

Can low-temperature thermoluminescence cast light on the nature of ultra-high dilutions?

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Low-temperature thermoluminescence has been used in attempt to understand the particular structure of ultra high dilutions. Samples are activated by irradiation after freezing at the temperature of liquid nitrogen (77°K). Experimental results show that, in the course of rewarming, the thermoluminescent glow is substantially different between dilutions of different substances. It is suggested that the dispersed gas phase might play a role in this process. *Homeopathy* (2007) 96, 170–174.

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Introduction

No chemical is more common on earth than water: it covers 75% of the earth's surface with a total mass of 1.4 billion megatons. A very simple molecule, with one central, negatively charged, oxygen atom and two positively charged hydrogen atoms 0.1 nm apart at an angle of 104° water is, nevertheless, a most atypical compound. In the liquid state, it is an abnormal fluid which should be a gas by comparison with other similar chemicals. Among other unusual properties, it increases in volume when crystallizing into solid ice at 0°C and boils at 100°C : both these temperatures are abnormally high for a substance which is neither a metal nor an ionic compound. Its dielectric constant as well as its increasing fluidity with rising pressure is equally odd.

In fact, liquid water is not a simple association of independent molecules; the molecules are actively interconnected by hydrogen bonds^{2,3}. Liquid water is, indeed, a structured fluid which behaves as a polymer. In an ever-moving universe, individual water molecules link to each other, most often in tetrahedral geometry, building evanescent clusters which are continuously formed and dissociated again at random in a pico-second timeframe. When an ionic compound is dissolved in H_2O , each ion is immediately surrounded

by a spherical shell of water molecules so intensely that, should the concentration of the solute be high enough (over about 10%) all the shells come into contact and there is no more truly liquid water.

It can, thus, be understood that, in the preparation of an homeopathic medicine, any compound dispersed in water gives rise, from the outset, to a specific structure. When successive dilutions are made the violent turbulence created in the liquid by each succussion, helps to both maintain and possibly spread the original structure despite, progressively, the solute content of the dilution dropping by a factor of 100 with each centesimal step. However, Brownian motion is still very active and these 'remnant structures' fade away and reconstitute continuously. In other terms, we could say that homeopathic dilutions are 'statistically structured' and could remain so beyond the Avogadro number. Succussion appears to be an essential part of the overall process.

Research objective

It is easy to understand why, based upon this succession of dilutions–succussions, many scientists believe that eventually—and definitely beyond the Avogadro number—the resulting 'solutions' are no more than the dilution fluid itself. However, numerous physiological and clinical tests have demonstrated for decades, since Hahnemann himself, that this is not the case. Our research objective has been to try to demonstrate that the high dilutions are physically

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different from the diluent and have, indeed, an 'individual personality'.

Method

Since any investigation is always difficult in an highly dynamic system we assumed that, should some specific 'patterns' exist in the liquid dilution they might be fixed when it is frozen giving rise to specific defects in the crystal lattice of ice, which could be investigated by appropriate means.

To perform this type of studies we selected low-temperature thermoluminescence. This technique, which is well known for archaeological and geological dating,⁴ has been adapted by us to low temperatures⁵ and described in detail in previous publications.^{6,7} I will here only summarize here its main features.

A 1 cc sample of the dilution under investigation is placed in an aluminum cup and frozen down to liquid nitrogen temperature ($-196^{\circ}\text{C} = 77^{\circ}\text{K}$) following a well defined multi-step process. The frozen 1 mm thick ice disk is then 'activated' by radiation (Gamma rays, X-rays or electron beams) which displace electrons from their quantum ground states. The sample is then rewarmed at constant rate ($3^{\circ}\text{C}/\text{min}$) from 77°K to melting point. During that process the electrons, powered by 'thermal activation' leave their respective traps and recombine with the empty quantum 'holes' releasing their 'activation energy' in the form of light as they do so. This light is the thermoluminescent glow that we record.

The analysis of the emitted light shows two main peaks around 120 and 166°K for deuterium oxide and

115 and 162°K for H_2O .⁵ Their relative intensity and shape vary both with the radiation dose and also with the nature of the radiant beam. In particular peak 2 displays a complex structure which can be resolved in a set of individual components by a deconvolution technique.^{8,9} It is assumed that the 'defects' present in the ice crystalline lattice are active luminescent centers, hence that thermoluminescence might be an appropriate tool to study the 'image' of the initial liquid samples.

Results

Thermoluminescence is known to be a very sensitive technique and has been used to identify trace compounds. For example see Figure 1, the thermoluminescence emissions of very dilute alumina colloidal sols which show major differences between the 10^{-8} g/ml, 10^{-9} and 10^{-10} g/ml solutions.

For homeopathic high dilutions we use deuterium oxide (D_2O , heavy water) as the solute since the signal is 50 times more intense than that of H_2O , due to the more rigid nature of the two 'arms' of the molecule. As diluted substances we selected two ionic compounds: sodium chloride (NaCl) and lithium chloride (LiCl). The latter was selected because, like urea and ethanol, it is known to impact on and suppress the hydrogen bonds¹⁰ which are thought to be involved into the high temperature peak (ca 166°K) of the thermoluminescence glow.⁶ Figure 2 shows that the curves recorded for successive dilutions of LiCl (3c, 5c, 7c, 9c) prepared by the classical Hahnemannian method and following the French Homeopathic Pharmacopoeia

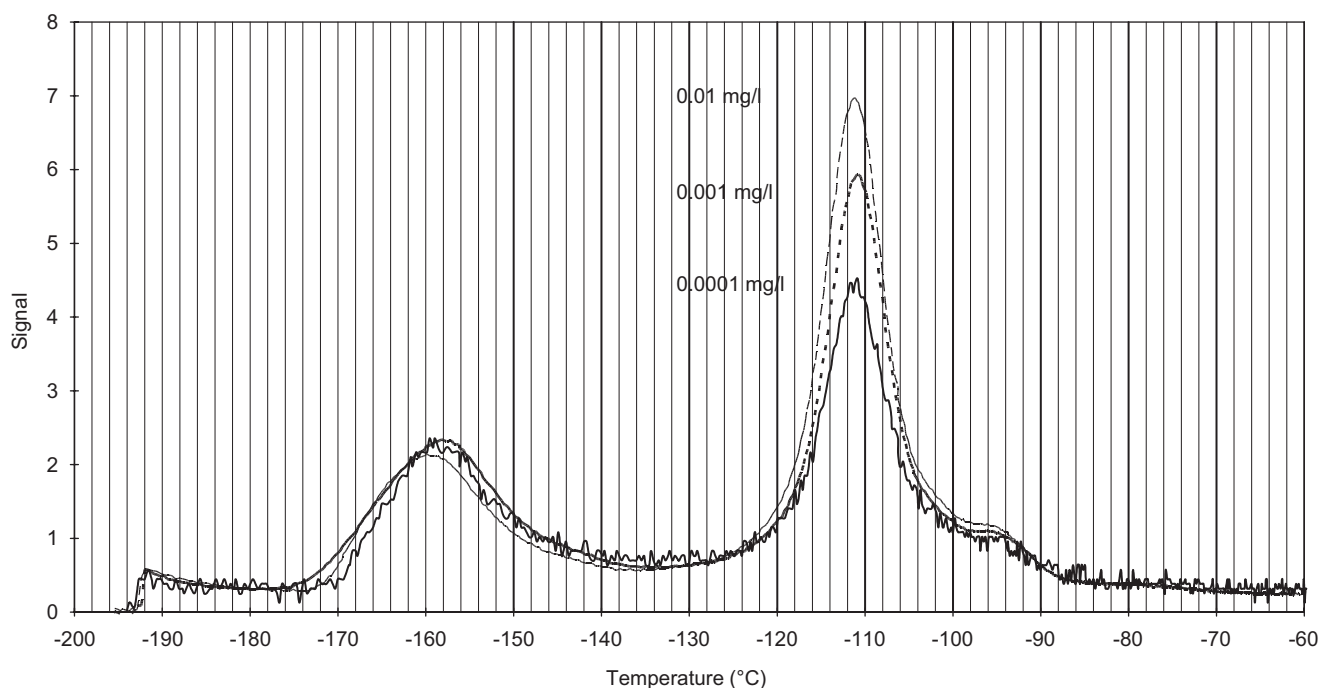


Figure 1 Thermoluminescence glow of colloidal sols of alumina irradiated by gamma rays (10 kGy) at liquid nitrogen temperature (77°K).

(150 strokes of 2 cm amplitude in 7.5 s, delivered by mechanical succussion machine) are substantially different.

Subsequently, since it appeared that we had a reliable tool for assessing the dilutions we applied the

same method to ultra-high dilutions beyond Avogadro's number.⁶ Figure 3 gives the results and shows evidence that the 'signature' peak of LiCl 15c is substantially lower than that of NaCl 15c and lower than succussed pure D₂O. This demonstrates that:

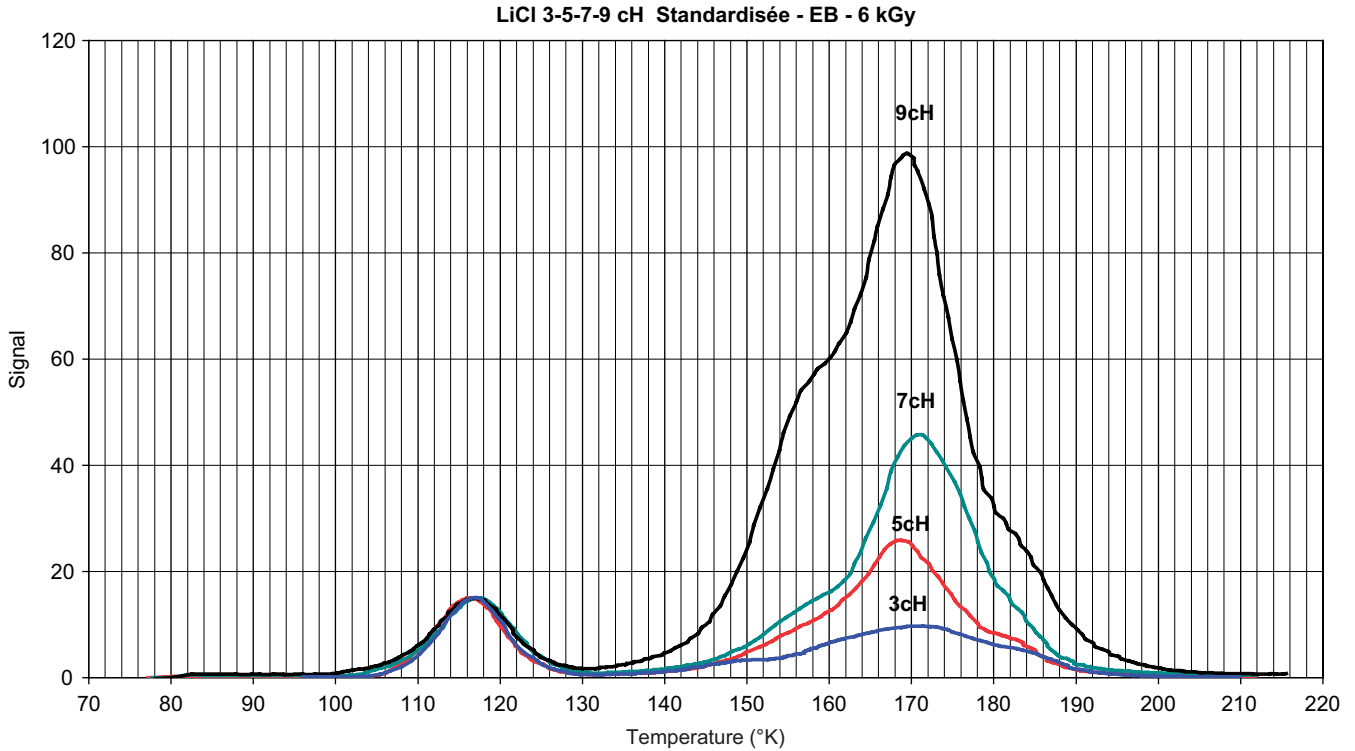


Figure 2 Thermoluminescence glow of successive dilutions (3c, 5c, 7c, 9c) of lithium chloride in D₂O irradiated by a 2.2 MeV electron beam (6 kGy) at 77°K.

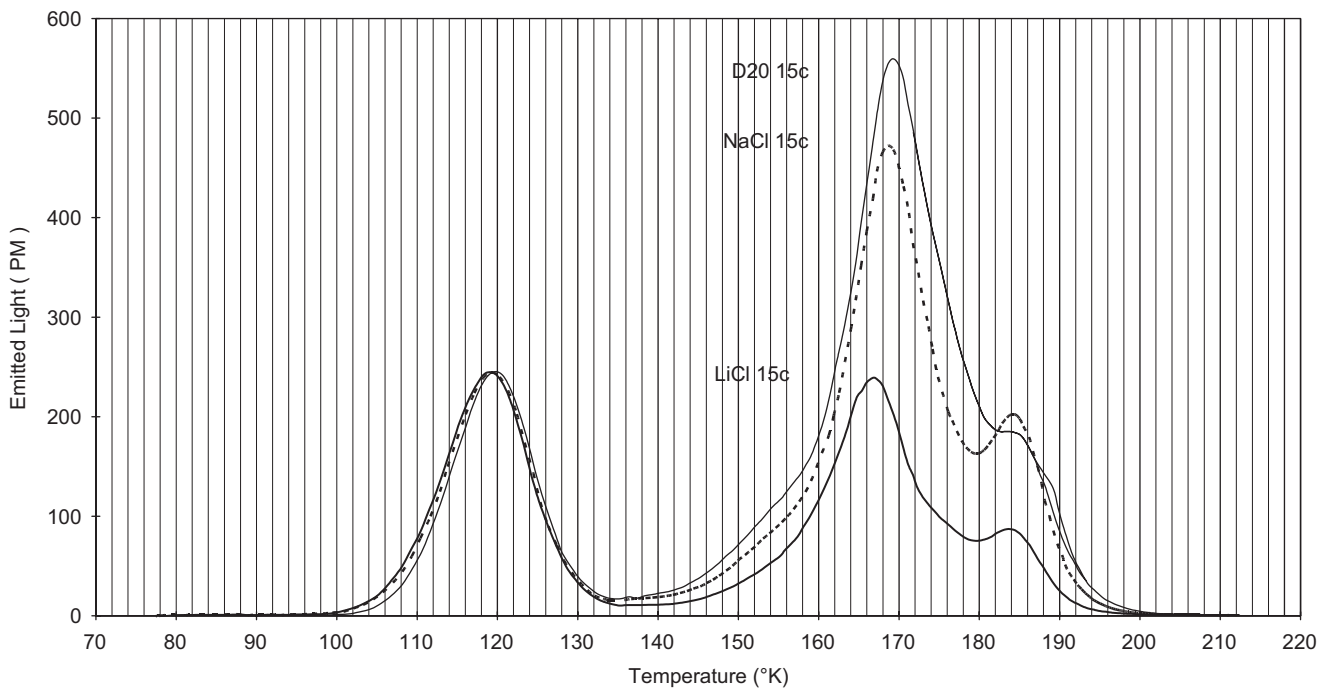


Figure 3 Thermoluminescence glow of ultra-high dilutions (15c) in D₂O of LiCl, NaCl and of pure D₂O, diluted and succussed to 15c irradiated by gamma rays (19 kGy) at 77°K.

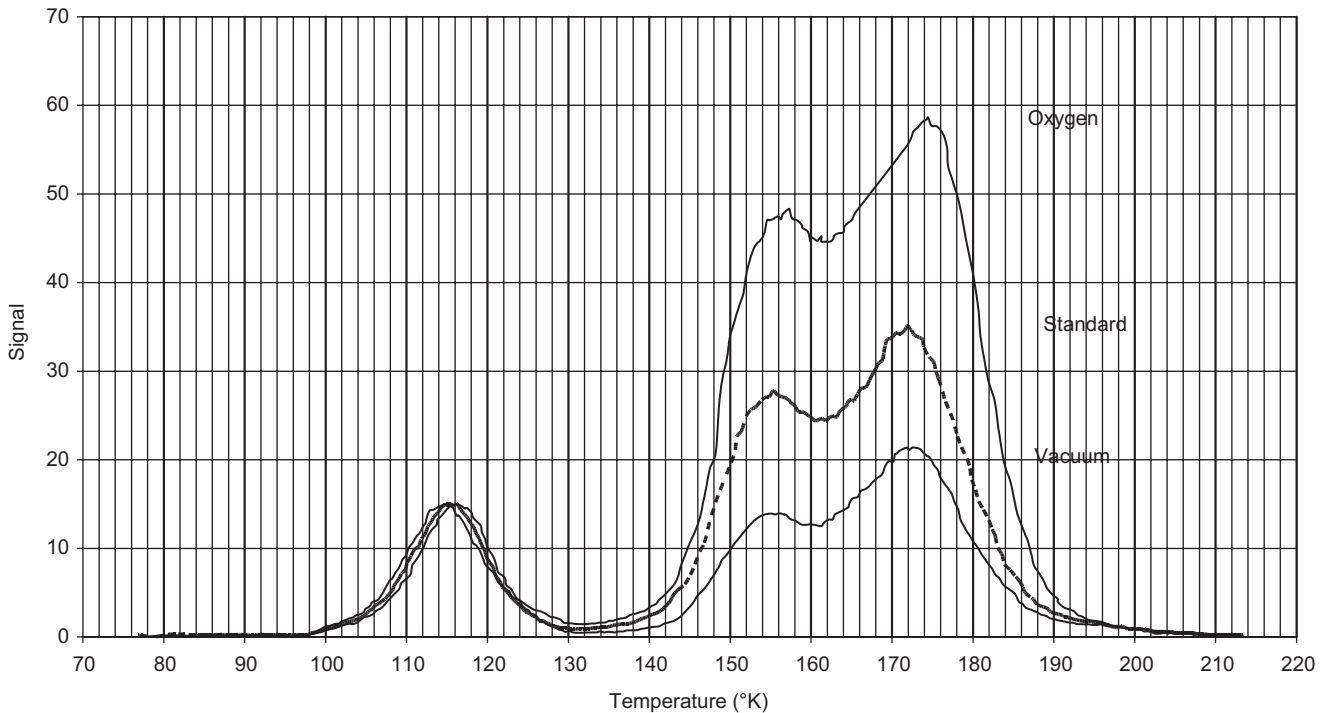


Figure 4 Thermoluminescence glow of LiCl 15c in D₂O dynamized in a vacuum and in a pure O₂ at 15 bars pressure and irradiated by a 2.2 MeV electron beam (6 kGy) at 77°K. We dynamize the dilution at room temperature (20°C) under moderate vacuum (2337 Pa = 24 mbar) which corresponds to the saturated water vapour pressure at 20°C. The time to reach vacuum is approximately 20 seconds, we use our standard dynamization: 150 strokes of approximately 2 cm amplitude in 7.5 sec, followed by stabilization under reduced pressure for 3 minutes. The vacuum is then broken, reverting to atmospheric pressure in approximately 20 seconds.

ultra-high dilutions are different from their dilution fluid.

The high temperature components of the glow (ca 166°K) is linked to the hydrogen bond network. These results have been recently confirmed by another research group.¹¹

In recent and still unpublished experiments we found the same type of ‘scaling’ between increasing dilutions of other compounds, among which potassium dichromate looks particularly interesting.¹²

New prospects

As I said above, in the homeopathic preparation scheme, succussion is an important component of the preparation process of homeopathic medicines, releasing considerable energy in the fluid. In view of this I became interested in recent research on the role of ‘nanobubbles’ in water.¹³ Part of the ‘message’ transferred from one dilution step to the next one might be linked to the nanobubbles created into the liquid by the successive strong mechanical agitation which creates turbulence.

To investigate this, we built special equipment to perform dynamization in gas atmosphere or vacuum. We dynamize the dilution at room temperature (20°C) under a moderate vacuum (2337 Pa = 24 mbar) which corresponds to the saturated water vapour pressure at 20°C. Time to reach vacuum is approximately

20 seconds. Dynamization is 150 strokes in 7.5 sec followed by stabilization under reduced pressure for 3 minutes. The vacuum is broken reverting to atmospheric pressure in 20 seconds. Figure 4 gives preliminary results which show that the gas-phase seems to play a major role in the ‘personalization’ of the dilutions. Bearing in mind that the number of nanobubbles created into the fluid is of the order of billions (which represents a very large ‘contact’ surface with the surrounding liquid) and that, due to their size, they may remain stable and undisturbed in the dilution for months or even much longer, this might open some new perspectives on our understanding of the homeopathic preparation process.

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