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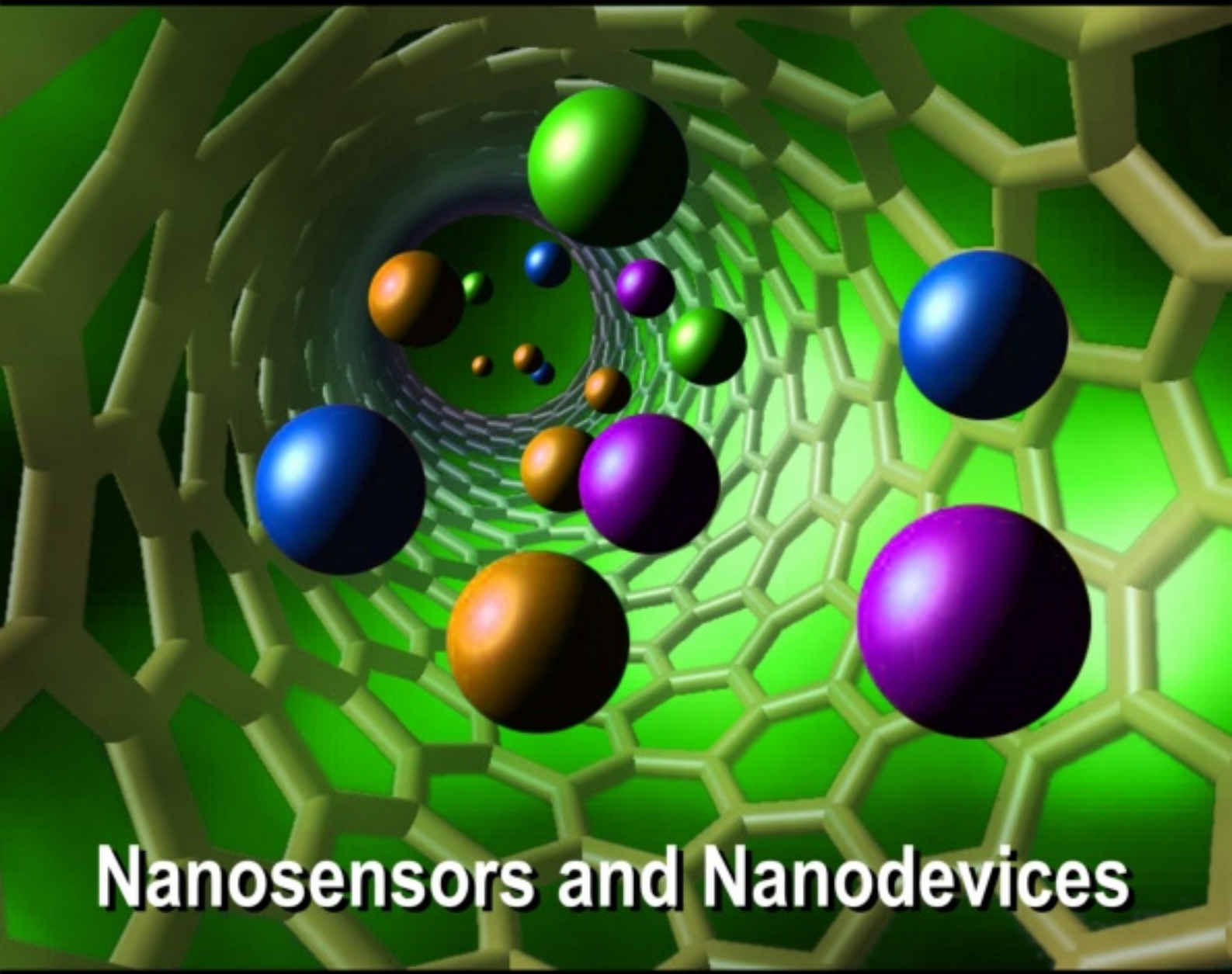

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Theory and Instrumentation Related to Anomalous Dielectric Dispersion in Ordered Molecular Groups

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Abstract: Anomalous dispersion of light leading to sharp changes of dielectric constant around natural frequencies of electrons in a molecule is a well known phenomenon. A similar phenomenon was reported in our earlier papers around allowed values of acoustic vibration frequencies of ordered molecular groups in a semiconductor wafer subjected to alternating electric field. This paper reports recurrence of similar thing in sugar crystals and sugar of milk, molecules of which are believed to be ordered by soaking them in homoeopathic medicines. A novel instrumentation method is employed here to observe the frequency-domain signature of the samples. These behaviors are observed repeatedly and recorded through the experimental arrangement. Further, the experimental results and the nature of results obtained from MATLAB-simulation support each other. *Copyright © 2007 IFSA.*

Keywords: Anomalous dispersion, Ordered molecular groups, Acoustic vibration frequencies, Homoeopathic medicines.

1. Introduction

Anomalous dispersion of light leading to sharp changes of dielectric constant around natural frequencies of electrons in a molecule is a well known phenomenon**.** A similar phenomenon was reported in our earlier papers [1-3] around allowed values of acoustic vibration frequencies of ordered molecular groups in a semiconductor wafer subjected to alternating electric field. Dielectric behaviours

of different materials both in solid and liquid forms are reported in different research works. Dielectric behavior study is carried out at different frequency range for DNA solution [4]. The results of these measurements indicate the presence of two anomalous dispersions at more than 1 MHz range. Dielectric measurements have been made on various soft tumour and normal tissues between 0.01 and 17 GHz at body temperature [5]. In [6] a new procedure is described to calculate the dielectric dispersion of a solution of globular protein molecules.

Homoeopathic medicines of sufficiently high potency (30^{th} or above) can not even theoretically contain atoms/molecules of the original medicinal substances. For example, [7] shows that one atom of Sulphur can be ascertained in a popular medicine like Sulphur-30 when its mass exceeds the mass of about 15,132 Suns ! Any theoretical or experimental research on such potentised medicines assuming presence of atoms or molecules of the original medicinal substance becomes an irrelevant work. Still, they have been found to cure diseases again and again for about two centuries in millions of cases. It is very unfortunate that there had all along been lack of a scientifically acceptable explanation of a basic question related to such a wonderful system of medicines called homoeopathy. The question is: wherein lies the medicinal value of sufficiently potentised (loosely called as diluted) homoeopathic medicines? There are many theoretical and experimental explanations advanced by different researchers since last 50 years from different areas of science which is briefly reported in a review literature [8]. In 1951 Alphonse Gay of France first reported that serially agitated dilutions have dielectric stress indices, which differ from their vehicles, the distilled water in which they were made [9]. Using a modified galvanometer he also showed that the dielectric stress measure for a particular dilution is specific for the substance in dilution as well as for the degree of dilution. This work is repeated for mercuric chloride again in 1966 by some other researchers [10] with the help of a 50 KV AC Dielectric Tester. They reported that the structure of the water itself is changed to act as if it actually carries the molecules of the governing mercuric chloride substance itself. In 1982 a team of Indian scientists measured the capacitance, resistance and dielectric dispersion of some agitated dilutions of some selected compounds using a LCR bridge and time domain reflectance spectroscopy [11]. They also showed dielectric indices for the dilutions.

The work reported in this paper simplifies the identification of potentised homoeo-medicines through spectral signature obtained by dielectric dispersion effect. This work is a continuation of same kind of investigation in ordered molecular groups as stated above. That homoeo-medicines can not be anything except specifically ordered molecular groups, is theoretically proposed by Mahata [12-15]. The present work seems to support that theoretical model. This is, however, just a beginning.

2. Theory

Electromagnetic radiation loses energy to a material medium at frequencies corresponding to allowed optical and acoustic modes of vibration of the material. But, electromagnetic radiation comprises of electric and magnetic fields. The ratio of the magnetic and electric forces exerted on an electron is [16] $\frac{v}{c}$ and it is less than 10^{-3}, where v is the velocity of orbiting electron and c is the velocity of light. For nuclear charge the velocity and hence the force ratio is still smaller. In other words, the major contribution to displacement of charges comes from the electric field. So, we concentrate on electric field only.

The phenomenon of dielectric dispersion follows from electrical properties of materials. In simplest case let us consider a linear chain of length L having N identical lattice atoms of spacing a as shown in Fig. 1. The atoms are considered to be connected by springs according to the Lorentz model. They are subjected to the lattice vibration or phonons [17], resultant displacement of n^{th} atom of which is:

$$\delta_n(t) = 2\delta_0 \sin(kna) \cdot \cos(\omega t) \tag{1}$$

This is the expression of a standing wave. The allowed values of k and ω are $\frac{p\pi}{L}$ and $\frac{\pi cp}{L}$ respectively. The wavenumber k=2π/λ ; $p = 1, 2, \ldots (N-1)$; $\lambda =$ wavelength and δ_0 is the amplitude of oscillation.

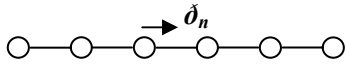

Fig. 1. A simple chain lattice of identical atoms.

Now, the general equation of motion of charge (having mass m and charge q) in an electric field is given by

$$\frac{d^2\delta}{dt^2} + \gamma \frac{d\delta}{dt} + \omega_a^2 \delta = \frac{q}{m} \cdot E \tag{2}$$

The motion is affected by friction in the guise of a damping force, where, ω_a is the natural frequency of oscillation of the charge, δ is the displacement of the oscillator, γ is the damping coefficient, and E is the electric field incident on the material. For the longitudinal acoustic mode oscillation the spring constant is approximately equal to $m\omega_a^2$ where the electric field is assumed to be time harmonic with frequency ω.

Taking $E = E_m \cdot e^{jwt}$ for the electric field we get the solution of equation (2) as

$$\delta = \frac{q}{m} \cdot \frac{E_m \cdot e^{jwt}}{(\omega_a^2 - \omega^2) + j\gamma\omega} \tag{3}$$

When we have an alternating electric field applied to a chain of atoms along its longitudinal direction, then this field will try to push the center of gravity of positive charges (associated with nuclei) along the direction of the field and simultaneously pull center of gravity of orbiting electrons towards the field, giving rise to electric dipoles oscillating along the field axis. The mass of any nucleus is much greater than the mass of an electron. So, displacement of nuclei will be much smaller than displacement of electrons. This is indicated by equation (3) also. As a result,

(i) The dipole moment will be mainly due to electron displacement.

(ii) Nevertheless, motion of nuclear charges will also follow same pattern as that of electrons, though of lower amplitudes. Nuclei are the lattice points of the linear chain. They are subjected to oscillating forces by the electric field.

(iii) In a standing wave [eqn. (1)] different particles have different amplitudes of vibration, because $\sin(kna)$ will have different values for different particles. But, all the particles vibrate in same time phase, because same $\cos\omega t$ term is associated with each particle, where ω can take up only the values given by ω_p. As such, an electric field will be able to excite this mode of vibration. Resonance will also occur when excitation frequency coincides with one of the allowed value of ω_p. In other words, the chain of atoms will have similar standing waves with same allowed values of frequency, wavelength etc as derived earlier in the discussion related to lattice vibrations.

(iv) Similar will be the case for electrons, except that they will be displaced with respect to the nuclei.

The above discussion enables us to rewrite eqn. (3)

For an electron:

$$\delta = \frac{q}{m_e} \cdot \frac{E_m \cdot e^{jwt}}{(\omega_p^2 - \omega^2) + j\gamma\omega} \tag{4a}$$

For nuclear charge:

$$\delta' = \frac{q}{m_p} \cdot \frac{E_m \cdot e^{jwt}}{(\omega_p^2 - \omega^2) + j\gamma\omega} \tag{4b}$$

Here, q is charge associated with each dipole, m_e is mass of an electron and m_p is mass of nucleus.

It is to be noted here that amplitude of vibration of different charged particles is different and hence the associated electric fields will also be different. Nevertheless, the dipole moments will add together to produce the total dipole moment. As argued above, considering that mainly the electrons contribute the dipole moment, total dipole moment of a chain of atoms consisting of N atoms is:

$$P = \sum_{p=1}^{N} q\delta_n = \sum_{p=1}^{N} \frac{q^2}{m_e} \cdot \frac{E_{nm}}{(\omega_p^2 - \omega^2) + j\gamma\omega}$$

$$= \frac{q^2}{m_e} \cdot \frac{\alpha}{(\omega_p^2 - \omega^2) + j\gamma\omega} N\langle E_{av} \rangle = \frac{q^2}{m_e} \cdot \frac{\alpha}{(\omega_p^2 - \omega^2) + j\gamma\omega} \sum_{p=1}^{N} E_{nm} \tag{5}$$

Here, α is a constant and E_{nm} is maximum value of E for the n^{th} particle. Now, from Maxwell's equations we can get a complex displacement, D., given by:

$$\underline{D} = \varepsilon(\omega)E = \varepsilon_0 E + P\,, \tag{6}$$

where $\varepsilon(\omega)$ is the complex dielectric function and ε_0 is dielectric constant of free space. Substituting P from eqn. (5), eqn. (6) becomes

$$\varepsilon(\omega) = \varepsilon_0 + \frac{Nq^2}{m_e} \cdot \frac{\alpha}{(\omega_p^2 - \omega^2) + j\gamma\omega} \tag{7}$$

The dielectric function is a complex quantity and therefore, can be separated into the real part $\varepsilon'(\omega)$ and imaginary part $\varepsilon''(\omega)$ as:

$$\varepsilon(\omega) = \varepsilon'(\omega) + j\varepsilon''(\omega) \tag{8}$$

$$\varepsilon'(\omega) = \varepsilon_0 + \frac{\alpha Nq^2}{m_e} \cdot \frac{(\omega_p^2 - \omega^2)}{(\omega_p^2 - \omega^2)^2 + \gamma^2\omega^2} \tag{9}$$

$$\varepsilon''(\omega) = -\frac{\alpha Nq^2}{m_e} \cdot \frac{\gamma\omega}{(\omega_p^2 - \omega^2)^2 + \gamma^2\omega^2} \tag{10}$$

The frequency dependence of $\varepsilon'(\omega)$ and $\varepsilon''(\omega)$ are shown in Fig. 2.

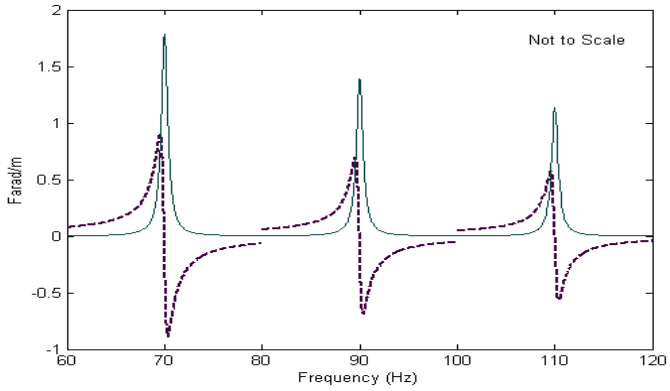

Fig 2. The variation of the real part ε' (dashed) and imaginary part $-\varepsilon''$ (solid) of the dielectric function w.r.t. frequency.

For a small region close to the resonance frequency of the oscillator ω_p, the value of ε' decreases with increasing ω. This behavior is known as anomalous dispersion. The height of the peak of ε'' as well as width of the region is dependent on the value of damping constant γ.

Thus we see that when a sample of macromolecule or crystal is placed in an alternating electric field, whose frequency coincides with a frequency of normal mode of vibration (but the strength is less than the breakdown value of the sample), then a resonance occurs. Dielectric dispersion causes sharp change of ε around this frequency involving resonance absorption of power. This will lead to a sharp phase shift of current drawn from the exciting signal in addition to the continuous phase shift with frequency. In the circuit model used for simulation purpose in section 5, this can be conveniently represented by a 'suitable imperfect capacitor' whose dielectric function ε is a function of frequency as given by Eqn. (8) whose components ε' and ε'' are graphically represented in Fig. 2 and by Eqns. (9) and (10). The direct experimental arrangement and results are described in section 3 and 4 below.

3. Experimental Technique

The experimental technique adopted for verification of coded molecular clusters is based on the phenomenon that a certain macromolecule or a coded structural unit will have its own natural or characteristic modes of vibration – both optical and acoustic modes. In other words, it will possess some resonance absorption frequencies peculiar to itself both in optical and acoustic modes. Experimentally the acoustic mode can be studied very conveniently by placing the sample in an alternating electric field, whose frequency can be varied quite conveniently with high resolution. Theoretical model described in section 2 for a simple chain lattice of identical atoms or molecules, forced to oscillate in an electric field, shows the variation of the real and imaginary parts of the dielectric constant, as a function of frequency. As a result of this dielectric dispersion, there is sudden change of dielectric constant at the points of resonance frequencies. So, a capacitor having such a substance as its dielectric medium will undergo sharp change in its capacitance value and the loss angle around these frequencies. Resonance frequencies for this mode is found from the simple equation $\lambda\gamma = c'$, where, λ = wavelength, γ = frequency, c′ = velocity of sound. Wavelength λ has discrete values and can be determined from the dimensions of coded molecular structure. As per

Kireev [18], only such vibrations can take place, the wavelengths of which are equal to integral umber of lattice constants. This forms the basis of the experimental technique adopted by us.

Block diagram of its experimental arrangement is given in Fig. 3. It is to be noted here that observation of the resonance frequencies related to molecular systems will be possible only when the excitation is very stable. This requirement is satisfied by Agilent make signal generator, model-8648A having a frequency stability better than 1 ppm. It is having a wide frequency range, the minimum step of frequency variation being 1 mHz only. It is interfaced with a Personal Computer through General Purpose Interface Bus (GPIB) for getting continuously variable frequency sinusoidal signal, controlled by a software programme. We used Agilent-developed VEE Pro software tool for the above purpose having a user-friendly graphic display. The same PC also controls the Agilent make Data Acquisition Unit, model 34970A through another GPIB bus. Except for the instruments mentioned, all other blocks of the experimental arrangement are fabricated on a PCB and are as described below.

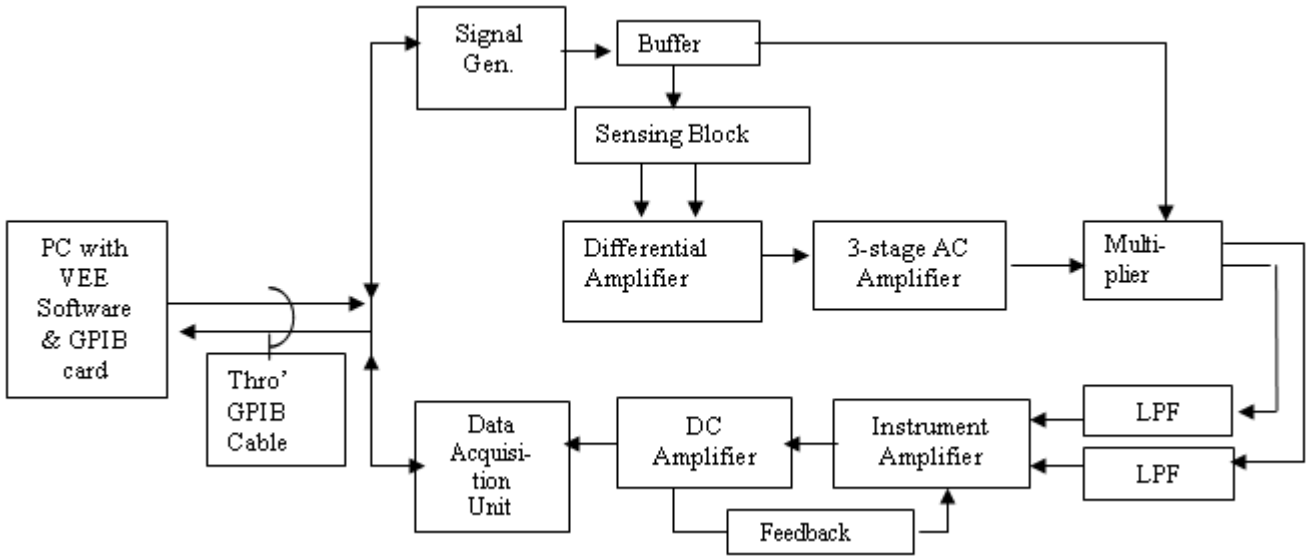

Fig. 3. The block diagram of the experimental arrangement.

Sensing Block: The Sensing Block is constructed in the form of two capacitors, one containing a sample as the dielectric (this is called the test cell) and the other containing a standard unpotentised vehicle material (this is called the standard cell). The output of the two cells is connected with a differential amplifier. However, this is a weak signal and needs amplification.

For convenience, experiments are carried out with medicated powder of sugar of milk when experimenting with homoeopathic medicines. It is because Sugar of milk is being successfully used as a standard preservative for homoeopathic medicines from Hahnemann's time. Scientific support behind this is that all the bio-molecules fit in nicely within the hollows of water crystals implying that molecular clusters of water can suitably bend the molecular structure of sugar of milk, which is like imparting an imprint to it. So, for obtaining the differential spectra, samples were prepared by soaking powder-form of sugar of milk kept on filter paper with medicines in liquid form. Such filter papers acted as dielectrics for the test cell. Same procedure was adopted for the standard cell also except that the medicated sugar of milk was replaced by unmedicated one.

A.C. Amplifier Block: The output of the sensing block is amplified by a differential amplifier and through three high frequency amplifier stages. Surface mounting IC chips AD 8009 with low distortion 1 GHz bandwidth from Analog Devices are used for these purposes. As a result of the dielectric

dispersion there is change of magnitude and phase of the signal at the output of the differential amplifier. If the output of the amplifier block in absence of it is *Asin ωt*, then its output during the dispersion may be represented by $v_1 = A' \sin(\omega t + \delta)$. This is fed to the Multiplier via the three stages AC amplifier. Another input of the Multiplier chip is $v_2 = B \sin \omega t$ (say).

Multiplier Block: The 500 MHz four quadrant multiplier IC chip AD834 (from Analog Devices) is used for the multiplication operation. When dielectric dispersion occurs, for two inputs $v_1 = A' \sin(\omega t + \delta)$ and $v_2 = B \sin \omega t$ to the multiplier, the output becomes

$$A' \sin(\omega t + \delta).B \sin \omega t = A'B.\left[\frac{1-\cos 2\omega t}{2} \cos\delta + \frac{\sin 2\omega t}{2} \sin\delta\right]$$

Low Pass Filter and Instrumentation Amplifier Block: The above output contains a double-frequency term and a d.c. term. When it is passed through a low pass filter (LPF), the d.c. term, $\frac{A'B}{2}\cos\delta$ will appear at the output of LPF. This dispersion–dependent term is further amplified through an instrumentation amplifier. The instrumentation amplifier used for this purpose is AD524 (Analog Devices) which is a precision type monolithic amplifier designed for data acquisition application with high accuracy. The gain of the amplifier is programmed at 800.

It is followed by a D.C. amplifier for increasing the overall gain of the system and serving as a buffer between the instrumentation amplifier and the Data Acquisition unit following it. The photographic view of the complete laboratory experimental setup is shown in Fig. 4.

Fig. 4. The Laboratory experimental setup view.

4. Experimental Results and Discussion

The differential spectrum or frequency-domain signature of the test sample is recorded through continuous scan by the PC operated data acquisition unit. The experiment is first carried out for the crystalline structures with known dimensions to establish the correctness of our approach and proper functioning of the developed instrumentation system. First dielectric dispersion phenomena are observed for silicon wafer inside the IC-chips (reported earlier [1]). To establish the theory again in the correct direction, the next set of experimentation is done using normal sugar sample (approximate size 1.1 mm x 1.2 mm x 1.1 mm) in place of sugar of milk in the sensing block described in the section 3. For the experiment the input signal amplitude was set as -8.0 dB and frequency-step was selected as 10 Hz. The duration of excitation at each frequency was set at 500 ms. It is used to scan and record

data (voltage amplitude) continuously through VEE Pro software based strip-chart with variable frequency but constant amplitude excitation signal. In our experiment we set scales of 200 μVdc/div for *y*-axis and 20 sec/div for *x*-axis. The experiment is carried in a stable temperature environment condition (25^0 C). Now, during scan, the sharp changes of voltage levels are observed at selective frequencies seemingly due to dielectric dispersion. The occurrence of the peaks is repeated with every fresh sample of sugar. But for the same sample, it is observed that after a few runs the repetition does not occur and the sugar gets visually discolored (brownish). This is indicative of softness of the induced orderly structures and their destruction due to the stress of alternating electric field. The result for sugar is shown in Table 1.

Table 1. Experimental Results for Sugar Sample.

Sample	Signal Frequency (KHz)	Change of dc voltage level(μV)	Signal Frequency (KHz)	Change of dc voltage level(μV)
Sugar (1.1mm x 1.2mm x 1.1mm)	Run-1		Run-2	
	111	430	112.3	430
	124	450	125.1	440
	220	420	221.8	430

An event log file documenting the occurrence of the peaks is also generated from the operating software. One such event log file is shown in Fig. 5 for the sugar sample.

Entry Type	Channel	Date/Time	Event Description
Download	203	Before Scan	08/11/05 02:55:32 PM - Setup download
Start	0	08/11/05 01:59:40.286	Test Started - Immediate
High Limit	203	08/11/05 02:01 :38.788	Scan = 238. Value = -0.00123387
High Limit	203	08/11/0502:01:44.288	Scan = 249. Value = -0.00129679
High Limit	203	08/11/05 02:04:42.288	Scan = 604. Value = -0.00126527
High Limit	203	08/11/05 02:05:51.788	Scan = 743. Value = -0.00129969
High Limit	203	08/11/05 02:06:21.788	Scan = 803. Value = -0.00127153
High Limit	203	08/11/05 02:06:55.288	Scan = 870. Value = -0.00121722
High Limit	203	08/11/05 02:09:04.288	Scan = 1128. Value = -0.00125778
Stop	0	08/11/0502:09:25.792	Test Terminated - by User

Fig. 5. The Recorded 'Event Log' by Data Acquisition unit for Sugar sample.

After the successful observation of results the next sets of scans are done using the sample of sugar of milk soaked with homoeo-medicine Sulphur of different potencies taken from different commercial manufacturers available in market. The same amplitude -8.0 dB is set for the input signal. The observation of dielectric dispersion in the form of change of voltage level for three different potentised homoeo-medicines viz. Sulphur-30, Sulphur-200 and Sulphur-1M is presented for thee separate samples in Table 2. A typical strip chart is also shown in Fig. 6. Discoloration of sugar of milk is also observed after a few runs. Results are repetitive for every fresh sample of medicine.

Table 2. Experimental Results for Sulphur - a homoeo-medicine.

Sample	Signal Amplitude	Run-1		Run-2		Run-3	
		Signal Frequency (KHz)	Change of dc voltage level (µV)	Signal Frequency (KHz)	Change of dc voltage level (µV)	Signal Frequency (KHz)	Change of dc voltage level (µV)
Sulphur-30 Batch No. 4525	- 8.0 dB	173.5	320	174.8	300	173.5	300
		219.1	320	217.9	320	217.6	300
		238.2	300	237.1	300	236.5	300
		266.9	290	267.5	280	266.8	290
		365.2	300	362.2	300	365.2	300
		446.2	290	445.5	290	443.8	290
		552.5	300	551.8	290	553.0	290
Sulphur-200 Batch No. 4090	- 8.0 dB	150.2	220	151.3	200	151.0	200
		180.1	200	181.4	210	180.5	200
		256.7	200	257.0	220	257.0	200
		347.5	210	345.9	220	346.5	210
		385.0	210	384.5	200	383.9	200
		502.2	220	502.4	220	502.9	210
		536.5	210	537.8	200	537.0	200
Sulphur-1M Batch No. 4328	- 8.0 dB	489.6	620	488.0	620	489.9	620
		498.5	700	498.4	700	498.6	700
		586.5	650	588.5	650	587.0	650
		591.5	670	590.4	670	590.5	670
		601.2	700	603.8	700	602.5	700
		705.2	720	706.7	720	705.2	720
		764.3	680	765.3	680	764.0	680

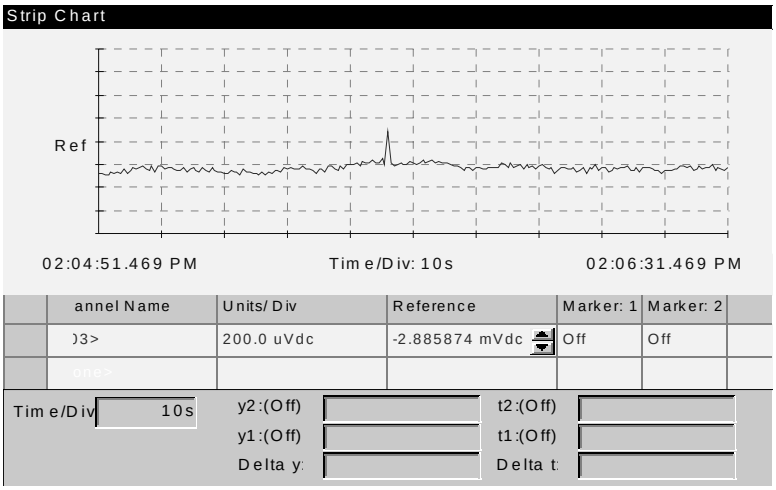

Fig. 6. The Recorded output by Data Acquisition unit for Sulphur-30 sample.

5. Simulation Results

Based on the discussion in sections 2 and 3, the experimental instrumentation can be represented by a simulated diagram as shown in Fig. 7. The sensing block is represented by two capacitors. The capacitor C_1 for the 'test' cell has a dielectric, the permittivity of which can be represented as

$\varepsilon = \varepsilon' + j\varepsilon''$ as given by Eqn. (8), ε' and ε'' being given by Eqns. (9) and (10), whose plots against frequency are shown in Fig 2. This capacitance can be represented as $C_1 = K\,(\varepsilon' + j\varepsilon'')$, where K = a constant, depending on the dimensions of the coded structure. Writing V_a (in Fig. 8) in terms of complex quantities for input signal = $V\angle 0^0$

$$\begin{aligned} V_a\angle\delta_1 &= \frac{R}{R + 1/j\omega C_1}.V\angle 0^0 = \frac{j\omega C_1 R}{1 + j\omega C_1 R}.V\angle 0^0 \\ &= \frac{j\omega RK\,(\varepsilon' + j\varepsilon'')}{1 + j\omega RK\,(\varepsilon' + j\varepsilon'')}.V\angle 0^0 \\ &= VR.\frac{-\omega K\varepsilon'' + j\omega K\varepsilon')}{(1 - R\omega K\varepsilon'') + jR\omega K\varepsilon'} \\ &= VR.\frac{a + jb}{c + jd} \end{aligned} \tag{11}$$

where, $a = -\omega K\varepsilon''$; $b = \omega K\varepsilon'$; $c = (1 - R\omega K\varepsilon'')$; $d = R\omega K\varepsilon'$.

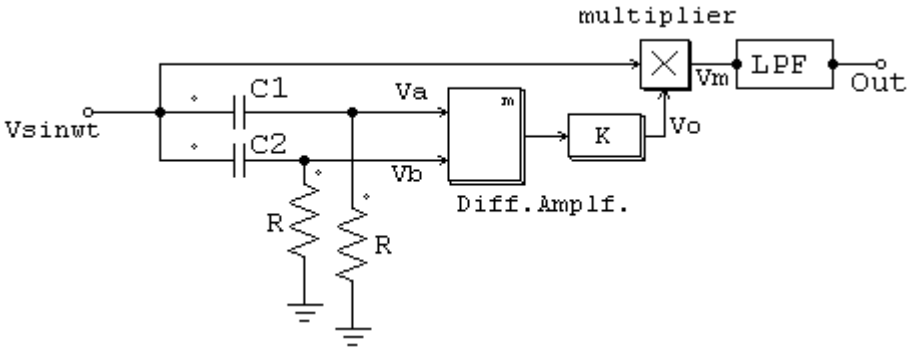

Fig. 7. Simulated circuit representation of the experimental setup.

The capacitor C_2 for the 'standard' cell has a dielectric, the permittivity of which is assumed constant with respect to frequency.

Again writing V_b (in Fig. 8) in terms complex quantities for input signal = $V\angle 0^0$

$$\begin{aligned} V_b\angle\delta_2 &= \frac{R}{R + 1/j\omega C_2}.V\angle 0^0 = \frac{j\omega C_2 R}{1 + j\omega C_2 R}.V\angle 0^0 \\ &= V.\frac{j\omega.p}{1 + j\omega.p} \end{aligned}, \tag{12}$$

where, $p = C_2 R$

Now, the output of the differential amplifier and ac amplifier with two inputs V_a and V_b and overall gain G is V_o,

$$V_0\angle\delta = G\,(V_a\angle\delta_1 - V_b\angle\delta_2)\,.$$

The corresponding time function is $\sqrt{2}V_0\sin(\omega t + \delta)$. The multiplier output,

$$V_m = \sqrt{2}V_0 \sin(\omega t + \delta).\sqrt{2}V \sin \omega t = 2VV_0.\left[\frac{1-\cos 2\omega t}{2}\cos\delta + \frac{\sin 2\omega t}{2}\sin\delta\right]$$

Output of LPF (V_{out}) will correspond to the d.c. term only.

$$V_{out} = VV_0 \cos\delta \tag{13}$$

[This dispersion–dependent dc signal, being a weak one, is amplified through the instrumentation amplifier and is recorded by the data acquisition unit.]

Now, taking the help of MATLAB software, the voltage V_{out} is plotted as a function of frequency ω using Eqns. (9) - (13). The appropriate value of the constants (N, q, m, γ) in Eqns. (9) and (10) are considered accordingly. The natural or resonant frequency (f_0 or $\omega_0/2\pi$) of the acoustic wave can be calculated from eqn. $\lambda f_0 = v$, where λ/2= half wavelength (available from the coded structures), v= velocity of sound in the medium. Now using these values along with some suitably chosen values for K, R, V, the graphical plot of the Eqn. (13) is made using MATLAB and the result is shown in Fig. 8. Here, the natural frequency is assumed as 400 KHz. Sharp peak is observed at the resonant or natural frequency.

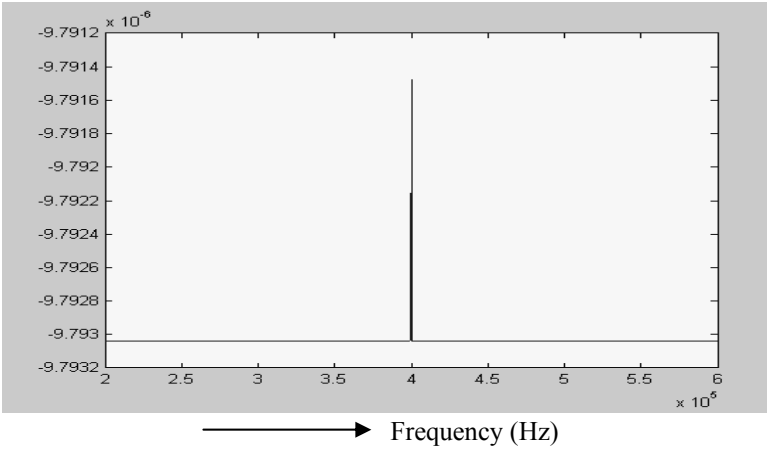

Fig. 8. Simulation output using MATLAB.

6. Conclusion

The experimental results described in section 4 and the nature of results obtained from simulation as given in section 5 support each other. They prove the correctness of our direction of investigation for scientific basis of homoeopathic medicines. Detection and/or identification of potentised homoeopathic medicines are now a possibility through this experimental technique. It is supported by a logically consistent theory too. Although sufficiently potentised homoeo-medicines can not contain any atoms/molecules of the original medicinal substances, their claim to be recognized as genuine medicines will be strengthened by this research work. Investigations in the wider frequency range for various medicines from different manufacturers are continuing. This is expected to generate more data related to medicines. Moreover, the spectral method conceived in this research work developing a suitable instrumentation system is expected to yield richer information and is full of promise related with homoeo-medicines.

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Guide for Contributors

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