Upon some efficient physical tests revealing structural modifications of water and aqueous solutions
1. Mixing experiments

by Gheorghe Dragan
gdfdatabanks@rdslink.ro

Experience – the mother of all sciences. (Cervantes).

Water and aqueous solutions have in the liquid state a composite structure consisting at least by two distinct phases: amorphous phase is reactive and unstable to any applied treatment and a crystalline phase mostly unaffected. Densimetry, calorimetry (specific heat, isothermal mixing, anisothermal freezing/melting) and thermochanical analysis are some of very efficient physical tests (easy to operate, sensitive, rapid, with low experimental uncertainty and cheap) revealing in specific accurate conditions the structural modifications of water and aqueous solutions induced by such treatments. There are sufficient reasons as these tests become in the first step home tests for homoeopathic dilutions characterization.

Introduction

Quality assurance of the products on the market imposes measurements of quantities defining their properties in conditions of repeatability and reproducibility (R&R) (see ISO, EN and national standards on this topic). These requirements are satisfied by adopting standardized and/or home tests defining R&R of the raw materials, intermediary and end products. These quality tests must be (requirements ordered according to their priority):

(i) sensitive in view to evidence small deviations in material properties
(ii) giving accurate results in R&R conditions;
(iii) rapid;
(iv) easy to operate;
(v) cheap.

These requirements define the efficacy of the applied test and finally of the quality. The first characteristic defines in fact the quality of a product, so that in general manufacturers continuously improve these tests becoming as home tests not patented and undisclosed even by selling the manufacturing license. The main goal of these tests is to correlate their results with the behavior of the end product in operating conditions. However, the final product on the market must be characterized according to a quality protocol recognized both by the manufacturer and the buyer.

Homeopathic products represent a strange case for which these basic rules of quality assurance and consumer protection are not applied, although there are

many cases reporting that high dilutions of tinctures have pharmacodynamic potency (PP) much “worse” or “better” than the initial tinctures. This situation is essentially due by the absence of efficient tests defining the quality of such products. This situation is strongly used by the manufacturers of allopathic products even by compromising scientific reports and buying corrupted scientists.

Actual series of contributions intends to present some of highly efficient tests developed first for common materials in chemical and pharmaceutical industry and progressively improved for aqueous solutions and homeopathic dilutions. It is important to evidence first their structural aspects and physical assignments, generally neglected even in scientific reports. The website and references cited therein contain much more details. Now appears as clear that we have many other results obtained with highly improved devices needing know-how protection. However, the presented tests and results are enough for an immediate and efficient characterization of homeopathic products.

Material memory

Material science is a well known science essentially dealing with material tests evidencing structural modifications induced by different treatments. This logic link simply defines material memory. For instance steel experts know about metal memory. The following general rules are working in material science:

(i) the chemical structure does not define univocally the properties of a material sample. Pure carbon is the best known example. It has infinite structures from graphite to diamond.

(ii) memory effect has the origin in the composite structure of the material samples. This means that these have distinct phases differently reacting to the applied treatments. In general, all material samples have at least two main phases: an amorphous phase sensitive to these treatments and a crystalline phase mostly unaffected.

(iii) the most efficient tests must be used in evidencing material properties (memory) in view to establish the repeatability and/or reproducibility of material processing (= the series of applied treatments from raw materials to end products).

(iv) differential measuring systems are used in view to better evidence structural modifications. These compare (simultaneously or separately, but in the same conditions) the treated material with the initial one, so are able to increase considerably their sensitivity by decreasing the noise effect.

We may expect these rules act also for aqueous solutions and particularly homoeopathic dilutions. Also it is better to mention another general rule according to which someone who never experienced a phenomenon can not

believe/understand it; for instance electrocution has no significance for a person who never experienced it.

Mixing experiments reveal composite structure

Solubility is a complex term used in particular in chemistry (see IUPAC definitions – International Unions of Pure and Applied Chemistry). It means essentially the interaction between two material samples revealed by their mixing in standard conditions. According to the above mentioned rules, not all the matter from the two components participates to this interaction. For instance, solubility of a salt in liquid water expressed by the saturation concentration of the salt at a given temperature, represents in fact the saturation of the amorphous phase of water which depends on the salt nature and the initial structure of water. These solubility experiments defining the saturation parameters are very laborious and expensive. High resolution mixing calorimetry (HRMC) evidences in highly efficient conditions the interaction between 2 material specimens far from their saturation. HRMC is a typical differential technique able to reveal in highly efficient conditions structural modifications induced by subtle treatments applied to a material sample.
Figure A represents the test specimen for a HRMC mixing experiment in which the two components are introduced in a stainless steel calorimetric cell (1) and in a bubble glass (2). The standard experimental conditions are mainly defined by the shape and volume of the calorimetric cell, of the two components and the temperature at which experiments are carried out. The test specimen A is introduced in calorimeter prepared and after the temperature reaches its equilibrium value (calorimeter senses no heat exchange) the mixing process is triggered by breaking the bubble glass. Calorimeter measures the heat flow in standard units (Joule/ second) associated to the interaction processes.
HRMC experiments for water/aqueous solutions structure use component 2 a substance interacting strongly and specifically with water called as structure developer. Each one has a specific nature of its interaction and is selected as a function of the structure of the water/aqueous solutions. We have used mainly the following structural developers: ethanol, methanol, phenol, pyridine, amines, ionic salts.

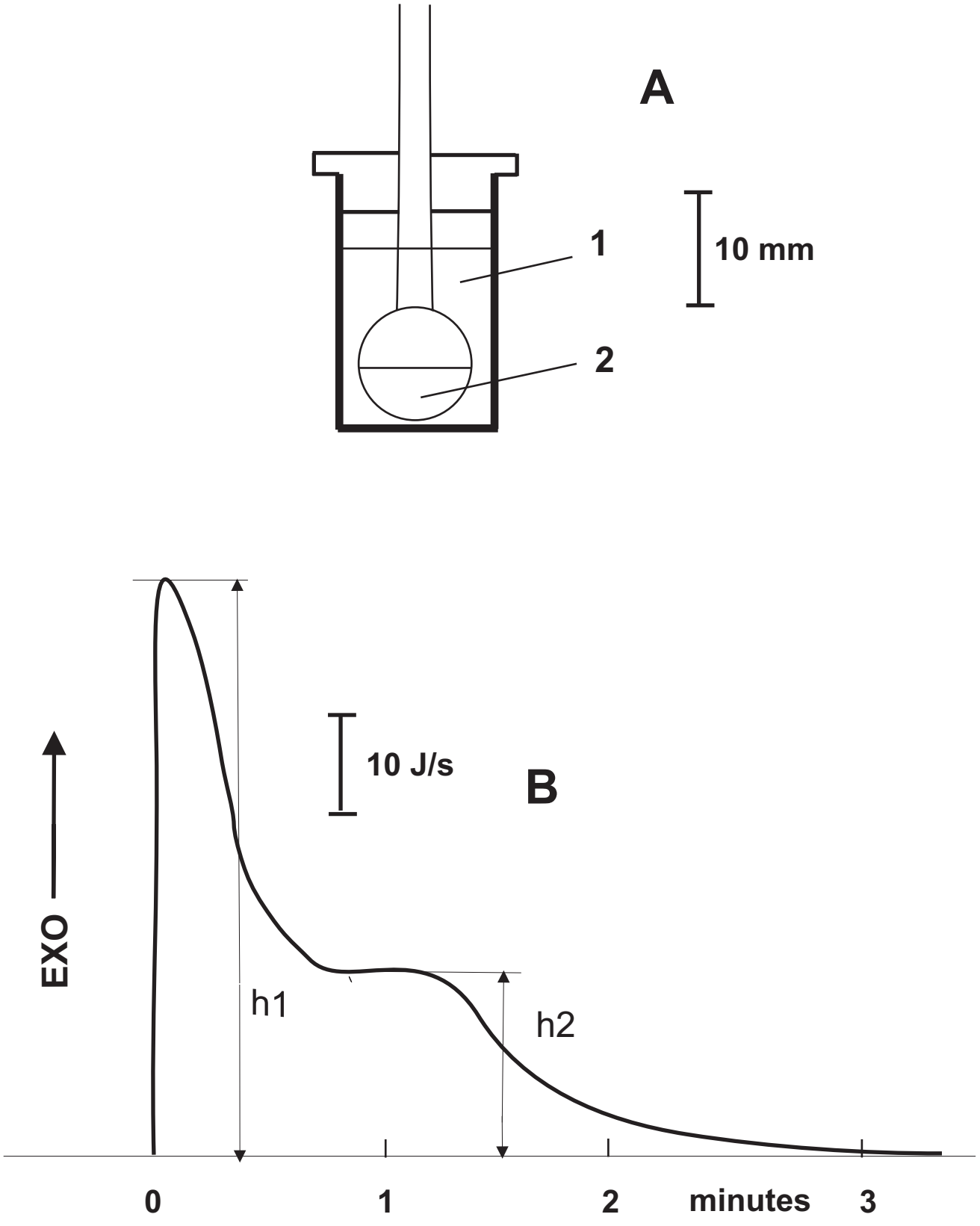
Water + Ethanol

In view to better understand water memory, let us consider in more details a mixing experiment of a sample of pure water (1) and ethanol (2)(ethyl alcohol, EtOH) at +30 ^{0}C. After the thermal equilibrium is reached the glass bubble is cracked by a short mechanical shock so an exothermal flow (= reacting system releases heat) (Figure B) is measured by specific temperature sensors. This fact is generally known, but few people know its physical meaning:

(i) exothermal processes mean structure making, i.e. two kinetic entities form a new unique entity. For instance two molecules can form together a new molecule (as in polymerization). However, there are structure making processes not involving chemical reactions like crystallization, annealing, condensation, etc. The reaction between water and EtOH forms stable clusters between these two kinds of molecule having H-bonds between their OH groups.

(ii) if we take a more careful look to this exothermal process we may observe that these are at least two distinct processes: one immediately after the mixing of the two liquids (h1) due by the fast diffusion of EtOH and its reaction with the main amorphous phase of water and another one (h2) delayed due by the slower diffusion in amorphous domains at the edge of the crystalline domains. The good separation (resolution) of these elementary processes is a characteristic of the HRMC device and reveals the composite structure of water sample. The overall exothermal process can be evaluated quantitatively by overall heat energy (area under curve calibrated in energy units, J) and by separated contributions of the (two or more) elementary processes.

It is important to note that the same water can memorize very subtle treatments developed by different kind of mixing experiments. For instance if we take from the same water sample a quantity (let us say 100 ml) in a jar and hold it in both hands for a while (5-15 minutes) and compare its mixing behaviour with EtOH with the initial water in the same SEC, we will observe distinct exothermal spectra depending on the human subject. The results have high repeatability (experimental errors and experimental uncertainty are small). In general, the hand held sample has the process h1 smaller and h2 greater than for the initial sample of water. This means that the hand held specimen has a greater crystalline phase. Let us consider directly the mixing process of the two water specimens, namely in the calorimetric cell we put the specimen 1- the initial water, 2- the hand held water. Their mixing is an endothermal process (= reacting system absorbs heat) much smaller as energy than the exothermal mixing with EtOH, but distinct and repeatable. Endothermal processes mean structure breaking, namely one entity decomposes in two or many entities (molecular decomposition, melting, vaporization, etc.).In this case the crystalline domains in water 2 are destroyed by dilution in amorphous phase of water 1.
Specific spectra of mixing processes are obtained for dynamized samples and/or by successive dilution.


A
1
2
10 mm
B
10 J/s
EXO
h1
h2
0
1
2
minutes
3

Concluding remarks

(i) HRMC technique as presented in this contribution and in the published papers, represents a highly efficient test for aqueous solutions in general and for homeopathic products (raw materials up to final products) in particular;

(ii) although HRMC results can not directly correlate and/or define PP of homeopathic products in all cases, they can define R&R conditions necessary for a good practice recognized by AHA and subsequently by Ministry of Health;

(iii) HRMC technique can be presented in a public demo session on suggestive experiments organized by us in cooperation with AHA officials, following to be applied in a research project for characterization of a series of most representative homeopathic products in view to evidence their R&R characteristics.

Abbreviations

AHA	Australian Homoeopathic Association
EN	European standards
EtOH	ethanol = n-ethyl alcohol
HRMC	high resolution mixing calorimetry
ISO	International Standard Organization
IUPAC	International Unions of Pure and Applied Chemistry
PP	pharmacodynamic potency
R&R	conditions of repeatability and/or reproducibility
SEC	standardized experimental conditions

Sydney, September 2003

This note was wrote to the suggestion of Nyema Hermiston (Newsletter Editor of AHA) and has been sent to all AHA contacts in www.homeopathyoz.org.