Evaluation of the Isotopic Abundance Ratio in Biofield Energy Treated Resorcinol Using Gas Chromatography-Mass Spectrometry Technique

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Abstract

The stable isotope ratio analysis is widely used in several scientific fields such as agricultural, food authenticity, biochemistry, metabolism, medical research, etc. Resorcinol is one of the most versatile chemicals used for the synthesis of several pharmaceuticals, dyes, polymers, organic compounds, etc. The current research work was designed to investigate the impact of the biofield energy treatment on the isotopic abundance ratios of $^{13}$C/$^{12}$C or $^{2}$H/$^{1}$H or $^{17}$O/$^{16}$O (P$_{M+1}$/P$_{M}$) and $^{18}$O/$^{16}$O (P$_{M+2}$/P$_{M}$) in resorcinol using Gas chromatograph - mass spectrometry (GC-MS) technique. Resorcinol was divided into two parts - one part was control and another part was considered as biofield energy treated sample. The biofield energy treatment was accomplished through unique biofield energy transmission by Mr. Mahendra Kumar Trivedi (also called as The Trivedi Effect®). T1, T2, T3, and T4 were denoted by different time interval analysis of the biofield treated resorcinol in order to understand the influence of the biofield energy treatment on isotopic abundance ratio with respect to the time. The GC-MS spectra of the both control and biofield treated resorcinol exhibited the presence of molecular ion peak [M+1] at m/z 110 (calculated 110.04 for C$_{6}$H$_{4}$O$_{2}$) along with major fragmented peaks at m/z 82, 81, 69, 53, and 39. The relative peak intensities of the fragmented ions in biofield treated resorcinol (particularly T2) was significantly changed with respect to the control sample. The stable isotope ratio analysis in resorcinol using GC-MS revealed that the percentage change of the isotopic abundance ratio of PM+1/PM was increased in the biofield treated resorcinol at T1, T2, T3 and T4 by 1.77%, 165.73%, 0.74%, and 6.79%, respectively with respect to the control sample. Consequently, the isotopic abundance ratio of P$_{M+2}$/P$_{M}$ in the biofield treated resorcinol at T2, T3, and T4 were enhanced by 170.77%, 3.08%, and 12.31%, respectively with respect to the control sample. Briefly, $^{13}$C, $^{2}$H, $^{17}$O contributions from (C$_{6}$H$_{4}$O$_{2}$)$^{+}$ to m/z 111 and $^{18}$O contribution from (C$_{6}$H$_{4}$H$_{2}$O)²⁺ to m/z 112 for the biofield treated resorcinol at T2 and T4 were significantly altered as compared to the control sample. For these reasons, biofield treated resorcinol might exhibit altered physicochemical properties like diffusion velocity, mobility and evaporation rate, reaction rate, binding energy, and stability. Biofield treated resorcinol could be valuable in pharmaceutical and chemical industries as intermediates during the preparation of pharmaceuticals and chemical compounds by altering its physicochemical properties, the reaction rate and selectivity, the study of the reaction mechanism and facilitating in designing extremely effective and specific enzyme inhibitors.

Keywords: Biofield energy treatment; The Trivedi Effect®; Resorcinol; Gas chromatograph-mass spectrometry; Isotopic abundance ratio; Isotope effects

Abbreviations

A: Element; GC-MS: Gas chromatography-mass spectrometry; M: Mass of the parent molecule; m/z: Mass-to-charge ratio; n: Number of the element; P$_{M}$: The relative peak intensity of the parent molecular ion [M$^{+}$]; P$_{M+1}$: The relative peak intensity of isotopic molecular ion [(M+1)$^{+}$)]; P$_{M+2}$: The relative peak intensity of isotopic molecular ion [(M+2)$^{+}$)]; R$_{t}$: Retention time

Introduction

Stable Isotope Ratio Analysis (SIRA) is the analysis of natural abundance variations in stable isotopes include $^{2}$H, $^{13}$C, $^{15}$N, $^{18}$O, $^{34}$S, $^{37}$Cl, etc. which have different atomic masses due to the variation in number of neutrons in the nucleus and is a powerful technique for the measurement of the flow of materials and energy both within and among organisms [1-3]. This technique is widely applied in various scientific fields such as agricultural, food authenticity, biochemistry, metabolism, medical research, forensic chemistry, military, sports, environmental pollution, earth and planetary sciences, archaeology, etc. [2-6]. The change in isotopic abundance ratio between the isotopic forms of the molecule causes isotope effects i.e. the alterations in physical and chemical properties of the molecule because of their tiny mass differences [5,6]. The isotopic composition of the isotopic molecules is considered through isotopic amount fractions or isotopic amount fractions [7]. It has been found from the literature that change in isotopic composition of the molecule has an effect on its chemical reactions (reaction rate and bond strength), physicochemical properties, thermal motion, molecular spectra, chemical equilibria, etc. [5-9]. SIRA is applied in pharmaceutical industry for the determination of the pharmacokinetic profile or mode of action of a drug substance, bioavailability of the drug products, the release profile for the drug delivery systems and also used for the assessment in relation to patient-specific drug treatment [4]. Mass spectrometry (MS) technique is the major choice for the isotope ratio analysis, although other techniques such as infrared (IR) spectroscopy, nuclear
magnetic resonance (NMR) spectroscopy, and neutron activation analysis (NAA) can be used [7,10]. The measurement of the ratio of natural isotopic abundances in the molecules having molar isotope enrichments at below 0.1% is usually performed on a specialized instruments like isotope ratio mass spectrometer (IRMS), multiple collector inductively coupled plasma mass spectrometry. Various interfaces such as elemental analyzers (EA-IRMS), gas chromatographs (GC-IRMS) and liquid chromatographs (LC-IRMS) are commonly applied to introduce samples into the IRMS [2,4,10]. If the molar isotope enrichment levels of the molecule are above 0.1%, conventional scanning mass spectrometer such as GCMS, LCMS, HRMS, etc. is able to perform isotope ratio measurement at low micromolar concentration levels with sufficient precision. The peak height (i.e. relative intensity) in the mass spectra is directly proportional to the relative isotopic abundance of the sample [11-14].

Resorcinol is one of the most diversified chemical compounds in organic chemistry and backbone of the several pharmaceutilicals. It is a white crystalline dihydric phenolic compound (Figure 1) having a molecular formula C₆H₄O₂ and molecular weight of 110.11. Literature reported that the two hydroxyl groups at 1,3-position in the benzene ring are principally responsible for the high reactivity of resorcinol. Besides, the hydrogen atoms at carbon atoms 2,4 and 6, which are located near to the hydroxyl groups are also reactive [15,16]. Resorcinol and its derivatives have wide application in several areas such as pharmaceuticals, food additives, veterinary products, dyes, agrochemicals, rubber products, flame retardants, UV stabilisers, wood adhesives, polymers, etc. [15-17]. As resorcinol has antibacterial, antifungal and keratolytic activity, it is used for the treatment of various dermatological disorders such as seborrheic dermatitis, psoriasis, corns, warts, and eczema [17,18].

![Figure 1: Structure of resorcinol.](image)

Biofield energy treatment (also known as The Trivedi Effect®) is now-a-days increased its scientific attention for its astounding capability to transform the physical, structural, and thermal properties of several pharmaceuticals [19,20], nutraceuticals [21], organic compounds [22-24], metals and ceramic in materials science [25,26], and improve the overall productivity of crops [27,28] as well as to modulate the efficacy of the various living cells [29-34]. On the other hand, it has been found from the literatures that biofield energy treatment has notable capacity for altering the isotopic abundance ratio of the organic compounds [35-38]. Recently, spectroscopic and thermal analysis in resorcinol revealed that the physicochemical and thermal properties of resorcinol was significantly altered due to the biofield energy treatment. Consequently, the observed findings suggested that biofield treated resorcinol that had reduced volatilization temperature might be useful to increase the rate of those reactions where resorcinol is used as synthetic intermediate [18]. By considering all these aspects, stable isotope ratio analysis of the both control and biofield treated resorcinol using GC-MS was performed here to investigate the effect of the biofield energy treatment on the isotopic abundance of ¹³C/¹²C or ²H/¹H or ¹⁷O/¹⁶O (P₇⁻/P₇) and ¹⁸O/¹⁶O (P₈⁻/P₈) in resorcinol.

Materials and Methods

**Chemicals and reagents**

Resorcinol was obtained from Loba Chemie Pvt. Ltd., India. All the other chemicals used in this experiment were analytical grade purchased from local vendors.

**Biofield energy treatment**

Resorcinol was divided into two portions: one was denoted as untreated or control and other part was considered as biofield energy treated sample. The sample for the treatment was handed over to Mr. Trivedi in a sealed condition. The biofield energy treatment was provided by Mr. Trivedi (also known as The Trivedi Effect®) through his unique energy transmission process to the test product in a sealed pack under laboratory conditions for 5 minutes without touching the sample.

The control and biofield energy treated samples were characterized by Gas Chromatograph - Mass Spectrometry (GC-MS). After treatment, the biofield treated sample was stored at standard laboratory condition and analyzed by GC-MS in different time intervals referred as T1, T2, T3, and T4.

**Gas Chromatograph - Mass Spectrometry (GC-MS)**

GC-MS analysis was conducted on Perkin Elmer/Auto system XL with Turbo mass, USA. The GC-MS was performed in a silica capillary column. It was equipped with a quadrupole detector with pre-filter, one of the fastest, widest mass ranges available for any GC-MS. The mass spectrometer was operated in an electron ionization (EI) positive/negative, and chemical ionization mode at the electron ionization energy of 70 eV. Mass range: 10-650 Daltons (amu), stability: ± 0.1 m/z mass accuracy over 48 hours. The analytes were characterized by retention time and by a comparison of the mass spectra of identified substances with references [42].

**Method for the calculation of isotopic abundance ratio from the GC-MS spectra**

The isotopic abundances of the elements are basically categorized into three types: A elements having only one natural isotope in appreciable abundance; A + 1 elements (For e.g. C, N and H) containing two isotopes – one isotope is one nominal mass unit heavier than the most abundant isotope, and A + 2 elements (For e.g. O, Cl, S, Si, and Br) having an isotope that has two mass unit heavier than the most abundant isotope.

The natural abundance of each isotope can be predicted from the comparison of the height of the isotope peak with respect to the base peak, i.e. relative intensity in the mass spectra [11-14]. The value of the natural isotopic abundance of the some elements are obtained from several literatures and presented in the Table 1 [4,11,12,39,40].
This fragmentation pattern was well matched with the literature [41]. The peaks at m/z 82, 81, 69, 53, and 39 might be due to C_{6}H_{10}^{+}, C_{6}H_{5}^{+}, C_{6}H_{4}^{+}, C_{6}H_{3}^{+}, and C_{6}H_{2}^{+} ions, respectively as shown in Figure 2. The GC-MS spectra of the biofield treated resorcinol at T1, T2, T3, and T4 as shown in Figures 3 and 4 exhibited molecular ion peak [M^+] at m/z 110 at the retention time of 12.35, 12.42, 12.39 and 12.41 min respectively, along with same pattern of fragmentation as shown in the control sample. Only, the relative peak intensities of the fragmented ions for the biofield treated resorcinol at T1, T3 and T4 was slightly changed whether in case of T2, the relative peak intensity of the fragmented ions was significantly altered as compared with the control sample.

Analysis of isotopic abundance ratio

Resorcinol has the molecular formula of C_{6}H_{4}O_{2} and the molecular ion [M^+] peak showed 100% relative intensity. P_{M+1} and P_{M+2} can be calculated theoretically according to the method described in the materials and method.

Results and Discussion

GC-MS analysis

The GC-MS spectra of the control and biofield treated samples at T1, T2, T3 and T4 are presented in the Figures 2-4. The GC-MS spectrum of the control resorcinol (Figure 2) indicated the presence of molecular ion peak [M^+] at m/z 110 (calculated 110.04 for C_{6}H_{4}O_{2}) along with five major fragmented peaks in lower m/z region at the retention time of 12.43 min.
at m/z 110, 111 and 112, respectively were obtained from the observed contribution to m/z 111.

Resorcinol was remarkably matched with the calculated value. 

From the above calculation, it has been found that 13C has major contribution to m/z 111. 

In the similar way, \( P_{M+2} \) can be calculated as follow:

\[
P(\overset{18}{\text{O}}) = \left[(2 \times 0.04\%)\right] / 100\% = 0.08\% 
\]

So, \( P_{M+1} \) i.e. \( 13\text{C}, \overset{2}{\text{H}}, \overset{17}{\text{O}} \) contributions from \( (\overset{13}{\text{C}}_6\overset{2}{\text{H}}_6\overset{17}{\text{O}})_6 \) to m/z 111 = 6.77% 

From the above calculation, it has been found that 13C has major contribution to m/z 111. 

So, \( P_{M+2} \) i.e. 18O contribution from \( (\overset{13}{\text{C}}_6\overset{2}{\text{H}}_6\overset{17}{\text{O}})_6 \) to m/z 112 = 0.40%. 

\( P_{M}, P_{M+1}, P_{M+2} \) for the control and biofield energy treated resorcinol at m/z 110, 111 and 112, respectively were obtained from the observed relative peak intensities of \( [M^+] \), \( [(M+1)^+] \), and \( [(M+2)^+] \) peaks in the GC-MS spectra respectively and are presented in the Table 2. From the Table 2, it has been found that the \( P_{M+1} \) at m/z 111 for the control resorcinol was remarkably matched with the calculated value. The percentage change of the isotopic abundance ratios \( (P_{M+1}/P_M \) and \( P_M \)

\( s^2/P_M \) in the biofield treated sample with respect to the control resorcinol is shown in Table 2 and Figure 5. The isotopic abundance ratios of PM+1/PM at T1, T2, T3, and T4 (biofield treated resorcinol) were increased by 1.77%, 165.73%, 0.74%, and 6.79%, respectively with respect to the control sample. Consequently, the percentage change in the isotopic abundance ratios of PM+2/PM was increased at T2, T3, and T4 (biofield treated resorcinol) by 170.77%, 3.08%, and 12.31%, respectively with respect to the control sample. Briefly, \( ^{13}\text{C}, \overset{2}{\text{H}}, \overset{17}{\text{O}} \) contributions from \( (\overset{13}{\text{C}}_6\overset{2}{\text{H}}_6\overset{17}{\text{O}})_6 \) to m/z 111 and \( \overset{18}{\text{O}} \) contribution from \( (\overset{13}{\text{C}}_6\overset{2}{\text{H}}_6\overset{18}{\text{O}})_6 \) to m/z 112 for the biofield treated resorcinol, particularly at T2 and T4 were significantly altered as compared to the control sample.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Control Resorcinol</th>
<th>Biofield Energy Treated Resorcinol</th>
</tr>
</thead>
<tbody>
<tr>
<td>( P_M ) at m/z 110 (%)</td>
<td>100</td>
<td>T1 100</td>
</tr>
<tr>
<td>( P_{M+1} ) at m/z 111 (%)</td>
<td>6.77</td>
<td>6.89</td>
</tr>
<tr>
<td>( P_{M+2}/P_M )</td>
<td>0.0677</td>
<td>0.0689</td>
</tr>
<tr>
<td>% Change of isotopic abundance ratio ( (P_{M+1}/P_M) )</td>
<td>1.77</td>
<td>165.73</td>
</tr>
<tr>
<td>( P_{M+2} ) at m/z 112 (%)</td>
<td>0.65</td>
<td>0.65</td>
</tr>
<tr>
<td>( P_{M+2}/P_M )</td>
<td>0.0065</td>
<td>0.0065</td>
</tr>
<tr>
<td>% Change of isotopic abundance ratio ( (P_{M+2}/P_M) )</td>
<td>0</td>
<td>170.77</td>
</tr>
</tbody>
</table>

Table 2: Isotopic abundance analysis result of the control and biofield energy treated resorcinol.

From the results, it has been found that after certain day's storage in laboratory conditions after received biofield energy treatment, the isotopic abundance ratio in resorcinol was significantly increased as in case of T2 with respect to the control sample. But, when it was stored for long time, as in case of T3 and T4, the isotopic abundance ratio in resorcinol fall down. This result indicated that the biofield energy treatment might be effective for alteration of the isotopic abundance ratio in resorcinol for a certain period of time after receiving the treatment. Bioplasmic energy field is constituted of ions, free protons and free electrons.

The bioplasmic particles are always reintroduced by chemical processes in the cells and are in constant motion. Thus, the human body exists in surround a dynamic electromagnetic field. This is called as biofield. The energy can freely flow between human and environment that leads to the continuous movement or matter of energy [42-44]. The biofield energy can be harnessed from the earth, the "universal energy field" and can be used through by healing practitioner in order to achieve the significant effects. This process is
known as biofield energy treatment [45,46]. Mr. Trivedi is one of the
owned healing practitioner and has outstanding capability to
modify the characteristic properties of the living and non-living
substance [18-38]. Neutrinos are produced through the nuclear
reactions in sun, cosmic rays, and collapsing stars/ supernovae and can
induce fission reactions within heavy nuclei and affect the natural
abundance of isotopes [47,48]. Neutrinos are the most probable carrier
of the hidden mass in the Universe. These particles blast through the
space and are part of all living systems. Without affecting the human
body, trillions of neutrinos are passing through the body at any given
time [49,50]. As neutrinos are neutrally electric particles, these are
not affected by the electromagnetic forces and are able to pass through
great distances in matter without being affected by the latter. Due to
this, the neutrinos have the ability to interact with protons and
neutrons in the nucleus. Recently, it has been found from the literature
that biofield energy might have effect on the variations of isotopic
composition in water molecule [51]. It is assumed that Trivedi’s unique
biofield energy might have capability to modify the behavior at atomic
and molecular level by changing the neutron to proton ratio in the
nucleus possibly through the introducing neutrino flux inside the
compound. Based on this hypothesis, it is presumed that neutrinos
particles introduction through the biofield energy treatment might
play a role in the alteration of the isotopic abundance ratio (P_{M+1}/P_M
and P_{M+2}/P_M) in biofield treated resorcinol.

The energy of a compound is the amount of the electronic,
vibration, rotational and translation energies. Replacement of the
isotopic composition of the molecule does not affect electronic,
translational and rotational energies of the molecule, but significantly
alters the vibrational energy [7,9]. The vibrational energy is depend on
the reduced mass (µ) for a diatomic molecule as shown in the below [7,9]:

\[ E_0 = \frac{\hbar^2 f}{4\pi^2 \mu} \]

Where \( E_0 \) is the vibrational energy of a harmonic oscillator at
absolute zero or zero point energy

\( f = \) force constant

\( \mu = \) reduced mass \( = \frac{m_a m_b}{m_a + m_b} \), ma and mb are the masses of the
constituent atoms.

The possible isotopic bond formation in the resorcinol molecule and
their effect on the vibrational energy of resorcinol are presented in the
Table 3. The chance of the both carbons containing \(^{13}\)C forming bond
is very rare, statistically nearly 1 in 10,000 [52]. Besides, the chances
for the formation of isotopic bond containing two heavy isotope are
impossible. From the Table 3, it has been observed that alteration of
\(^{12}\)C with \(^{13}\)C for C-C bond, \(^{1}\)H with \(^{2}\)H for C-H and O-H bond, \(^{16}\)O
with \(^{18}\)O for C-O bond have much effect on the vibrational energy of
the molecule. The isotope effect is principally due to the ground state
vibrational energies as shown in the Table 3. The isotopic abundance
ratio analysis clearly indicated that the isotopic abundance ratios of
\(^{13}\)C/\(^{12}\)C or \(^{2}\)H/\(^{1}\)H (PM +1/PM) and \(^{18}\)O/\(^{16}\)O (PM+2/PM) in biofield
treated resorcinol (particularly at T2 and T4) was significantly
increased as compared to the control resorcinol. Hence, biofield treated
resorcinol might display altered isotope effects than the control sample.
Literature described that the heavier isotopic molecules have lower
diffusion velocity, mobility, evaporation rate and reaction rate, but
having higher binding energy than lighter molecules [13]. Several

\begin{table}[h]
\centering
\begin{tabular}{|c|c|c|c|}
\hline
Entry No. & Probable isotopic bond & Isotope type & Reduced mass (\(\mu\)) & Zero point vibrational energy (\(E_0\)) \\
\hline
1 & \(^{12}\)C-\(^{13}\)C & Lighter & 6.00 & Higher \\
2 & \(^{13}\)C-\(^{12}\)C & Heavier & 6.26 & Smaller \\
3 & \(^{1}\)H-\(^{2}\)H & Lighter & 0.92 & Higher \\
4 & \(^{2}\)H-\(^{1}\)H & Heavier & 1.04 & Smaller \\
5 & \(^{12}\)C-\(^{16}\)O & Lighter & 6.86 & Higher \\
6 & \(^{13}\)C-\(^{16}\)O & Heavier & 7.17 & Smaller \\
7 & \(^{12}\)C-\(^{17}\)O & Heavier & 7.03 & Smaller \\
8 & \(^{12}\)C-\(^{18}\)O & Heavier & 7.2 & Smaller \\
9 & \(^{16}\)O-\(^{1}\)H & Lighter & 0.94 & Higher \\
10 & \(^{16}\)O-\(^{2}\)H & Heavier & 1.78 & Smaller \\
\hline
\end{tabular}
\caption{Possible isotopic bond and their effect in the vibrational energy in resorcinol molecule.}
\end{table}

Conclusions
The current analysis inferred that biofield energy treatment had
outstanding capability for altering the isotopic abundance ratio in
resorcinol. The GC-MS spectra of the control and biofield treated
resorcinol exhibited the presence of molecular ion peak [M^+] at m/z
110 (calculated 110.04 for C_{9}H_{10}O_{2}) along with similar pattern of
fragmentation. Among the biofield treated resorcinol, the relative
peak intensity of the fragmented ions in T2 was significantly altered
as compared with the control sample. The isotopic abundance ratio
analysis in resorcinol exhibited that the isotopic abundance ratio of PM
The percentage change of the isotopic abundance ratio of $\frac{P_{M+2}}{P_M}$ was enhanced in the biofield treated resorcinol at T2, T3, and T4 by 1.77%, 165.73%, 0.74%, and 6.79%, respectively with respect to the control sample.

In summary, $^{13}C$, $^2H$, $^{17}O$ contributions from ($C_6H_4O_2$)$^+$ to m/z 111 and $^{18}O$ contribution from ($C_6H_4O_2$)$^+$ to m/z 112 for biofield treated resorcinol at T2 and T4 were remarkably changed as compared to the control sample. Due to the increased isotopic abundance ratio in biofield treated resorcinol, it might show altered isotope effects from the control resorcinol. Biofield treated resorcinol could be advantageous in pharmaceutical and chemical industries as intermediates during the preparation of pharmaceuticals and chemical compounds by altering its physicochemical and thermal properties, the rate of reaction and selectivity, the study of the reaction mechanism and assisting in designing potent enzyme inhibitors.

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