

## 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 <sup>13</sup>C/<sup>12</sup>C or <sup>2</sup>H/<sup>1</sup>H or <sup>17</sup>O/<sup>16</sup>O ( $P_{M+1}/P_M$ ) and <sup>18</sup>O/<sup>16</sup>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<sup>®</sup>). 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 [ $M^+$ ] at  $m/z$  110 (calculated 110.04 for C<sub>6</sub>H<sub>6</sub>O<sub>2</sub>) 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  $P_{M+1}/P_M$  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, <sup>13</sup>C, <sup>2</sup>H, <sup>17</sup>O contributions from (C<sub>6</sub>H<sub>6</sub>O<sub>2</sub>)<sup>+</sup> to  $m/z$  111 and <sup>18</sup>O contribution from (C<sub>6</sub>H<sub>6</sub>O<sub>2</sub>)<sup>+</sup> to  $m/z$  112 for the biofield treated resorcinol at T2 and T4 were significantly altered as compared to the control sample. For this 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<sup>®</sup>; 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)<sup>+</sup>];  $P_{M+2}$ : The relative peak intensity of isotopic molecular ion [(M+2)<sup>+</sup>];  $R_t$ : Retention time

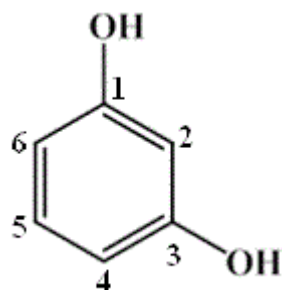
### Introduction

Stable Isotope Ratio Analysis (SIRA) is the analysis of natural abundance variations in stable isotopes include <sup>2</sup>H, <sup>13</sup>C, <sup>15</sup>N, <sup>18</sup>O, <sup>34</sup>S, <sup>37</sup>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 isotope amount ratios or isotope 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 pharmaceuticals. It is a white crystalline dihydric phenolic compound (Figure 1) having a molecular formula  $C_6H_6O_2$  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.

Biofield energy treatment (also known as The Trivedi Effect<sup>®</sup>) 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  $^{13}C/^{12}C$  or  $^2H/^1H$  or  $^{17}O/^{16}O$  ( $P_{M+1}/P_M$ ) and  $^{18}O/^{16}O$  ( $P_{M+2}/P_M$ ) 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<sup>®</sup>) 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:  $\pm 0.1$  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].

Element	Symbol	Mass	% Natural Abundance	A+1 Factor	A+2 Factor
Hydrogen	<sup>1</sup> H	1	99.9885		
	<sup>2</sup> H	2	0.0115	0.015 nH	
Carbon	<sup>12</sup> C	12	98.892		
	<sup>13</sup> C	13	1.108	1.1 nC	
Oxygen	<sup>16</sup> O	16	99.762		
	<sup>17</sup> O	17	0.038	0.04nO	
	<sup>18</sup> O	18	0.200		0.20 nO
Nitrogen	<sup>14</sup> N	14	99.60		
	<sup>15</sup> N	15	0.40	0.40 nN	
Chlorine	<sup>35</sup> Cl	35	75.78		
	<sup>37</sup> Cl	37	24.22		32.50 nCl

**Table 1:** The isotopic composition (i.e. the natural isotopic abundance) of the elements. A represents element, n represents the number of the element (i.e. C, H, O, N, etc.)

Based on the findings from the literatures [11-13], the following method was used for calculating the isotopic abundance ratio in the current study:

$P_M$  stands for the relative peak intensity of the parent molecular ion [ $M^+$ ] expressed in percentage. In other way, it indicates the probability to have A elements (for e.g. <sup>12</sup>C, <sup>1</sup>H, <sup>16</sup>O, <sup>14</sup>N, etc.) contributions to the mass of the parent molecular ion [ $M^+$ ].  $P_{M+1}$  represents the relative peak intensity of the isotopic molecular ion [(M+1)<sup>+</sup>] expressed in percentage = (no. of <sup>13</sup>C x 1.1%) + (no. of <sup>15</sup>N x 0.40%) + (no. of <sup>2</sup>H x 0.015%) + (no. of <sup>17</sup>O x 0.04%) i.e. the probability to have A + 1 elements (for e.g. <sup>13</sup>C, <sup>2</sup>H, <sup>15</sup>N, etc.) contributions to the mass of the isotopic molecular ion [(M+1)<sup>+</sup>].  $P_{M+2}$  represents the relative peak intensity of the isotopic molecular ion [(M+2)<sup>+</sup>] expressed in the percentage = (no. of <sup>18</sup>O x 0.20%) + (no. of <sup>37</sup>Cl x 32.50%) i.e. the probability to have A + 2 elements (for e.g. <sup>16</sup>O, <sup>37</sup>Cl, <sup>34</sup>S, etc.) contributions to the mass of isotopic molecular ion [(M+2)<sup>+</sup>]

Isotopic abundance ratio for A + 1 elements =  $P_{M+1}/P_M$

Similarly, isotopic abundance ratio for A + 2 elements =  $P_{M+2}/P_M$

Percentage (%) change in isotopic abundance ratio =  $[(IAR_{Treated} - IAR_{Control}) / IAR_{Control}] \times 100$ , Where,  $IAR_{Treated}$  = isotopic abundance ratio in the treated sample and  $IAR_{Control}$  = isotopic abundance ratio in the control sample.

## Results and Discussion

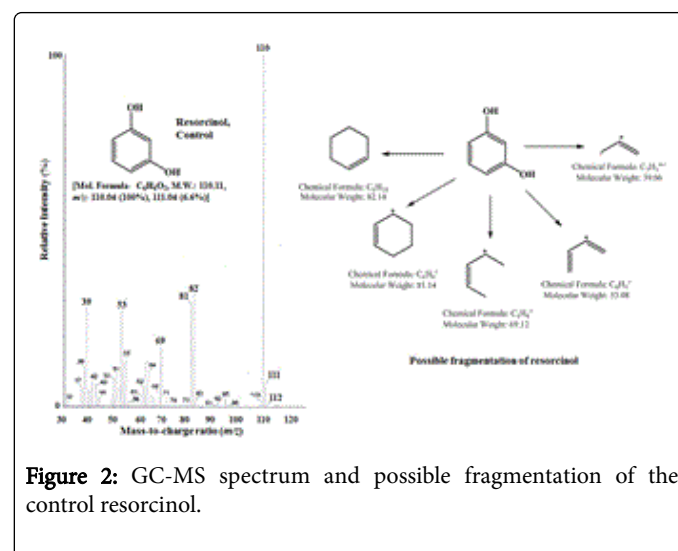
### GC-MS analysis

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<sub>6</sub>H<sub>6</sub>O<sub>2</sub>) along with five major fragmented peaks in lower m/z region at the retention time of 12.43 min.

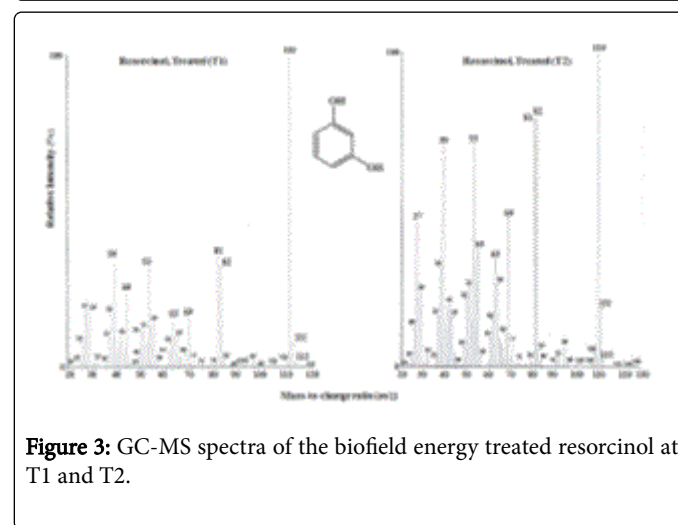
This fragmentation pattern was well matched with the literature [41]. The peaks at m/z 82, 81, 69, 53, and 39 might be due to C<sub>6</sub>H<sub>10</sub>, C<sub>6</sub>H<sub>9</sub><sup>+</sup>, C<sub>5</sub>H<sub>9</sub><sup>+</sup>, C<sub>4</sub>H<sub>5</sub><sup>+</sup> and C<sub>3</sub>H<sub>3</sub><sup>+</sup> 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

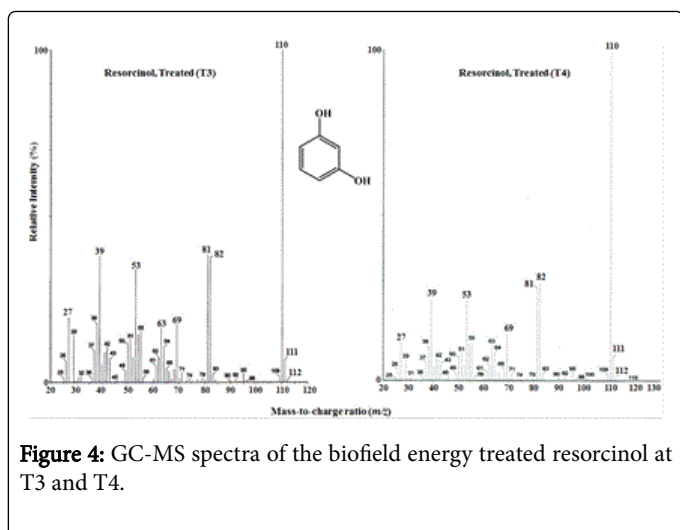
Resorcinol has the molecular formula of C<sub>6</sub>H<sub>6</sub>O<sub>2</sub> and the molecular ion [ $M^+$ ] peak showed 100% relative intensity.  $P_{M+1}$  and  $P_{M+2}$  can be calculated theoretically according to the method described in the materials and method.



**Figure 2:** GC-MS spectrum and possible fragmentation of the control resorcinol.



**Figure 3:** GC-MS spectra of the biofield energy treated resorcinol at T1 and T2.



**Figure 4:** GC-MS spectra of the biofield energy treated resorcinol at T3 and T4.

$P(^{13}\text{C}) = [(6 \times 1.1\%) \times 100\% \text{ (the actual size of the } M^+ \text{ peak)}] / 100\% = 6.6\%$

$P(^2\text{H}) = [(6 \times 0.015\%) \times 100\%] / 100\% = 0.09\%$

$P(^{17}\text{O}) = [(2 \times 0.04\%) \times 100\%] / 100\% = 0.08\%$

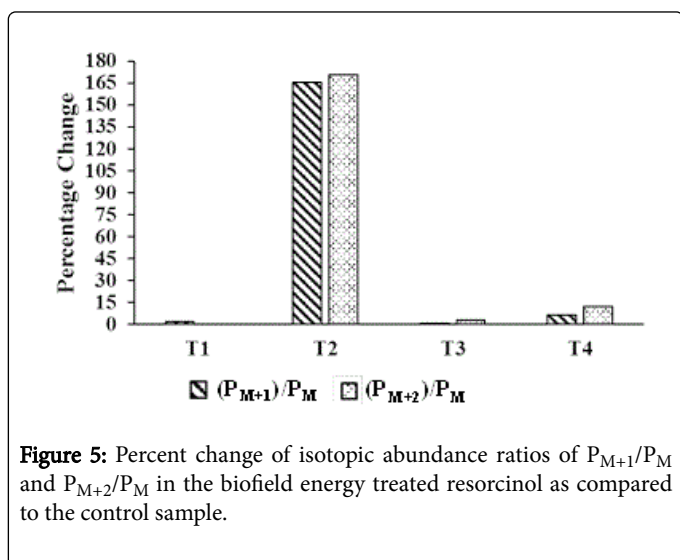
$P_{M+1}$  i.e.  $^{13}\text{C}$ ,  $^2\text{H}$ ,  $^{17}\text{O}$  contributions from  $(\text{C}_6\text{H}_6\text{O}_2)^+$  to  $m/z$  111 = 6.77%

From the above calculation, it has been found that  $^{13}\text{C}$  has major contribution to  $m/z$  111.

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

$P(^{18}\text{O}) = [(2 \times 0.20\%) \times 100\%] / 100\% = 0.40\%$

So,  $P_{M+2}$  i.e.  $^{18}\text{O}$  contribution from  $(\text{C}_6\text{H}_6\text{O}_2)^+$  to  $m/z$  112 = 0.40%.



**Figure 5:** Percent change of isotopic abundance ratios of  $P_{M+1}/P_M$  and  $P_{M+2}/P_M$  in the biofield energy treated resorcinol as compared to the control sample.

$P_M$ ,  $P_{M+1}$ ,  $P_{M+2}$  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  $P_{M+2}/P_M$ ) in the biofield treated sample with respect to the control resorcinol is shown in Table 2 and Figure 5. The isotopic abundance ratios of  $P_{M+1}/P_M$  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  $P_{M+2}/P_M$  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,  $^{13}\text{C}$ ,  $^2\text{H}$ ,  $^{17}\text{O}$  contributions from  $(\text{C}_6\text{H}_6\text{O}_2)^+$  to  $m/z$  111 and  $^{18}\text{O}$  contribution from  $(\text{C}_6\text{H}_6\text{O}_2)^+$  to  $m/z$  112 for the biofield treated resorcinol, particularly at T2 and T4 were significantly altered as compared to the control sample.

$^{13}\text{C}$ ,  $^2\text{H}$ ,  $^{17}\text{O}$  contributions from  $(\text{C}_6\text{H}_6\text{O}_2)^+$  to  $m/z$  111 and  $^{18}\text{O}$  contribution from  $(\text{C}_6\text{H}_6\text{O}_2)^+$  to  $m/z$  112 for the biofield treated resorcinol, particularly at T2 and T4 were significantly altered as compared to the control sample.

Parameter	Control Resorcinol	Biofield Energy Treated Resorcinol			
		T1	T2	T3	T4
$P_M$ at $m/z$ 110 (%)	100	100	100	100	100
$P_{M+1}$ at $m/z$ 111 (%)	6.77	6.89	17.99	6.82	7.23
$P_{M+1}/P_M$	0.0677	0.0689	0.1799	0.0682	0.0723
% Change of isotopic abundance ratio ( $P_{M+1}/P_M$ )		1.77	165.73	0.74	6.79
$P_{M+2}$ at $m/z$ 112 (%)	0.65	0.65	1.76	0.67	0.73
$P_{M+2}/P_M$	0.0065	0.0065	0.0176	0.0067	0.0073
% Change of isotopic abundance ratio ( $P_{M+2}/P_M$ )		0	170.77	3.08	12.31

T1, T2, T3, and T4: Biofield energy treated sample analyzed at different time intervals;  $P_M$  = the relative peak intensity of the parent molecular ion  $[M^+]$ ;  $P_{M+1}$  = the relative peak intensity of the isotopic molecular ion  $[(M+1)^+]$ ;  $P_{M+2}$  = the relative peak intensity of the isotopic molecular ion  $[(M+2)^+]$  and  $M$  = mass of the parent molecule.

**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 was 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 renowned 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 electrically neutral 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 ( $\mu$ ) for a diatomic molecule as shown in the below [7,9]:

$$E_0 = \frac{h}{4\pi} \sqrt{\frac{f}{\mu}}$$

Where  $E_0$  = the vibrational energy of a harmonic oscillator at absolute zero or zero point energy

$f$  = force constant

$$\mu = \text{reduced mass} = \frac{m_a m_b}{m_a + m_b}, \text{ } m_a \text{ and } m_b \text{ are the masses of the constituent atoms.}$$

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  $^{13}\text{C}$  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  $^{12}\text{C}$  with  $^{13}\text{C}$  for C-C bond,  $^1\text{H}$  with  $^2\text{H}$  for C-H and O-H bond,  $^{16}\text{O}$  with  $^{18}\text{O}$  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  $^{13}\text{C}/^{12}\text{C}$  or  $^2\text{H}/^1\text{H}$  ( $P_{M+1}/P_M$ ) and  $^{18}\text{O}/^{16}\text{O}$  ( $P_{M+2}/P_M$ ) 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

literatures reported that isotope effects play a vital role in the thermal decomposition of the molecules [53,54]. Literature demonstrated that the stability of the proteins seems to be mostly unaffected due to the entropic compensation for the decrease in enthalpy that is attributed to the alteration in hydration of proteins in  $\text{D}_2\text{O}$  compared to  $\text{H}_2\text{O}$  [55]. So, changes in the isotopic abundance ratio in the molecule might have an effect on the thermal properties of the molecule. Thus, biofield treated resorcinol (particularly at T2 and T4) might have different physicochemical properties like lower volatilization rate, reaction rate and thermal properties than control resorcinol. The various spectroscopic techniques like XRD, particle size, UV-visible, FT-IR spectroscopy and thermal like TGA and DSC analysis revealed that biofield treated resorcinol had different physicochemical and thermal properties as compared to the control resorcinol. Thus, current findings are well correlated with the previous results [18]. Alteration in the rate of a chemical reaction occurred due to the isotopic substitution of one of the atoms in the reactants is known as kinetic isotope effect (KIE). KIE is a very powerful tool for the study of the reaction mechanism, and also for understanding the enzymatic transition state and all aspects of enzyme mechanisms. It might be useful to stabilize the transition state of the rate-determining step of the reaction, enhance the reaction rate and selectivity and for designing extremely effective and specific inhibitors [7,9,56-58]. In short, biofield treated resorcinol might have altered physicochemical and thermal properties, different reaction rate, selectivity and binding energy.

Entry No.	Probable isotopic bond	Isotope type	Reduced mass ( $\mu$ )	Zero point vibrational energy ( $E_0$ )
1	$^{12}\text{C}-^{12}\text{C}$	Lighter	6.00	Higher
2	$^{13}\text{C}-^{12}\text{C}$	Heavier	6.26	Smaller
3	$^1\text{H}-^{12}\text{C}$	Lighter	0.92	Higher
4	$^2\text{H}-^{12}\text{C}$	Heavier	1.04	Smaller
5	$^{12}\text{C}-^{16}\text{O}$	Lighter	6.86	Higher
6	$^{13}\text{C}-^{16}\text{O}$	Heavier	7.17	Smaller
7	$^{12}\text{C}-^{17}\text{O}$	Heavier	7.03	Smaller
8	$^{12}\text{C}-^{18}\text{O}$	Heavier	7.2	Smaller
9	$^{16}\text{O}-^1\text{H}$	Lighter	0.94	Higher
10	$^{16}\text{O}-^2\text{H}$	Heavier	1.78	Smaller

**Table 3:** Possible isotopic bond and their effect in the vibrational energy in resorcinol molecule.

## 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  $\text{C}_6\text{H}_6\text{O}_2$ ) along with similar pattern of fragmentation. Among of 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  $P_M$

$_{+1}/P_M$  in the biofield treated resorcinol at T1, T2, T3 and T4 were increased by 1.77%, 165.73%, 0.74%, and 6.79%, respectively with respect to the control sample. The percentage change of the isotopic abundance ratio of  $P_{M+2}/P_M$  was enhanced in the biofield treated resorcinol at T2, T3, and T4 by 170.77%, 3.08%, and 12.31%, respectively as compared to the control sample. In summary,  $^{13}C$ ,  $^2H$ ,  $^{17}O$  contributions from  $(C_6H_6O_2)^+$  to m/z 111 and  $^{18}O$  contribution from  $(C_6H_6O_2)^+$  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 reaction rate and selectivity, the study of the reaction mechanism and assisting in designing potent enzyme inhibitors.

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