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Nano technology extending into the Pico and quantum realm has the propensity for an entirely new way of dealing with problems associated with conventional Classical Physics.

Due to ignorance as to what exactly constitutes REAL colloidal silver and the absence of some Standard and highly inaccurate descriptions, this substance has been banned by legislation and is currently in the DOG HOUSE because of it.

Abstract:

Current problems associated with Nano and Pico technologies for either material production of and the need for quality control, as well as its end use, are not well understood or even imagined. A reason for this lack of understanding is that very small atomic silver clusters in sizes below 10nm, fall into the realm of quantum physics on the one hand and also cannot easily be observed by even the most sophisticated optical microscopes directly, on the other. At those small dimensions, behaviour of classical physics disappears and only light scattering techniques enable indirect observation. Pico and nanometre sized atomic clusters can have their electrons so tightly compacted that they are considered to be 'quantum confined'. These clusters also are no longer subjected to gravitational forces and are more or less in a state of permanent (repelling) suspension within an aqueous medium. The mechanism of electro-photochemistry relies on stripping away the outer electron and producing ionic silver. Deliberate collisions between the hydrated electrons contained in the water with violet light photons at 420nm provides the necessary additional energy for these hydrated electrons to escape the ionic confinement of the water and re-occupy ionic silver atoms (Ag^{+}) resulting in a reduction to neutral silver (Ag^{-}). Removing electrons and returning electrons within an atom with photonics energy at a sufficiently high level of electron volt (2.6eV), is considered quantum physics. Compared to that any action at a molecular level is still within the realm classical physics. With the possible quantum confined electrons have additional stored energy, their release may actually respond as a blue-shifted phenomena. More energy out than coming in. Both Interfacial as well as Colloidal Science display complex phenomena mostly due to poorly understood water structure behaviour. As a direct result of many of these complications, a plethora of confusing issues is fast developing by a lack of suitable test equipment as well as a lack of knowledge on how to test for these conditions. This essay will make an attempt to address some of these issues.

INTRODUCTION

This essay is mainly orientated on most of the unknown aspects of the production of colloidal silver as an effective biocide and in particular in an attempt to explore the possibility of this material as a strategic agent against the so-called "Super Bugs", a populist description for Biofilm Protected Bacterial Colonies (BPBC). At present, BPBCs pose a severe worldwide health hazard due to the fast mutating ability of many of these pathogens to become immune to conventional antibiotics and being responsible for at least 60% of all infectious diseases.

Historically, there have never been any imposed guidelines as to what constitutes so-called colloidal silver. It has become a 'Buzz Word' together with AgNPs as evidenced by being used as a perceived acceptable description of a material that could be literally anything at all. Much of it is actually unstable ionic silver and more often than not, consisting of corrosive Silver nitrate. Recently it was realised that so-called colloidal silver is not really a colloid when compared to the strict definition of what constitutes a colloid. Where does that leave Science? The use of the description 'particle' is also suspect as an almost deliberate attempt at vagueness about what the material is. Then there is the measurement for the purity of water. At a concentration of 10ppm silver, 999,990ppm is water. An undeniable formidable ratio of 999,990:10ppm. Understandably we expect that ratio to be what it is claimed, but any unwanted contamination by foreign matter would have to be less than two digits in the ppb to be on the safe side, especially heavy metals such as lead and arsenic. Unfortunately that is not always the case, especially when the water is only distilled water and measuring no less than 1 micro Siemens. Also when so-called deionised water is not at the level of 0.01 micro Siemens (reciprocal of 100 million Ohms resistivity). On the one hand, chemists have decided that only the Total Dissolved Solids need to be known, which should in fact be more accurately described as Total Dissolved Ions (TDI), as these cannot be dissolved and ions at the same time. But what of all of the other immersed solids in the water, both organic and inorganic? Not important for the establishment of the purity of water? In the mid 1900s attention was paid to determine if and how much immersed solids were actually in the water by making use of the sedimentometer to determine obscurity levels and the nepholometer to learn from light scattering disciplines. Where have these systems gone? Since any outcome of trials involving contaminated water will most likely fail, it would appear prudent for optical instrumentation to be re-introduced, albeit in a more modern application. Such an augmenting facility would certainly identify foreign matter. Also, what about the water itself? Water has dielectric properties, such as materials like glass and plastics. It is an electrical insulator. It is supposed to oppose any electrical current flow and by virtue of these properties thus possess an infinite (OHMIC) resistance. Unfortunately, much more is amiss with water used for scientific purposes.

Water and water purity concerns in scientific studies.

Absolute values in science are desirable but never quite attainable. Water in particular, as the great dissolver, is no different and most likely even more so than other materials. Water even modifies its molecular structure in an attempt to adapt to foreign materials contained in its aqueous medium as well the type of container it finds itself stored in. Regardless of whatever foreign material is found in water and to what extent by volume, it is bound to have an impact on any scientific study. This will be by way of reduced or increased viscosity, density, transparency and even temperature and a tendency to adsorption. It is for that reason water must be as pure as possible, as during exposure to air and thus the atmosphere, much is collected by water and assuring an ever increasing contamination.

PREAMBLE.

Infectious diseases by the so-called superbugs is on the increase as pathogens are learning very fast to mutate and change their DNA structure to seek immunity against conventional antibiotics. Some of these mutational changes are alleged to occur in some cases within days and even hours. Research into the antiseptic or biocidal properties of silver needs to be thoroughly investigated at an increased rate.

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INTRODUCTION:

There appears to be a tendency in present science to be complacent and not properly identify ways to assess situations and properties of matter accurately. This is particularly the case with the concept of nanometre sized colloidal silver particles of silver, that are neither a colloid nor a particle. The same can be said about water and water testing for purity, just using a conductivity meter for determining ionic content, but not even be concerned about immersed inorganic and organic solids that require optical means of identification. The irony of these shortcoming are that suitable technology for all these present shortcomings in science have been abandoned in vain. Much of this type of Instrumentation has already been designed and used during the 1900's. Examples of such discarded technology are the effective use of the Vacuum Tube Voltmeter, boasting a resistance measurement level of maximum 1,000 million Ohm and outperforming the latest commercial digital technology. Likewise the demise of the sedimentometer and nepholometer for measuring obscurity levels and light scattering properties respectively. Looking through a 24 page document on water purity testing using resistivity and conductance published in 1998, no reference was made what equipment was used for measuring or even how so-called resistance and conductivity levels were measured and providing an only comment: ***"Such equipment was not commercially available"***. Attitudes like that are not conducive to the 'search for evidence' in science and the time has come to realise that. A listing of these shortcomings and anomalies in nano and pico technologies are listed as follows:

1. An existing absence of an acceptable nomenclature on nano sized silver as well as precise descriptions, specification and proper wording for consistent communication. A proper introduction for such a concept is urgently required to ensure adequate scientific progress. There can be no real progress by a lack of consistency. Using 'Buzzwords' like AgNPs is not scientifically becoming and displays ignorance about the nature of the material. The use of the word 'particles' is another such an example. The only time that the word particle should be used is for identifying finely mechanically pulverised silver.

2. The need for the introduction of an International Standard of nanometre (and pico metre) sized silver that accurately describes all technical properties in such a way that it precisely identifies a material so that it cannot possibly be confused with any other material. In the case of Colloidal Silver particles, that is neither a colloid nor consisting of particles, that are instead made up of atomic clusters. These clusters can be of varying sizes in a liquid suspension as well possess an equally narrow size distribution, i.e. as a means of characterize and quantify its properties.

3. The proper use of such materials and protocols introduced for best concentrations, handling and short and long term storage of these materials. Especially purity of all of the ingredients used for its manufacture should form part of a specification. For instance, only knowing the level of remaining ionic content in water used and not considering what else is in the water by way of undissolved solids of either an organic or inorganic nature as well as the purity of the silver used, is likely to destroy credibility of any experiment or clinical trial.

4. The absolutely essential use of proper testing instrumentation. When testing colloidal silver, using conductivity or pH values are 'scientifically' nonsensical. Colloidal silver in suspension (it presents a hydrophobic character when submersed in water) does not conduct current in that water, as it is electrically neutral but for the interfacial charge called a repelling Zeta potential (negative

potential). Presently, the only instrumentation available are Particle Sizing, Zeta Potential assessment and AC based Conductivity meters. All these methods used are limited and are 'by inference' based and not 'direct' characterization. Further obscurity is created by the constant use of the meaningless word PARTICLE, without identifying what type of particle is referred to, if indeed it even is a particle.

A lack of a coordinated effort to have instruments claiming to be measuring the same parameters, nevertheless operating on different principals and/or frequencies to try and obtain the same results. Using different frequencies equates to different impedances and resulting in different loadings on the substance under test. This is particularly the case with alternating current operating conductivity measurements that may operate from 50Hz to 1,000Hz. There is so much confusion about such measurements, that one such chemists claims that "All AC conductivity meters operate at HF". HF is short for High Frequency radio waves between 3 and 30 MHz. Such a frequency is not conducive for measuring as it is likely to heat up the water from its radiation potential. To my knowledge, radio waves in the MHz ranges have never been used for measuring conductivity, so what is this chemist talking about?

3. Accurately describe Nanotechnology by stating where it starts and stops, There have been suggestions in Europe and the USA to categorise nano particles by limiting the range of size from 1 nano metre to 100 nano metres. Surely though you cannot leave out particles fractionally smaller and measuring 600pm (pico metre) or 0.6nm.

4. Since a concentration of say 10ppm is needed for a test or clinical trial, it means that the volume of water for accommodation will be 999, 990 ppm. It presents the bulk of the material and also needs to be determined for foreign impurities. For some inexplicable reason ONLY the conductivity of ions in the water are measured but no attempt is made to determine what else is in the water by any unwanted and inorganic and organic material. During most of the 20th Century the use of optical observation equipment and instrumentation was available but has since been discarded. Instrumentation such as the sedimentometer for light obscurity determination and the nepholometer for 90 degree light scattering analysis would identify optically what is in the water that perhaps should not be in there. Today there is also the flawed concept of Total Dissolved Solids. The use of describing Total Dissolved Solids or TDS is a very misleading nomenclature, since there is nothing that can be both a solid AND totally dissolved at the same time. A better description would be Total Dissolved Ions (TDI). The same would apply for describing Total Undissolved and/or Immersed Solids (TUIS). In the end we must know how pure and safe the water actually is. Anything else in the way of foreign materials added will seriously effect outcomes and is considered very unscientific. Silver is the perfect example. No matter how small its size, even down to 1nm it can still be observed by way of light scattering. It is not dissolved in water due to its hydrophobicity. Ionic silver however is totally dissolved as an uncomplete atom and completely invisible, very much the same as an exposed image on film that has not been developed yet.

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5. Imagine bio-luminescence from pathogens in close proximity to pico and nanometre sized silver clusters becoming their own undoing as the bio-luminescence creates a blue shifted ionising radiation from the silver that kills them. Likewise the astronomical small size to volume ratio of nano and pico sized clusters in water having the ability to change the structure of the water molecule to such an extent that the dipolar nature of water disappears, enabling penetration in ever smaller confines (quantum confined electrons and water). However before we get there, much more research will be required. This is especially the case in the availability of suitable and affordable instrumentation that equally operates in the nano and pico areas of testing resistance and the reciprocal values (inversely proportional) current levels. This means having the ability to measure resistances and current levels as high as 10^{12} and 10^{-12} respectively and according to Ohm's Law, allowing the voltage potential to become part of the equation. This can only occur using analogue systems as it is beyond the capability of digital technology at present.

CONCLUSION

At the present time there is absolutely too much confusion about 'bogus' silver, a mixture of ionic and neutral silver in varying ratios with or without added chemistry, such as capping agents for stability. There is also absolutely no need for such practices as precisely produced Quantum Silver at 10nm or less has proven itself to be stable for years. Some samples from 2009, (that is eight years ago) is not observably different than when it was originally produced. A great deal more in-depth and sustained research and development will be needed if ever we can determine that Quantum Silver is a boon to mankind or a dangerous substance. My sincere apologies for some repetitive texts in some areas of concerns, as there is an need for the shortcomings in these areas to be addressed sooner rather than later.

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Reference: Quantum plasmon resonances of individual metallic nanoparticles. By Jonathan A. Scholl et.al. Research Article doi:10.1038/nature 10904, 2012 Macmillan Publishers Limited