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# Determination of Isotopic Abundance of $^2\text{H}$ , $^{13}\text{C}$ , $^{18}\text{O}$ , and $^{37}\text{Cl}$ in Biofield Energy Treated Dichlorophenol Isomers

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**Abstract:** 2,4-Dichlorophenol (2,4-DCP) and 2,6-dichlorophenol (2,6-DCP) are two isomers of dichlorophenols, have been used as preservative agents for wood, paints, vegetable fibers and as intermediates in the production of pharmaceuticals and dyes. The aim of the study was to evaluate the impact of biofield energy treatment on the isotopic abundance ratios of  $^2\text{H}/^1\text{H}$  or  $^{13}\text{C}/^{12}\text{C}$ , and  $^{18}\text{O}/^{16}\text{O}$  or  $^{37}\text{Cl}/^{35}\text{Cl}$ , in dichlorophenol isomers using gas chromatography-mass spectrometry (GC-MS). The 2,4-DCP and 2,6-DCP samples were divided into two parts: control and treated. The control sample remained as untreated, while the treated sample was further divided into four groups as T1, T2, T3, and T4. The treated group was subjected to Mr. Trivedi's biofield energy treatment. The GC-MS spectra of 2,4-DCP and 2,6-DCP showed three to six  $m/z$  peaks at 162, 126, 98, 73, 63, 37 *etc.* due to the molecular ion peak and fragmented peaks. The isotopic abundance ratios (percentage) in both the isomers were increased significantly after biofield treatment as compared to the control. The isotopic abundance ratio of (PM+1)/PM and (PM+2)/PM after biofield energy treatment were increased by 54.38% and 40.57% in 2,4-DCP and 126.11% and 18.65% in 2,6-DCP, respectively which may affect the bond energy, reactivity and finally stability to the product.

**Keywords:** Biofield Energy Treatment, 2,4-Dichlorophenol, 2,6-Dichlorophenol, Gas Chromatography-Mass Spectrometry

## 1. Introduction

Dichlorophenols in small amounts used directly as pesticides or converted into pesticides by chemical means. 2,4-DCP and 2,6-DCP are two isomers of dichlorophenols, and they have been used as preservative agents for wood [1, 2], paints [3], vegetable fibers, and as disinfectants. In addition, they are used as herbicides, fungicides insecticides and as intermediates in the production of pharmaceuticals and dyes [4]. Chlorophenols are obtained by direct chlorination of phenol using chlorine gas [5]. In the technical product, there are impurities of other chlorophenol isomers or chlorophenols with more or less chlorine [6]. Environmental contamination is mainly occurred during manufacturing, storage, transportation and application of chlorophenols. In recent years, public health authorities are concerned about the air borne contaminations and so germicidal paints has been proposed in reducing atmospheric microbial pollutions [7]. Keeping in mind of the applicability in large quantities

the stability of these isomers is most desired quality that determines the life of the finished product. Hence, it is important to find out an alternate approach that could enhance the chemical stability of the compound by altering the structural properties. Recently, biofield energy treatment is reported to alter the physicochemical properties and even isotopic ratios of various elements significantly in a molecule of various living and non-living substances [8-10]. The isotopic abundance ratios of  $^2\text{H}/^1\text{H}$ , or  $^{13}\text{C}/^{12}\text{C}$ , and  $^{37}\text{Cl}/^{35}\text{Cl}$  or  $^{18}\text{O}/^{16}\text{O}$ , could be locally altered by kinetically driven chemical reactions. There is an alternative and well-known approach; Mr. Trivedi's biofield energy treatment, also known as The Trivedi Effect<sup>®</sup>, that can be applied on dichlorophenol isomers to undergo the isotopic changes.

The distribution of contaminant sources of any molecule on a native or global scale can be understood by determining the isotopic abundance ratio [11]. Any kinetic process that leads to the local depletion or enhancement of isotopes in organic molecules can be successfully determined using gas

chromatography-mass spectrometry (GC-MS) [12]. These deviations from perfect chemical equivalence are termed as isotope effects. The isotopic abundance ratio is commonly reported in terms of atom percent and determined by high resolution mass spectrometry (HRMS spectrometry) [13]. For example,  $^{13}\text{C}$

$$\text{Atom percent } ^{13}\text{C} = \left[ \frac{^{13}\text{C}}{^{12}\text{C} + ^{13}\text{C}} \right] \times 100$$

Moreover, the rate of chemical reaction may vary with the mass of the nucleus with different isotopic substitutions, which slightly affect the partitioning of energy within the molecules [14]. Study the impact of biofield energy treatment on isotopic abundance ratio of elements in a molecule is new to its kind and our group have successfully designed and establish the fact.

The National Center for Complementary and Alternative Medicine (NCCAM) has recommended the use of energy therapy as a part of Complementary and alternative medical therapies (CAM) in the healthcare sector [15]. CAM includes numerous energy-healing therapies, in which the biofield therapy is a form of putative energy therapy that is being widely used worldwide to improve the overall health of human beings. Humans have the ability to harness energy from the environment/universe that can be transmitted to any objects around. The ability of Mr. Trivedi as a biofield energy practitioner was well studied in recent years. The physicochemical properties of various molecules and crystals were altered by utilizing Mr. Trivedi's biofield energy treatment [16-18]. Based on the previous results achieved by The Trivedi Effect in various fields, biofield energy treated 2,4-DCP and 2,6-DCP were taken for mass spectroscopy studies to evaluate the isotopic abundance ratio of  $^2\text{H}/^1\text{H}$ , or  $^{13}\text{C}/^{12}\text{C}$  [(PM+1)/PM] and  $^{37}\text{Cl}/^{35}\text{Cl}$  or  $^{18}\text{O}/^{16}\text{O}$  [(PM+2)/PM], [where PM is the primary molecule and (PM+1) and (PM+2) are isotopic molecules].

## 2. Experimental

### 2.1. Materials

2,4-Dichlorophenol (2,4-DCP) and 2,6-dichlorophenol (2,6-DCP) were procured from Lobachemie Pvt. Ltd., India and S. D. Fine Chemicals Pvt. Limited, India, respectively.

### 2.2. Method

Each of the 2,4-DCP and 2,6-DCP samples was divided into two parts, one part remained untreated and called as control and the other part was subjected to Mr. Trivedi's biofield energy treatment under standard laboratory conditions, that considered as treated sample. The treated sample was further divided into four groups (*i.e.* T1, T2, T3, and T4) for GCMS analysis. There are no differences among the treated samples T1, T2, T3, and T4, except time. The isotopic abundance ratio of [(PM+1)/PM] and [(PM+2)/PM] in control and treated samples were characterized using gas chromatography-mass spectrometry (GC-MS).

### 2.3. GC-MS Spectroscopy

GC-MS analysis was done 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: 20-620 Daltons (amu), stability:  $\pm 0.1$  m/z mass accuracy over 48 hours. The identification of analytes were done by retention time and by a comparison of the mass spectra of identified substances with references.

The isotopic abundance ratio (PM+1)/PM and (PM+2)/PM was expressed by its deviation in treated samples as compared to the control. The percentage change in isotopic ratio was calculated from the following formula:

$$\begin{aligned} \text{Percent change in isotopic abundance ratio} \\ = \frac{R_{\text{Treated}} - R_{\text{control}}}{R_{\text{control}}} \times 100 \end{aligned}$$

Where,  $R_{\text{Treated}}$  and  $R_{\text{Control}}$  are the ratios of intensity at (PM+1) or (PM+2) to PM in mass spectra of treated and control samples, respectively.

## 3. Results and Discussion

### 3.1. GC-MS Study of 2,4-Dichlorophenol

The mass spectrum obtained for the control sample of 2,4-DCP in the positive-ion mode is illustrated in Fig. 1. It gives molecular ion peak at  $m/z$  162 with two major fragmented peaks in lower  $m/z$  region that are well matched with the literature report [19]. The peaks at  $m/z$  64 and 98 were due to the fragmentation of 2,4-DCP to  $\text{C}_5\text{H}_4^+$  and  $\text{C}_6\text{H}_{10}\text{O}^+$  ions, respectively. The GC-MS spectra of treated samples were slightly different from the fragmentation pattern of the control sample. The GC-MS spectra of treated (T1, T2, T3, and T4) samples are presented in Fig. 2. It showed three major peaks including molecular ion peak in T1 sample of 2,4-DCP with the base peak at  $m/z$  63 ( $\text{C}_5\text{H}_3^+$ ). In both the cases (control and treated) mass spectra showed the loss of two Cl<sup>-</sup> ions in the fragmentation process, followed by the ring opening reaction, corresponded to the following ions, respectively:  $\text{C}_6\text{H}_{10}\text{O}^+$ ,  $\text{C}_5\text{H}_3^+$ ,  $m/z$  98 and 63. Most unlikely, there were four major peaks observed in T2, with an additional peak at  $m/z$  73 ( $\text{C}_4\text{H}_9\text{O}^+$ ). However, similar to the control sample, three major peaks at  $m/z$  162, 98 and 63, were observed in T3 and T4.

The intensity ratio and calculated percentage isotopic abundance ratio of all three elements are presented in Table 1. The isotopic abundance ratio of (PM+1)/PM and (PM+2)/PM in the control and treated 2,4-DCP was plotted in Fig. 3.

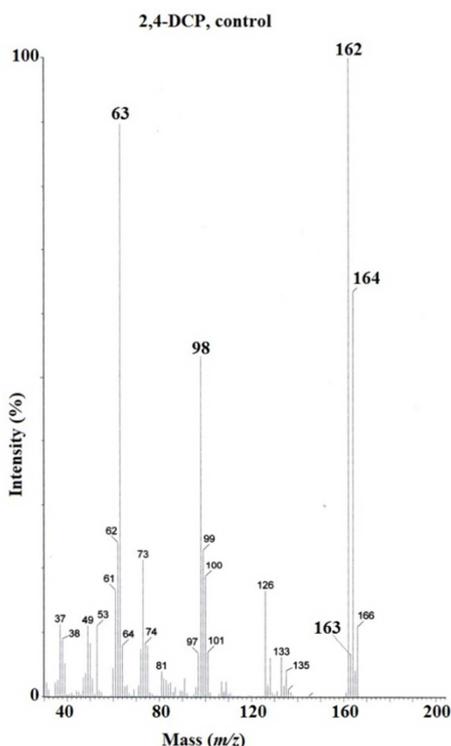


Figure 1. GC-MS spectrum of control 2,4-dichlorophenol.

Table 1. GC-MS isotopic abundance analysis result of 2,4-dichlorophenol.

Peak Intensity	Control	Treated			
		T1	T2	T3	T4
<i>m/z</i> of PM	100	78.63	100	100	100
<i>m/z</i> of (PM+1)	6.73	5.35	10.39	6.83	8.96
(PM+1)/ PM	0.0673	0.0680	0.1039	0.0683	0.0896
Percent change		1.09	54.38	1.48	33.13
<i>m/z</i> of PM	100	78.63	100	100	100
<i>m/z</i> of (PM+2)	63.37	50.69	89.08	63.5	79.03
(PM+2)/ PM	0.633	0.644	0.890	0.635	0.7903
Percent change		1.73	40.57	0.25	24.71

It was clearly seen from the Fig. 3 that, the isotopic abundance ratio of (PM+1)/PM and (PM+2)/PM was increased by 54.38% and 40.57%, respectively in treated samples of 2,4-DCP as compared to the control. The significant increase in the isotopic abundance ratio of (PM+1)/PM and (PM+2)/PM in 2,4-DCP may have high impact on the bond energies and reactivity of the molecules after biofield energy treatment. The increased isotopic abundance ratio of (PM+1)/PM and (PM+2)/PM in the treated samples may increase  $\mu$  (effective mass) and binding energy in the 2,4-DCP molecule with heavier isotopes, and this may result in enhancing binding energy and stability of the molecule [20].

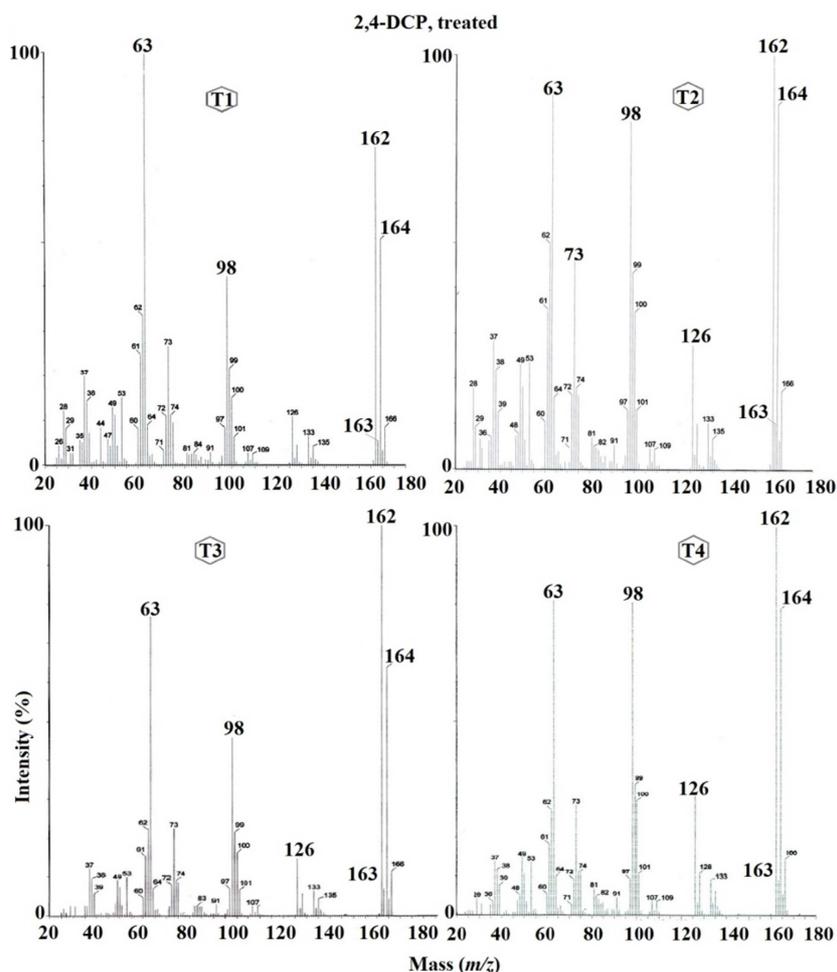
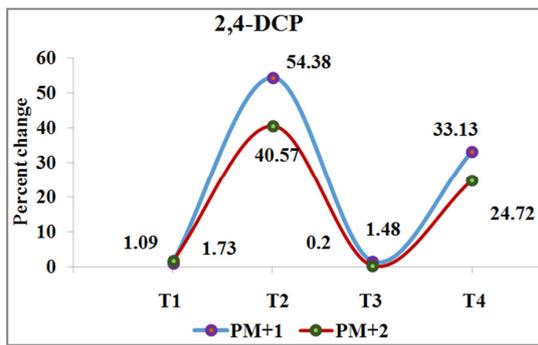


Figure 2. GC-MS spectra of treated 2,4-dichlorophenol samples (T1, T2, T3, and T4).

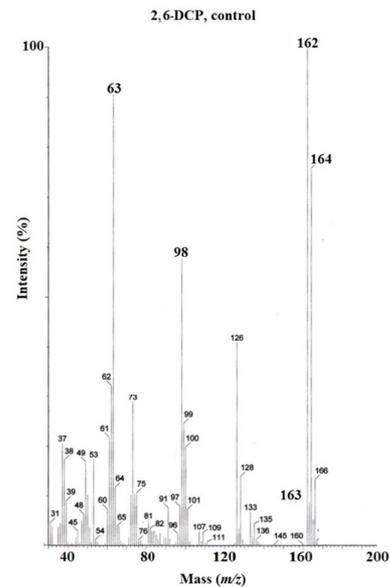


**Figure 3.** Percent change in the isotopic abundance of (PM+1)/PM and (PM+2)/PM in 2,4-dichlorophenol after biofield energy treatment.

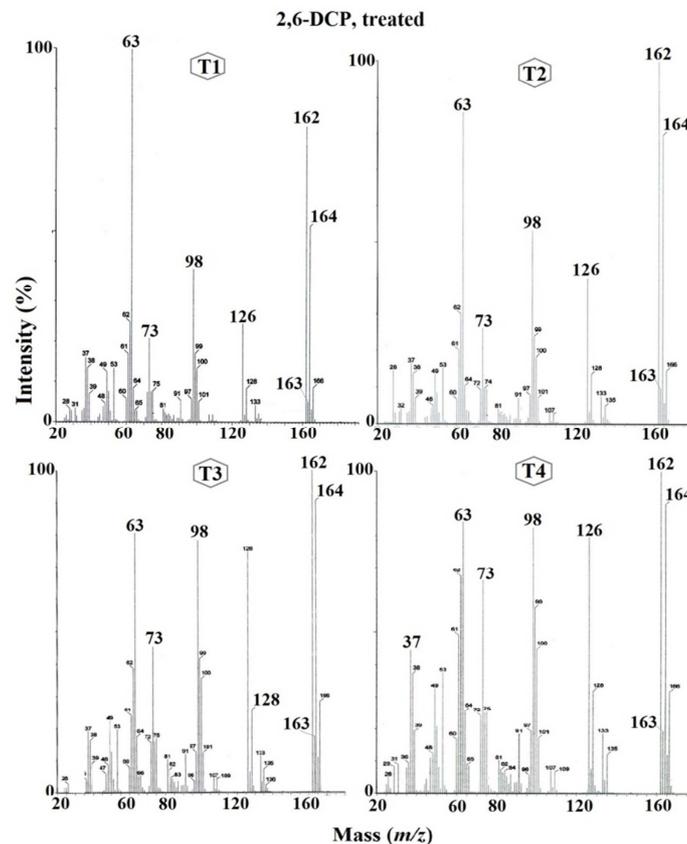
### 3.2. GC-MS Study of 2,6-Dichlorophenol

The mass spectrum of the control sample of 2,6-DCP is presented in Figure 4 and well matched with the literature report [21]. The molecular ion peak was observed at  $m/z$  162 with three other fragmented peaks in mass spectra. Unlike the control sample, there are 3-6 major  $m/z$  peaks were observed in the mass spectra of treated 2,6-DCP (Figure 5) at  $m/z$  162, 126, 98, 73, 63, 37 *etc.* The calculated relative intensity ratio and percentage abundance ratios in 2,6-DCP are presented in Table 2. In both the isomers 2,4-DCP and 2,6-DCP, molecular ion peak was observed as a base peak except in the T1. However, they exhibited slight different fragmentation

pattern due to the structural and reactivity differences in them. The isotopic abundance ratio of (PM+1)/PM and (PM+2)/PM in control and treated samples of 2,6-DCP are presented in Fig. 6. The isotopic abundance ratio of (PM+1)/PM and (PM+2)/PM of treated 2,6-DCP was increased upto 126.11% and 18.65% as compared to the respective control.

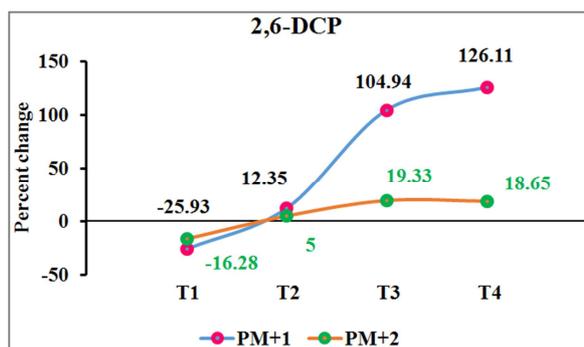


**Figure 4.** GC-MS spectrum of control sample of 2,6-dichlorophenol.



**Figure 5.** GC-MS spectra of treated samples of 2,6-dichlorophenol (T1, T2, T3, and T4).

If the lighter isotopes were substituted by heavier isotopes then the effective mass ( $\mu$ ) of the particular bond is increased with the subsequently binding energy in the molecule [20]. Thus, this might increase the effective mass and binding energy after biofield energy treatment. As a result, the chemical stability of dichlorophenol isomers might be enhanced. On the contrary, the slight decrease in the isotopic abundance ratio of (PM+1)/PM and (PM+2)/PM in T1 of 2,4-DCP might reduce the effective mass of the particular bond with binding energy.



**Figure 6.** Percent change in the isotopic abundance of (PM+1)/PM of 2,6-dichlorophenole after biofield energy treatment as compared to the control.

**Table 2.** GC-MS isotopic abundance analysis result of 2,6-dichlorophenol.

Peak Intensity	Control	Treated			
		T1	T2	T3	T4
$m/z$ of PM	100	80.69	100	99.8	100
$m/z$ of (PM+1)	8.5	5.08	9.55	17.42	19.22
(PM+1)/PM	0.085	0.062	0.095	0.174	0.192
Percent change		-25.93	12.35	104.94	126.11
$m/z$ of (PM+2)	75.78	51.19	79.57	90.43	89.92
(PM+2)/PM	0.757	0.634	0.795	0.904	0.899
Percent change		-16.28	5.0	19.33	18.65

The effective mass of some probable isotopic bonds were calculated and presented in Table 3. The result showed that  $\mu$  of normal  $^{12}\text{C}-^{12}\text{C}$  ( $\mu=6$ ),  $^{12}\text{C}-^{35}\text{Cl}$  ( $\mu=8.93$ ) and  $^1\text{H}-^{12}\text{C}$  ( $\mu=0.923$ ) bonds were increased in case of heavier isotopes *i.e.*  $^{13}\text{C}-^{12}\text{C}$  ( $\mu=6.26$ ),  $^{12}\text{C}-^{37}\text{Cl}$  ( $\mu=9.06$ ) and  $^2\text{H}-^{12}\text{C}$  ( $\mu=1.71$ ). After biofield treatment, bond strength, stability, and binding energy of the aromatic ring of 2,4-DCP and 2,6-DCP molecules might be increased due to the higher effective mass ( $\mu$ ) after biofield energy treatment [22].

The decreased reactivity of the dichlorophenol isomers may increase the stability of the chlorophenol based industrial products, by reducing the degradation kinetics in the finished products after production. Furthermore, the molecules used in paint industry should have high chemical and photo stability for sustainability of the product. Photo stability is a great concern in order to use them successfully in outdoor conditions without degradation. After biofield treatment, the chemical, as well as photo stability might be enhanced due to the presence of higher isotopes, that enable them to expose the materials to light and robust weather conditions for longer period.

**Table 3.** Possible isotopic bonds in 2,4-dichlorophenol and 2,6-dichlorophenol.

Isotopes Bond	Isotope type	Reduced mass ( $m_{\text{A}}m_{\text{B}}/(m_{\text{A}} + m_{\text{B}})$ )
$^{12}\text{C}-^{12}\text{C}$	Lighter	6.000
$^{13}\text{C}-^{12}\text{C}$	Heavier	6.260
$^1\text{H}-^{12}\text{C}$	Lighter	0.923
$^1\text{H}-^{13}\text{C}$	Heavier	0.929
$^2\text{H}-^{12}\text{C}$	Heavier	1.710
$^{12}\text{C}-^{35}\text{Cl}$	Lighter	8.936
$^{12}\text{C}-^{37}\text{Cl}$	Heavier	9.061
$^{16}\text{O}-^{12}\text{C}$	Lighter	6.850
$^{18}\text{O}-^{12}\text{C}$	Heavier	7.200
$^{16}\text{O}-^{13}\text{C}$	Heavier	7.170

Where,  $m_{\text{A}}$ - mass of atom A,  $m_{\text{B}}$ - mass of atom B, here A may be C or H and so on

## 4. Conclusions

In summary, dichlorophenol isomers, 2,4-DCP and 2,6-DCP were studied with GC-MS under the influence of biofield energy treatment and observed a significant change in isotope abundance of  $^2\text{H}/^1\text{H}$  or  $^{13}\text{C}/^{12}\text{C}$ , and  $^{18}\text{O}/^{16}\text{O}$  or  $^{37}\text{Cl}/^{35}\text{Cl}$ , as compared to the respective control samples. The percent change in isotope abundance ratio of (PM+1)/PM and (PM+2)/PM in 2,4-DCP was increased upto 54.38% and 40.57%, respectively in the treated samples. Similarly, the percent change in isotope abundance ratio of (PM+1)/PM and (PM+2)/PM in 2,6-DCP was increased significantly by 126.11% and 18.65%, respectively. The increased isotopic abundance ratios have significant effect on chemical reactivity and energies of the molecule. Due to the enhancement in the isotopic abundance ratio the reactivity may be reduced significantly by increase in the effective mass ( $\mu$ ) of the treated sample. It can be concluded from the above observations that the enhancement of heavier isotopes in the molecule as well as the functional groups may decrease the reactivity the functional groups of chlorophenol isomers, consequently enabling their utility as germicidal coating in the dye industry and as an effective pesticide.

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