SYNTHESIS, EVALUATION OF ANTIMICROBIAL ACTIVITIES OF SOME (E)-1-(5-CHLORO-2-HYDROXYPHENYL)-3-PHENYLPROP-2-EN-1-ONE COMPOUNDS

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ABSTRACT

Objective: The aim of this study was to synthesize some substituted(E)-1-(5-chloro-2-hydroxyphenyl)-3-phenylprop-2-en-1-one compounds using crossed-aldol condensation reaction of 5-chloro-2-hydroxyacetophenone with various substituted benzaldehydes in the presence of sodium hydroxide (base) and to characterize the by their analytical, physical and spectroscopic data. Also we aim to study their antimicrobial activities. Methods: Crossed-aldol condensation reaction was used for synthesizing some substituted (E)-1-(5-chloro-2-hydroxyphenyl)-3-phenylprop-2-en-1-one compounds. They were characterized by ultraviolet (UV), infrared (IR) and nuclear magnetic resonance (NMR) spectral data. The Bauer-Kirby method was used for evaluation of antimicrobial activities of the synthesized compounds. Results: Yields of synthesized compounds were more than 80%. Few substituted (E)-1-(5-chloro-2-hydroxyphenyl)-3-phenylprop-2-en-1-one compounds gave excellent antimicrobial activities, whereas others gave poor antimicrobial activities. Conclusion: The synthesized 3-N2 substituted compound has shown excellent activity against five out of ten bacterial strains. The 4-OC6H4 and 3-OC6H4 substituted compounds have shown excellent activity against one out of five fungal strains.

Key words: Synthesis, UV, IR and NMR spectra, Anti-bacterial and Anti-fungal activities.

INTRODUCTION

1,3-diphenylprop-2-en-1-one is a very interesting compound because it is known to possess many biological activities. Moreover, natural and synthetic 1,3-diphenylprop-2-en-1-one compounds act as precursors for other compounds. Therefore, many 1,3-diphenylprop-2-en-1-one compounds become model structure of target compound by researchers[1]. Recently, 1,3-diphenylprop-2-en-1-one compound doped polymers [2-4] are gaining attention of researchers due to their interesting properties and potential applications.

The α,β-unsaturated ketones are otherwise called chalcone compounds. They contain 1,3-diphenylprop-2-en-1-one framework and the name ‘Chalcone’ was given by Kostanecki and Tambor [5]. Many plants contain several bioactive substances such as flavonoids [6]. α,β-unsaturated ketones are belonging to the flavonoid family [7]. Chalcones are used as initial materials for synthesising many compounds like quinoliones, isoazoles, thiadiazines, benzodiazepines, benzothiazepines, benzofuranones, tetrahydro-2-chronemes, flavones, etc., Chalcones consisting of two aromatic rings assume linear or nearly planar structure [8-10].

Chalcones, a sub-class of flavonoids are widely distributed as secondary metabolites in plant kingdom. They are reported for various biological activities such as anti-fungal [11], anti-oxidant [12], anticonvulsant [13], anti-inflammatory [14-17], anti-leishmanial [18], anti-tuberculoid [19-20], anti-malarial [21,22], anti-parasite [23], anti-tumor [24], anti-nociceptive [25] and anti-invasive [26,27]. They are used as nitric oxide synthase inhibitors, associated with diseases such as Alzheimer, Huntington, and inflammatory arthritis [28]. They are reported to show inhibition of the enzymes, especially mammalian alpha-amylase [29], cyclo-oxygenase (COX) [30] and monoamine oxidase (MAO) [31]. They have shown anti-tryptic activity too [32].

In the present study we report the synthesis of substituted (E)-1-(5-chloro-2-hydroxyphenyl)-3-phenylprop-2-en-1-one by crossed-aldol condensation reaction of 5-chloro-2-hydroxyacetophenone with various substituted benzaldehydes and their biological activity.

MATERIAL AND METHODS

All the used chemicals and materials were purchased from Aldrich and Merck chemical companies. Melting points of all the synthesized substituted (E)-1-(5-chloro-2-hydroxyphenyl)-3-phenylprop-2-en-1-one compounds were observed in open glass capillaries on Mettler FP51 and were uncorrected. The UV spectra of all substituted (E)-1-(5-chloro-2-hydroxyphenyl)-3-phenylprop-2-en-1-one compounds have been recorded using SHIMADZU-1650 SPECTROMETER in spectral grade methanol. IR spectra (KBr, 4000-400 cm-1) have been recorded on SHIMADZU-2010 Fourier transform spectrophotometer. The NMR spectra have been recorded in BRUKER 400 spectrometer operating at 400 MHz for 1H NMR spectra and 100 MHz for 13C NMR spectra in CDCl3 solvent using TMS as internal standard.

General procedure for synthesising substituted (E)-1-(5-chloro-2-hydroxyphenyl)-3-phenylprop-2-en-1-one compounds by crossed-aldol condensation reaction:

Equimolar 5-chloro-2-hydroxy acetophene (0.05 mol) and various substituted benzaldehydes (0.05 mol) were dissolved in 50 mL ethanol in a 250 mL round-bottom flask equipped with a magnetic sterrer. Then 50 mL NaOH solution (1.0 g in 50 mL H2O) was added drop wise to the reaction mixture with vigorous stirring for 20 minutes [33, 34]. The reaction mixture was neutralized by the addition of 0.1N HCl and then the precipitate was obtained. The filter crude substituted (E)-1-(5-chloro-2-hydroxyphenyl)-3-phenylprop-2-en-1-one compounds were dried in air-oven and recrystallized from ethanol to get glistening yellow color solid, and their melting points were observed. The general reaction is shown in Scheme-1.

Scheme 1: Synthesis of substituted (E)-1-(5-chloro-2-hydroxyphenyl)-3-phenylprop-2-en-1-one compounds

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Measurement of antimicrobial activities

Measurement of Antibacterial activity

The synthesized substituted (E)-1-(5-chloro-2-hydroxyphenyl)-3-phenylprop-2-en-1-one compounds were dissolved in Dimethyl sulfoxide (DMSO) separately at the concentration of 1mg/mL for antimicrobial assay [35].

The antibacterial activities of ten synthesized substituted (E)-1-(5-chloro-2-hydroxyphenyl)-3-phenylprop-2-en-1-one compounds have been studied against five gram positive pathogenic strains Bacillus subtilis., Clostridium botulinum., Staphylococcus aureus., Nocardia and Enterococcus and five gram negative strains Escherichia coli., Klebsiella pneumonia., Proteus mirabilis., Salmonella typhi and Vibrio cholera by Kirby-Bauer method [36]. Ciprofloxacin was used as the standard. The antibacterial screening effect of synthesized substituted (E)-1-(5-chloro-2-hydroxyphenyl)-3-phenylprop-2-en-1-one compounds is displayed in Figure-1 (Plates 1–20).

Figure 1: Antibacterial activity of substituted (E)-1-(5-chloro-2-hydroxyphenyl)-3-phenylprop-2-en-1-one compounds (petri plates).
Measurement of Antifungal activity

The antifungal activities of all synthesized (E)-1-(5-chloro-2-hydroxyphenyl)-3-phenylprop-2-en-1-one compounds have been studied against five fungal species namely Aspergillus niger., Aspergillus flavus., Candida albicans., Trichaderma viride and Mucor . The disc diffusion technique has been followed using the Kirby–Bauer method [36], using ciprofloxacin as the standard. The antifungal screening effect of synthesized substituted (E)-1-(5-chloro-2-hydroxyphenyl)-3-phenylprop-2-en-1-one compounds is shown in Figure-2. (Plates 21–30).

RESULTS

The synthesized substituted (E)-1-(5-chloro-2-hydroxyphenyl)-3-phenylprop-2-en-1-one compounds were characterized with their physical, analytical and spectroscopic data. The obtained physical constants and analytical data are presented in Table 1.

Table 1: Physical constants of substituted (E)-1-(5-chloro-2-hydroxyphenyl)-3-phenylprop-2-en-1-one compounds.

<table>
<thead>
<tr>
<th>Entry</th>
<th>X</th>
<th>M. F.</th>
<th>M. W.</th>
<th>Yield (%)</th>
<th>M.P. (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>H</td>
<td>CH₁H₂ClCl</td>
<td>259</td>
<td>88</td>
<td>59-60</td>
</tr>
<tr>
<td>2</td>
<td>3-Br</td>
<td>CH₁H₂BrBrCl</td>
<td>337</td>
<td>86</td>
<td>97-98</td>
</tr>
<tr>
<td>3</td>
<td>4-Br</td>
<td>CH₁H₂BrBrCl</td>
<td>337</td>
<td>89</td>
<td>60-62</td>
</tr>
<tr>
<td>4</td>
<td>3-Cl</td>
<td>CH₁H₂ClCl₂</td>
<td>293</td>
<td>83</td>
<td>129-130</td>
</tr>
<tr>
<td>5</td>
<td>3-F</td>
<td>CH₁H₂OFCI</td>
<td>276</td>
<td>94</td>
<td>105-106</td>
</tr>
<tr>
<td>6</td>
<td>4-F</td>
<td>CH₁H₂OFCI</td>
<td>276</td>
<td>92</td>
<td>158-160</td>
</tr>
<tr>
<td>7</td>
<td>4-OCH₃</td>
<td>CH₁Cl₂Cl</td>
<td>289</td>
<td>89</td>
<td>135-136</td>
</tr>
<tr>
<td>8</td>
<td>4-CH₃</td>
<td>CH₁H₂ClCl</td>
<td>273</td>
<td>87</td>
<td>79-81</td>
</tr>
<tr>
<td>9</td>
<td>3-NO₂</td>
<td>CH₁H₂NOCl</td>
<td>304</td>
<td>90</td>
<td>162-163</td>
</tr>
<tr>
<td>10</td>
<td>3-OC₆H₅</td>
<td>CH₁H₂OClOCl</td>
<td>351</td>
<td>85</td>
<td>118-120</td>
</tr>
</tbody>
</table>

The observed UV, IR and NMR spectral data of synthesized substituted (E)-1-(5-chloro-2-hydroxyphenyl)-3-phenylprop-2-en-1-one compounds are presented below.

(E)-1-(5-chloro-2-hydroxyphenyl)-3-phenylprop-2-en-1-one:

UV λ max = 316.5 nm

IR (KBr): v = 1643.35, 1577.77 cm⁻¹ (CO s-cis and s-trans); 1192.01, 808.17 cm⁻¹ (CH₆ and ω); 1024.20 cm⁻¹(=CH=CH₂), 522.71 cm⁻¹(=C=O), 3037.89 cm⁻¹ (CH aromatic); 1469.76 cm⁻¹

(C=C str): 3057.17 cm⁻¹ (CH str CH₃); 725.23 cm⁻¹ (mono substituted); 840.96 cm⁻¹ (di substituted); 3419 cm⁻¹ (OH).

1H NMR (CDCl₃): (ppm) = 7.564 (d; J= 15.6 Hz, 1H, =CH); 7.944 (d; J = 15.2 Hz, 1H, =CH); 4.580(s; H, OH).

13C NMR (CDCl₃): (ppm) = 119.45(Cα); 146.53(Cβ); 192.81(CO); 128.84(C-Cl); 162.05(C-OH).

(E)-3-(3-bromophenyl)-1-(5-chloro-2-hydroxyphenyl)prop-2-en-1-one:

UV λ max = 316.0 nm

IR (KBr): v = 1643.35, 1579.70 cm⁻¹ (CO s-cis and s-trans); 1190.08, 806.25 cm⁻¹ (CH₆ and ω); 1022.27 cm⁻¹ (CH=CH₂), 526.57 cm⁻¹ (C=O); 2918.30 cm⁻¹ (CH aromatic); 1469.76 cm⁻¹

Plate 21
Plate 22
Plate 23
Plate 24
Plate 25
Plate 26
Plate 27
Plate 28
Plate 29
Plate 30
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(C=C str); 3055.24 cm⁻¹ (CH str CH₂); 723.31 cm⁻¹ (mono substituted); 840.96 cm⁻¹ (di substituted); 3415.93 cm⁻¹ (OH).

¹H NMR (CDCl₃): (ppm) = 7.586 (d; J = 15.6 Hz, 1H, =CH); 7.852 (d; J = 15.2 Hz, 1H, =CH); 4.692 (s; H, OH).

¹³C NMR (CDCl₃): (ppm) = 119.13(Cα); 145.21(Cβ); 192.63(CO); 128.78(C-Cl); 162.08(C-CH₂); 163.25(sub C-F).

(Ε)-3-(4-bromophenyl)-1-(5-chloro-2-hydroxyphenyl)prop-2-en-1-one:

UV λ max = 370.5 nm

IR (KBr): v = 1691.57, 1573.91 cm⁻¹ (CO s-cis and s-trans); 1182.72, 833.25 cm⁻¹ (CH φ and ω);

1022.27 cm⁻¹ (CH₂=CH₂); 352.35 cm⁻¹ (C=C ω); 2929.87 cm⁻¹ (CH aromatic); 1494.83 cm⁻¹ (C=C str).

(Ε)-1-(5-chloro-2-hydroxyphenyl)-3-(3-nitrophenyl)prop-2-en-1-one:

UV λ max = 337.0 nm

IR (KBr): v = 1695.43, 1597.06 cm⁻¹ (CO s-cis and s-trans); 1188.86, 837.11 cm⁻¹ (CH φ and ω);

1022.27 cm⁻¹ (CH₂=CH₂); 547.78 cm⁻¹ (C=C ω); 2937.59 cm⁻¹ (CH aromatic); 1510.28 cm⁻¹ (C=C str).

¹H NMR (CDCl₃): (ppm) = 7.581(d; J = 15.2 Hz, 1H, =CH); 7.981 (d; J = 15.2 Hz, 1H, =CH); 4.660 (s; H, OH); 2.430 (s; H, CH₂).

¹³C NMR (CDCl₃): (ppm) = 119.94(Cα); 146.72(Cβ); 192.87(CO); 127.12(C-Cl); 162.07(C-CH₂); 21.69(CH₃).

(Ε)-1-(5-chloro-2-hydroxyphenyl)-3-(3-fluorophenyl)prop-2-en-1-one:

UV λ max = 304.0 nm

IR (KBr): v = 1691.57, 1589.34 cm⁻¹ (CO s-cis and s-trans); 1184.29, 829.39 cm⁻¹ (CH φ and ω);

1024.20 cm⁻¹ (CH₂=CH₂); 542.0 cm⁻¹ (C=C ω); 2918.30 cm⁻¹ (CH aromatic); 1467.38 cm⁻¹ (C=C str).

¹H NMR (CDCl₃): (ppm) = 7.563(d; J = 15.6 Hz, 1H, =CH); 7.867 (d; J = 15.6 Hz, 1H, =CH); 5.300 (s; H, OH).

¹³C NMR (CDCl₃): (ppm) = 120.35(Cα); 144.78(Cβ); 192.55(CO); 128.30(C-Cl); 162.12(C-CH₂); 147.90(CH₂).

(Ε)-1-(5-chloro-2-hydroxyphenyl)-3-(3-phenoxophenyl)prop-2-en-1-one:

UV λ max = 290 nm

IR (KBr): v = 1689.64, 1593.20 cm⁻¹ (COs-cis and s-trans); 1182.36, 821.86 cm⁻¹ (CH φ and ω);

1022.27 cm⁻¹ (CH₂=CH₂); 545.85 cm⁻¹ (C=C ω); 2960.73 cm⁻¹ (CH aromatic); 1483.26 cm⁻¹ (C=C str).

¹H NMR (CDCl₃): (ppm) = 7.541(d; J = 16 Hz, 1H, =CH); 7.891 (d; J = 15.6 Hz, 1H, =CH); 5.331 (s; H, OH).

¹³C NMR (CDCl₃): (ppm) = 119.87(Cα); 154.03(Cβ); 192.59(CO); 128.79(C-Cl); 162.10(C-CH₂).
Antibacterial activity

The measured zone of inhibition values for the antibacterial activities of synthesized substituted (E)-1-(5-chloro-2-hydroxyphenyl)-3-phenylprop-2-en-1-one compounds are summarized in Table 2.

Table 2: Zone of inhibition (mm) values of antibacterial activity of substituted (E)-1-(5-chloro-2-hydroxyphenyl)-3-phenylprop-2-en-1-one compounds.

<table>
<thead>
<tr>
<th>S. No</th>
<th>X</th>
<th>Gram positive Bacteria</th>
<th>Gram negative Bacteria</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Control</td>
<td>Standard</td>
</tr>
<tr>
<td>1</td>
<td>H</td>
<td>11</td>
<td>16</td>
</tr>
<tr>
<td>2</td>
<td>3-Br</td>
<td>13</td>
<td>16</td>
</tr>
<tr>
<td>3</td>
<td>4-Br</td>
<td>11</td>
<td>12</td>
</tr>
<tr>
<td>4</td>
<td>3-Cl</td>
<td>0</td>
<td>9</td>
</tr>
<tr>
<td>5</td>
<td>3-F</td>
<td>16</td>
<td>16</td>
</tr>
<tr>
<td>6</td>
<td>4-F</td>
<td>0</td>
<td>19</td>
</tr>
<tr>
<td>7</td>
<td>4-OCH&lt;sub&gt;3&lt;/sub&gt;</td>
<td>8</td>
<td>7</td>
</tr>
<tr>
<td>8</td>
<td>4-CH&lt;sub&gt;3&lt;/sub&gt;</td>
<td>8</td>
<td>16</td>
</tr>
<tr>
<td>9</td>
<td>3-NO&lt;sub&gt;2&lt;/sub&gt;</td>
<td>35</td>
<td>20</td>
</tr>
<tr>
<td>10</td>
<td>3-OCH&lt;sub&gt;3&lt;/sub&gt;H&lt;sub&gt;5&lt;/sub&gt;</td>
<td>28</td>
<td>20</td>
</tr>
</tbody>
</table>

Antifungal activity

The measured zone of inhibition values for the antifungal activities of synthesized substituted (E)-1-(5-chloro-2-hydroxyphenyl)-3-phenylprop-2-en-1-one compounds are summarized in Table 3.

Table 3: Zone of inhibition (mm) values of antifungal activities of substituted (E)-1-(5-chloro-2-hydroxyphenyl)-3-phenylprop-2-en-1-one compounds.

<table>
<thead>
<tr>
<th>S.No</th>
<th>X</th>
<th>Zone of Inhibition (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A. niger</td>
<td>A. flavus</td>
</tr>
<tr>
<td>1</td>
<td>H</td>
<td>9</td>
</tr>
<tr>
<td>2</td>
<td>3-Br</td>
<td>9</td>
</tr>
<tr>
<td>3</td>
<td>4-Br</td>
<td>13</td>
</tr>
<tr>
<td>4</td>
<td>3-Cl</td>
<td>9</td>
</tr>
<tr>
<td>5</td>
<td>4-F</td>
<td>8</td>
</tr>
<tr>
<td>6</td>
<td>4-OCH&lt;sub&gt;3&lt;/sub&gt;</td>
<td>12</td>
</tr>
<tr>
<td>7</td>
<td>4-CH&lt;sub&gt;3&lt;/sub&gt;</td>
<td>16</td>
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<tr>
<td>8</td>
<td>3-NO&lt;sub&gt;2&lt;/sub&gt;</td>
<td>0</td>
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<td>4-NO&lt;sub&gt;2&lt;/sub&gt;</td>
<td>0</td>
</tr>
<tr>
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<td>0</td>
</tr>
<tr>
<td>Standard</td>
<td>Ciprofloxacin</td>
<td>16</td>
</tr>
<tr>
<td>Control</td>
<td>DMSO</td>
<td>0</td>
</tr>
</tbody>
</table>

DISCUSSION

UV-visible Spectra

In the UV–visible spectra of substituted (E)-1-(5-chloro-2-hydroxyphenyl)-3-phenylprop-2-en-1-one compounds (figure-3) a single peak is observed below 375 nm. However there occurs a transition band due to π-π* at 316.5 λ<sub>max</sub> (nm) for the parent compound. The observed peak is assigned to π-π* transition. According to the valence bond theory, as the conjugation increases, the energy difference between the highest occupied and the lowest unoccupied π-orbitals decreases and hence the wave length of the absorption band increases.

Figure 3: UV spectrum of (E)-1-(5-chloro-2-hydroxyphenyl)-3-phenylprop-2-en-1-one.
Infrared Spectrum

The important IR frequencies (figure-4) of substituted (E)-1-(5-chloro-2-hydroxy phenyl)-3-phenylprop-2-en-1-one compounds are presented in the table-2. For (E)-1-(5-chloro-2-hydroxyphenyl)-3-phenylprop-2-en-1-one compound two strong bands are observed for bending vibrations for (one for CO\textsuperscript{cis} and another for CO\textsuperscript{trans}) around 1643.35 and 1577.77 cm\textsuperscript{-1} characteristic of the CO group. The sharp peaks at 1192.01 and 808.17 cm\textsuperscript{-1} correspond to (\textit{=CH}) stretching. The sharp peak at 1024.20 cm\textsuperscript{-1} corresponds to (CH=CH) stretching. The sharp peak at 522.71 cm\textsuperscript{-1} corresponds to (C=C out of plane) stretching and the sharp peak at 723.31 and 840.96 cm\textsuperscript{-1} correspond to (substituted benzene) stretching.

\textbf{Figure 4:} IR spectrum of (E)-1-(5-chloro-2-hydroxyphenyl)-3-phenylprop-2-en-1-one.

\textbf{1H NMR Spectra}

The observed \textsuperscript{1}H NMR spectra of (E)-1-(5-chloro-2-hydroxyphenyl)-3-phenylprop-2-en-1-one is given in (figures-5 & 6). The spectrum was recorded in CDCl\textsubscript{3} solvent at 400 MHz. The assignment is done on the basis of chemical shifts, multiplicities and coupling constants. The \textsuperscript{1}H NMR spectrum (E)-1-(5-chloro-2-hydroxyphenyl)-3-phenylprop-2-en-1-one shows one doublet at \(\delta=7.564\) (d; \(J=15.6\) Hz, 1H, \textit{=CH}), (ppm), and another doublet at \(\delta=7.944\) (d; \(J=15.2\) Hz, 1H, \textit{=CH}), (ppm). The signal at \(\delta=4.580\) (s) is for H in OH. For this compound multiplets are observed around 6.982-7.963 ppm is assigned for 8 aromatic protons of the aromatic rings.

\textbf{Figure 5:} \textsuperscript{1}H NMR spectrum of (E)-1-(5-chloro-2-hydroxyphenyl)-3-phenylprop-2-en-1-one.

\textbf{Figure 6:} \textsuperscript{1}H NMR spectrum of (E)-1-(5-chloro-2-hydroxyphenyl)-3-phenylprop-2-en-1-one: expanded
**13C NMR Spectra**

The observed 13C NMR spectra of (E)-1-(5-chloro-2-hydroxyphenyl)-3-phenylprop-2-en-1-one is given in (figure 7). The spectrum was recorded in CDCl3 solvent at 400 MHz. The assignment is done on the basis of chemical shifts, multiplicities, and coupling constants. The 13C NMR spectrum (E)-1-(5-chloro-2-hydroxyphenyl)-3-phenylprop-2-en-1-one shows signals at 119.45(C-O), 146.53(C-C), 192.81(C=O), 128.84(C-Cl), and 162.05(C-OH).

**Antibacterial sensitivity assay**

From the table 2, the zone of inhibition (mm) values of substituted (E)-1-(5-chloro-2-hydroxyphenyl)-3-phenylprop-2-en-1-one compounds reveal that most of the compounds have shown moderate, good, and excellent activity. However, some compounds show no activity against all the ten microorganisms used in the present investigation. The cluster column chart of the zone of inhibition is given in (figure 8). The 3-NO2 substituted compound has presented excellent activity against *Bacillus subtilis*, *Staphylococcus aureus*, *klebsiella pneumonia*, *proteus mirabilis* and *salmonella typhi*. The H (parent) compound has presented excellent activity against *Clostridium botulinii*, *Enterococcus species*, *Escherichia coli* and *klebsiella pneumonia*. The 4-F substituted compound has presented excellent activity against *Staphylococcus aureus*, *Escherichia coli* and *klebsiella pneumonia*. The 4-CH3 substituted compound has presented excellent activity against *Nocardia species*, *Escherichia coli* and *salmonella typhi*. The 3-CI substituted compound has presented excellent activity against *Escherichia coli* and *proteus mirabilis*. The 3-OCH3 substituted compound has presented excellent activity against *Staphylococcus aureus* and *salmonella typhi*. The 3-OCH3, 3-CI substituted compound has presented excellent activity against *Bacillus subtilis* and *Staphylococcus aureus*. The remaining substituted compounds have shown good and moderate antibacterial activity.

**Antifungal sensitivity assay**

From the table 3, the zone of inhibition (mm) values of substituted (E)-1-(5-chloro-2-hydroxyphenyl)-3-phenylprop-2-en-1-one compounds reveal that most of the compounds have shown moderate, good, and excellent activity. However, some compounds show no activity against all the five fungal species evaluated in general, used in the present investigation. The cluster column chart of the zone of inhibition is given in (figure 9). The 4-OCH3 substituted compound has shown excellent activity against *Aspergillus niger*. The 3-OCH3 substituted compound has shown excellent activity against *Mucor species*. The remaining substituted compounds have shown good and moderate antibacterial activity.
CONCLUSION

Ten number of substituted (E)-1-(5-chloro-2-hydroxyphenyl)-3-phenylprop-2-en-1-one compounds have been synthesized and their structures have been confirmed by their physical constants, UV, IR and NMR spectral data. The antimicrobial activity of all the synthesized (E)-1-(5-chloro-2-hydroxyphenyl)-3-phenylprop-2-en-1-one compounds have been studied using Kirby-Bauer method. The 3-NO2 substituted compound has shown excellent activity against five out of ten bacterial strains namely Bacillus subtilis., Staphylococcus aureus., klebsiella pneumonia., proteus mirabilis and salmonella typhi. The H (parent), substituted compound has shown excellent activity against four out of ten bacterial strains namely Clostridium botulin, Escherichia coli, klebsiella pneumonia and salmonella typhi. The 3-Br substituted compound has shown excellent activity against four out of ten bacterial strains namely Clostridium botulin., Nocardia species., Escherichia coli and proteus mirabilis. The 4-Br substituted compound has shown excellent activity against four out of ten bacterial strains namely Nocardia species., Enterococcus species., Escherichia coli and proteus mirabilis. The 3-F substituted compound has shown excellent activity against four out of ten bacterial strains namely Clostridium botulin., Nocardia species., Escherichia coli and klebsiella pneumonia. The 4-OCH3 substituted compound has shown excellent activity against one out of five fungal strains namely Aspergillus niger. 3-OC6H3 substituted compound has shown excellent activity against one out of five fungal strains namely Mucor species.

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References


