Conference presentation

Raman spectroscopy reveals distinctive features of drugs at ultra high dilution

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Background: Drugs at ultra high dilution (UHD) have been used in homeopathy for a couple of centuries. The central theme in homeopathic Materia Medica is that each drug has its own distinctive features which need to be matched with the symptoms of a patient for eliciting therapeutic response. However, UHD's very often (above 12 cH) cross the Avogadro number, and are, therefore, devoid of original drug molecules. How do they maintain their individual identity? This study aims to address this pertinent question.

Objective: The medium of UHD's is ethanol water. It is thought that water structures in a UHD carry the identity of the drug and its rank of dilution. The objective is to decipher the exact nature of water structure in UHD's of different drugs by laser Raman spectroscopy.

Method : Six homeopathic drugs and their control ethanol, all in 90% ethanol v/v, were used in the study. For *Sulphur* and *Natrum mur* potencies used were 30 cH, 200 cH and 1000 cH, and for *Calcarea carb* and *Sepia* the potencies were 8 cH, 202 cH and 1002 cH. In addition to the four drugs we also used *X-ray* and *Magnetis poli ambo* which did not originate from any substance by exposure of ethanol water to X radiation and strong magnetic field. For this we could use their mother tinctures as well as ultrahigh dilutions (potencies) like 8cH, 14cH and 32cH. The potencies used for ethanol control were 8 cH, 14cH, 32cH and 20 cH. Raman spectra of all the potencies of 6 drugs, ethanol control and pure water were taken in the wave number region of 2400-4200 cm⁻¹. All the samples were reduced to 25% ethanol by adding appropriate volume of water to each of them before taking the spectra. The mother tinctures MT of *X-ray* and *Magnetis* were studied.

The intensity ratio of vibration frequencies between 3200 cm⁻¹ and 3420 cm⁻¹ (R1) and that between 3620 cm⁻¹ and 3420 cm⁻¹ (R2) were calculated for each UHD of the samples.

Results: All the UHD's of the drugs and the control tested show difference in intensities in the stretching vibrations of CH and OH groups. The three UHD's from low to high ranks of both *Natrum mur* and *Sulphur* show negative relationship with respect to R1 values, and positive one concerning R2 values. R1 values for 3 UHD's of *Calcarea carb* and *Sepia* show

negative and positive relationships, respectively. In case of R2 values the relationship in 3 UHD's is $8 < 202 > 1002$ for *Calcarea carb*, and $8 > 202 < 1002$ for *Sepia*. R1 value position for X-ray is $MT < 8, 32 < 14$ and for Magnetis is $MT < 8 < 32 < 14$. The relative position of R2 values for X-ray is $14 < 8 < 32 < MT$ and that for Magnetis is $14 < 8 < 32 < MT$. R1 and R2 values for the 2 UHD's (8 cH, 202 cH) of ethanol control the show negative relationship. For the 3 more UHDs of ethanol control the relative position of R1 values is $32 < 8 < 14$, and for R2 values is $14 < 8 < 32$.

Discussion: The intensity of Raman scattering is proportional to the electric dipole-electric dipole polarizability of change. So, the UHD's of different drugs vary from each other with respect to that aspect.

The intensity ratio R1 gives information about the relative number of OH groups with strong and weak hydrogen bonds. Judged from the perspective of R1 values, the lower is the rank of UHD, the stronger is the H-bond of the OH groups as with *Natrum mur*, *Sulphur* and *Calcarea carb*. The situation is different with *Sepia*. Here the higher the potency the stronger is the H-bond of the OH groups. It is also different with *X-ray* and *Magnetis*.

The intensity ratio R2 suggests the relative number of OH groups with broken and weak hydrogen bonds. In the light of R2, the higher is the UHD rank, the more abundant is the free OH groups and non-hydrogen bonded water molecules, as with *Natrum mur*, *Sulphur*. However, for *Calcarea carb* and *Sepia* the proportion of free water molecules is not positively correlated with the potency ranks studied. The same is the situation with *X-ray* and *Magnetis*. As for the control the UHD's differ from each other with respect to free water molecules and hydrogen bond strength. It may be mentioned here that UHD of ethanol is a homeopathic drug with specific symptoms.

Conclusion: UHD's of homeopathic drugs irrespective of their origin either from any substance or energy, are different from each other with respect to the hydrogen bond strength of OH groups and relative proportion of free water molecules. These two physical aspects characterize the uniqueness of homeopathic drugs vis-à-vis the central theme in homeopathic material medica.

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