in the idle group XX (upper spectrum)



Rice. 3. Averaged over66 samples NMR spectra ^2H (46.08 MHz) saline with the addition of heavy water (7% by volume D_2O): 1) control samples K (lower spectrum) and 2) experimental samples in the placebo group PL (high spectrum)

Table 1 shows the obtained NMR parameters of these averaged spectra.

From these data it follows that the effect of the transfer of the properties of a homeopathic preparation to physiological saline in groups XX and PL practically does not change the value of the chemicalshift relative to control measurements K of the same samples. Moreover, in the groups of transfer of properties XX andPL reduce the line width at half height Δ√ by 0.032 Hz and 0.006 Hz, respectively, relative to pilot signals.

The data obtained can be interpreted as follows.

The effect of the transfer of the properties of a homeopathic preparation to saline in groups BRP, XX and PL cause a slight decrease in the deuteron relaxation ratewater molecules at 0.03–0.04 Hz. The effect of the transfer of the properties of a homeopathic preparation to a physiological solution (groupBRP) increases the magnetic resonance frequency of deuteronswater molecules at 0.38 Hz. NMR frequency^2H ($\sqrt{}_{H-2}$) is defined by the expression:$\sqrt{}_{H-2} = Y H_O(1 - \sigma_{H-2}) / 2\pi$,

where Y is the gyromagnetic ratio of deuterons (nuclear constant),H_O - the magnitude of the magnetic field strength of the spectrometer, equal to 7.05 T,
σ_{H-2} Is the constant of magnetic (electronic) shielding of deuterons of water molecules, dependson the electronic environment of deuterons (on the density and shape of the electronic environment).

From this expression it follows: in order to increase the resonance frequency of deuterons of water molecules, it is necessary to reduce the electronic magnetic shielding, i.e. decrease the value of σ_{H-2}... In other words, it is necessary to screen the deuterons of the water molecules. Thus, we can say that the effect of the transfer of the properties of the homeopathic drug to the saline in the group unscreens the deuterons of the water molecules (the electron density in the deuteron region decreases), while the effect of the transfer of the properties of the homeopathic drug to the saline solution at idle and placebo does not change the electronic environment of the deuterons. water molecules. It should be noted that the observed de-shielding of deuterons of water molecules under the influence of the transfer of the properties of a homeopathic preparation to a physiological solution has a very small value (0.008 ppm) compared to changes in the electronic shielding of deuterons of various organic molecules (changes in the chemical shifts of deuterons of organic molecules reach 10-12 ppm).

Conclusions:

1. Reliable influence on the transfer of the properties of a homeopathic preparation by 0.9% physiological sodium chloride solution on the NMR parameters of deuterons of water molecules in groupsidle speed XX and placebo PL is not marked.

2. An increase in the chemical shift δ (a decrease in the electron constant magnetic shielding σ_{H-2} and, accordingly, an increase in the local magnetic field)deuterons of water molecules of physiological solution from the effect of transfer properties homeopathic remedy for saline in the group BRP.

Literature

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