

## Synthesis of Some Benzalacetophenones and Their Imino Derivatives

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A group of five new benzalacetophenones (**L<sub>1</sub>-L<sub>5</sub>**) were synthesized by the condensation of variably substituted aldehydes with acetophenone and acetyl furan, in the presence of 10 % NaOH and ethanol. Further more benzalacetophenones (**L<sub>1</sub>-L<sub>5</sub>**) were converted to three series of their imino derivatives (**L<sub>1</sub>A<sub>1</sub>-L<sub>5</sub>C<sub>3</sub>**). The chemical structure of these compounds was characterized by FTIR, EIMS, <sup>1</sup>H NMR, <sup>13</sup>C NMR spectroscopy and CHN analysis.

**Key Words:** Synthesis, Benzalacetophenone, Acetyl furan, Imino derivatives.

### INTRODUCTION

Benzalacetophenones constitute a class of naturally occurring pigments, which are often referred to as chalcones. Kostanecki<sup>1</sup> first coined this term and did pioneering work in the synthesis of natural colouring compounds. An interesting feature of these compounds is that they serve as starting material for the synthesis of another class of naturally occurring pigments called flavones. Many patents have appeared in the literature, describing the usefulness of these compounds and their derivatives. These find applications as artificial sweeteners, oxidation inhibitors, stabilizers against light, heat and aging<sup>2</sup>, visible and UV light<sup>3</sup>, colour photography<sup>4</sup>, scintillates<sup>5</sup>, polymerization catalysts<sup>6</sup>, fluorescent whiting agents<sup>7</sup> and organic brightening additives<sup>8</sup>. Benzalacetophenone analogues have been reported to be bioactive compounds, e.g. furyl-analogues of benzalacetophenone<sup>9,10</sup> have been reported to be a significant bacteriostatic agent against *E. coli*, *S. aureus*, *B. micoidis*, *B. subtilis* and *S. lutea*. These compounds also act as strong toxic accaricidal agents<sup>11,12</sup>. Oxime derivatives of benzalacetophenone exhibit week herbicidal activity<sup>13</sup>. Benzalacetophenone and its semicarbazone derivatives possess high antifungal activity<sup>14</sup>. In continuation of our reported work<sup>15</sup> on the synthesis of benzylacetophenones, we now report the synthesis of one new heterocyclic *mimic* of benzylaceto-phenone and another fifteen new imino derivatives of benzylacetophenone.

## EXPERIMENTAL

All melting points were determined in open capillaries using Gallenkamp melting point apparatus and are un-corrected. All chemicals were supplied by Fluka and Sigma Aldrich (Germany).  $R_f$  values were calculated by using pre-coated silica gel aluminum backed plates Kieselgel 60 F<sub>254</sub> Merck (Germany), in ethyl acetate:pet-ether (1:2). FTIR spectra were recorded on Bio-Rad Merlin using KBr discs. <sup>1</sup>H NMR spectra were recorded on Bruker (400 MHz) AM-250 using TMS as internal standard. EIMS were recorded on VG: 70 SE Mass Spectrometer. Purity of each compound was monitored by TLC.

**Preparation of 1,3-difuranyl prop-2-en-1-one (L<sub>1</sub>):** 1,3-Difuranyl prop-2-en-1-one was synthesized by condensing 2-acetyl furan (0.01 mol) with benzaldehyde (0.01 mol) according to Claisen Schmidt condensation reaction<sup>16,17</sup>.

**Preparation of 1-(2'-hydroxy)-3-phenyl-prop-2-ene(L<sub>5</sub>):** 1-(2'-Hydroxy)-3-phenyl-prop-2-ene (L<sub>5</sub>) was synthesized by condensing 2'-hydroxy acetophenone (0.01 mol) with benzaldehyde (0.01 mol) in 100 mL of distilled ethanol in a round bottom flask and 50 % aqueous solution of KOH was added drop wise to the reaction mixture with continuous stirring for about 0.5 h. The reaction mixture was then allowed to stand over night. Crushed ice was then added to it and was neutralized with dilute HCl, the product was filtered off and recrystallized from ethanol.

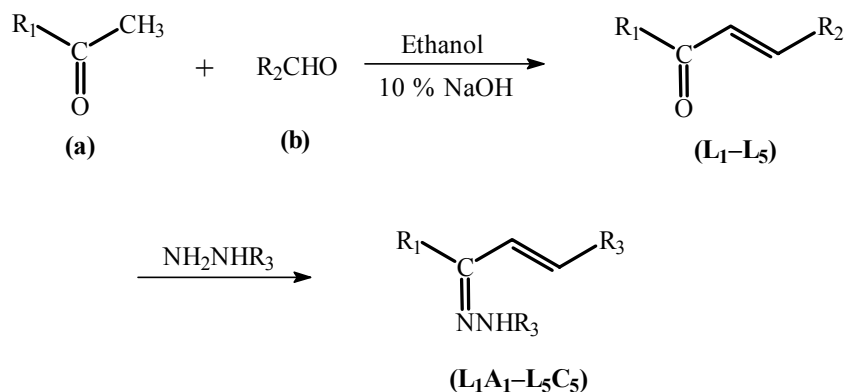
**Preparation of 1, 3-difuranyl-pro-2-ene-1-oxime (L<sub>1</sub>A<sub>1</sub>):** In a 250 mL round bottom flask, 5.83 g (0.084 mol) hydroxylamine hydrochloride, 35 mL of distilled water, 24 mL of 10 % NaOH solution, 5 g (0.024 mol) of furfural and enough ethanol was added drop wise while shaking, to obtain a clear solution. The reaction mixture was refluxed on a water bath for about 10 to 20 min. The resultant solution was cooled in an ice bath and crystallization was initiated by scratching the walls of the container with a glass rod. The contents of the flask were allowed to stand over night in a refrigerator. The crystals thus formed were collected by suction filtration, washed with ice cold water and recrystallized from ethanol. Same procedure was used for the synthesis of (L<sub>2</sub>A<sub>2</sub>-L<sub>5</sub>A<sub>5</sub>).








**Preparation of phenyl hydrazone derivatives of 1,3-difuranyl prop-2-en-1-one (L<sub>1</sub>B<sub>1</sub>):** To a solution of 5 g (0.024 mol) of 1,3-difuranyl prop-2-en-1-one (L<sub>1</sub>) in 25 mL of glacial acetic acid, 2.35 mL (0.022 mol) of phenyl hydrazine was added gradually with continuous shaking and the mixture was allowed to stand for 1 h. Yellow crystals began to separate which were filtered on a Buchner funnel and washed with supper cooled ethanol. Recrystallization of the product (L<sub>1</sub>B<sub>1</sub>) was achieved with 90 % ethanol. Same procedure was used for the synthesis of (L<sub>2</sub>B<sub>2</sub>-L<sub>5</sub>B<sub>5</sub>).

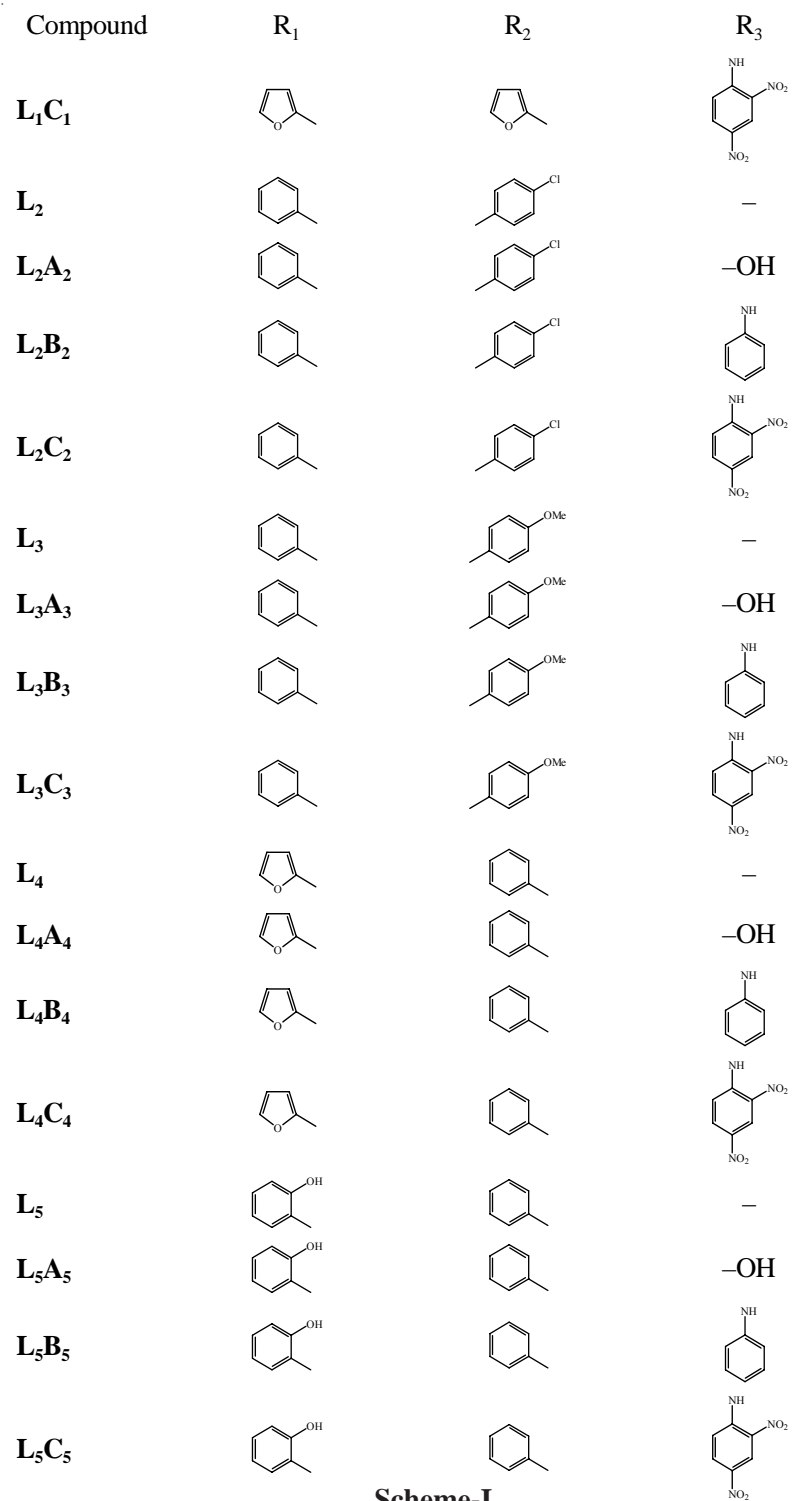
**Preparation of 2,4 dinitrophenyl hydrazone derivatives of 1,3-difuranyl prop-2-en-1-one ( $L_1C_1$ ):** To a solution of 4.42 g (0.022 mol) of 2,4 dinitrophenyl hydrazine in 24 mL of distilled water, 24 mL of concentrated sulfuric acid was added drop wise. The resultant solution was allowed to attain room temperature. 100 mL of 95 % ethanol was then added to this solution. Separately a solution of 2-furyl acetophenone 5 g (0.022 mol) in 100 mL of 95 % ethanol was prepared. This solution was then added slowly to the 2,4-dinitrophenyl hydrazine solution and was refluxed on a steam bath for 15-20 min. On cooling crystals of ( $L_1C_1$ ) were formed and were collected by suction filtration, washed with cold ethanol and recrystallized with 98 % ethanol. Same procedure was used for the synthesis of ( $L_2C_2$ - $L_5C_5$ ).

## RESULTS AND DISCUSSION

Benzalacetophenones  $L_{1-5}$  were synthesized by condensing acetophenone (**a**) with appropriate benzaldehyde derivatives (**b**) in dilute ethanolic sodium hydroxide solution at room temperature, their oxime derivatives ( $L_1A_1$ - $L_5A_5$ ), Phenyl hydrazone derivatives ( $L_1B_1$ - $L_5B_5$ ) and 2,4-dinitrophenylhydrazone derivatives ( $L_1C_1$ - $L_5C_5$ ) were synthesized by the reaction of appropriate benzalacetophenone derivatives ( $L_{1-5}$ ), according to **Scheme-I**. Physical data of all synthesized benzalacetophenones, their oxime, phenyl hydrazone and 2,4-dinitrophenyl hydrazone derivatives are listed in Table-1.



Compound	R <sub>1</sub>	R <sub>2</sub>	R <sub>3</sub>
$L_1$			—
$L_1A_1$			—OH
$L_1B_1$			



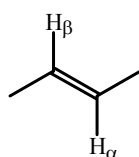
Scheme-I

TABLE-1  
PHYSICAL DATA OF SYNTHESIZED COMPOUNDS L<sub>1</sub>-L<sub>5</sub>C<sub>5</sub>

Compd.	m.f.	m.w.	m.p. (°C)	Yield (%)	Found (Calcd.) %		
					C	H	N
L <sub>1</sub>	C <sub>11</sub> H <sub>8</sub> O <sub>3</sub>	188	191- 193	73.00	70.8 (70.21)	4.32 (4.25)	–
L <sub>2</sub>	C <sub>15</sub> H <sub>11</sub> OCl	242	97- 99	75.00	74.3 (74.12)	4.83 (4.54)	–
L <sub>3</sub>	C <sub>16</sub> H <sub>14</sub> O <sub>2</sub>	239	65- 67	82.00	79.4 (80.67)	5.23 (5.88)	–
L <sub>4</sub>	C <sub>13</sub> H <sub>10</sub> O <sub>2</sub>	233	94- 95	78.00	79.12 (78.78)	4.89 (5.05)	–
L <sub>5</sub>	C <sub>11</sub> H <sub>8</sub> O <sub>3</sub>	224	78- 80	82.00	79.12 (80.35)	14.89 (14.28)	–
L <sub>1</sub> A <sub>1</sub>	C <sub>11</sub> H <sub>9</sub> N	155	195- 196	68.00	64.99 (65.16)	4.67 (4.43)	6.81 (6.89)
L <sub>2</sub> A <sub>2</sub>	C <sub>15</sub> H <sub>12</sub> NOCl	257	178- 180	65.00	69.29 (70.03)	4.51 (4.66)	5.69 (5.44)
L <sub>3</sub> A <sub>3</sub>	C <sub>16</sub> H <sub>15</sub> NO <sub>2</sub>	253	123- 125	64.00	75.12 (75.88)	5.67 (5.92)	5.20 (5.53)
L <sub>4</sub> A <sub>4</sub>	C <sub>13</sub> H <sub>11</sub> NO <sub>2</sub>	213	252- 253	75.00	74.11 (73.90)	5.52 (5.21)	6.50 (6.63)
L <sub>5</sub> A <sub>5</sub>	C <sub>15</sub> H <sub>13</sub> NO	223	211- 213	62.00	80.11 (80.71)	5.92 (5.82)	6.50 (6.27)
L <sub>1</sub> B <sub>1</sub>	C <sub>17</sub> H <sub>14</sub> N <sub>2</sub> O <sub>2</sub>	278	253- 255	73.00	72.67 (73.38)	6.29 (5.03)	9.82 (10.07)
L <sub>2</sub> B <sub>2</sub>	C <sub>21</sub> H <sub>17</sub> N <sub>2</sub> Cl	332	121- 122	69.00	84.45 (84.56)	6.29 (6.04)	9.82 (9.39)
L <sub>3</sub> B <sub>3</sub>	C <sub>22</sub> H <sub>20</sub> N <sub>2</sub> O	328	220- 222	71.00	80.31 (80.48)	6.45 (6.09)	8.46 (8.53)
L <sub>4</sub> B <sub>4</sub>	C <sub>19</sub> H <sub>16</sub> N <sub>2</sub> O	228	154- 156	67.77	80.11 (79.16)	6.12 (5.9)	9.51 (9.72)
L <sub>5</sub> B <sub>5</sub>	C <sub>21</sub> H <sub>19</sub> N <sub>2</sub> O	314	202- 205	69.01	80.11 (80.25)	5.12 (5.73)	9.11 (8.91)
L <sub>1</sub> C <sub>1</sub>	C <sub>17</sub> H <sub>12</sub> N <sub>4</sub> O <sub>6</sub>	368	198- 201	62.01	55.63 (55.43)	3.33 (3.26)	7.54 (7.60)
L <sub>2</sub> C <sub>2</sub>	C <sub>21</sub> H <sub>15</sub> N <sub>4</sub> O <sub>4</sub> Cl	422	178- 180	50.07	59.71 (59.71)	3.55 (3.55)	12.98 (13.27)
L <sub>3</sub> C <sub>3</sub>	C <sub>22</sub> H <sub>18</sub> N <sub>4</sub> O <sub>5</sub>	418	201- 203	53.00	63.05 (63.15)	4.32 (4.30)	13.40 (13.39)
L <sub>4</sub> C <sub>4</sub>	C <sub>19</sub> H <sub>15</sub> N <sub>4</sub> O <sub>5</sub>	378	210- 112	50.10	60.63 (60.31)	3.81 (3.70)	14.85 (14.81)
L <sub>5</sub> C <sub>5</sub>	C <sub>21</sub> H <sub>16</sub> N <sub>4</sub> O <sub>5</sub>	404	211- 213	62.00	61.63 (62.37)	3.81 (3.96)	13.15 (13.86)

Benzalacetophenone *mimic* 1,3-difuranyl prop-2-en-1-one (**L<sub>1</sub>**) was obtained as off white crystals. The molecular formula and molecular weight of the compound (**L<sub>1</sub>**) are C<sub>11</sub>H<sub>8</sub>O<sub>3</sub> and 188, respectively. The FTIR spectrum showed stretching frequencies at 1506 cm<sup>-1</sup>, 1690 cm<sup>-1</sup> which are characteristics of aromatic (C=C) and carbonyl (C=O), respectively.

<sup>1</sup>H NMR spectrum of (**L<sub>1</sub>**) showed two doublets at 6.67 and 7.54 ppm with large coupling constant of 15 and 17.6 Hz, which are respectively characteristic of the α and β protons as shown below:



The six aromatic protons of the two furan rings appear as doublets in the range of 6.61-7.80 ppm. <sup>13</sup>C NMR spectrum showed two doublets at 127.4 and 131.5 ppm, which are characteristic of the two alkenyl carbons, carrying the α and β protons. Singlets at 153.6 and 151.6 ppm are characteristic of the two furan ring carbons, which are attached to carbonyl and alkenyl groups of the molecule, respectively. Doublets at 121.2, 112.6, 149.3, 111.4, 112.7 and 145.9 ppm are due to six carbon atoms of the two furane rings to which aromatic protons are attached. A singlet at 177.6 ppm showed the presence of a carbonyl carbon.

The mass spectrum of 1,3-difuranyl prop-2-en-1-one (**L<sub>1</sub>**) showed molecular ion peak [M]<sup>+</sup> at m/z 188 which is also the base peak and is in good agreement with the molecular weight of the compound. Physical and spectral (FTIR, <sup>1</sup>H NMR, <sup>13</sup>C NMR, EIMS) data confirmed the structure of benzalacetophenone *mimic* (**L<sub>1</sub>**) as 1,3-difuranyl prop-2-en-1-one. Similarly benzalacetophenone (**L<sub>2-5</sub>**) were characterized on the basis of their physical and spectral data.

Oxime derivative of 1,3-diphenyl-pro-2-ene (**L<sub>1A<sub>1</sub></sub>**) of benzalacetophenone *mimic* (**L<sub>1</sub>**) was obtained as white granules. In the FTIR spectrum of this derivative, the band due to carbonyl of **L<sub>1</sub>** at 1690 cm<sup>-1</sup> disappeared and a new band at 1585 cm<sup>-1</sup> appeared, which is characteristic of (C=N). The molecular ion peak enhanced from 188 to 203 and in <sup>1</sup>H NMR and <sup>13</sup>C NMR a significant singlet at 11.00 ppm and a peak at 164.6 ppm are due to the hydroxyl proton and the carbon doubly bonded to nitrogen, respectively. All other oxime derivatives (**L<sub>2A<sub>2</sub></sub>**-**L<sub>5A<sub>5</sub></sub>**) were similarly identified.

1,3-Diphenyl-pro-2-ene-1-phenylhydrazone (**L<sub>1B<sub>1</sub></sub>**) was obtained as pale yellow crystals. There was not much difference between the FTIR spectra of (**L<sub>1A<sub>1</sub></sub>**) and (**L<sub>1B<sub>1</sub></sub>**) however, the molecular ion peak further increased to m/z = 278. <sup>1</sup>H NMR spectrum of 1,3-diphenyl-pro-2-ene-1-phenylhydrazone (**L<sub>1B<sub>1</sub></sub>**) was almost similar to that of (**L<sub>1A<sub>1</sub></sub>**) except for the presence of

a singlet at 7.00 due to the imino proton instead of a hydroxyl proton of (**L<sub>1</sub>A<sub>1</sub>**) and a multiplet between 6.4-7.01 ppm due to the protons of phenyl ring attached to the imino group. <sup>13</sup>C NMR spectrum of (**L<sub>1</sub>B<sub>1</sub>**) was also not very different from (**L<sub>1</sub>A<sub>1</sub>**) except that a singlet at 143.1, doublets at 116.3, 129.8, 118.8 were observed, which are due to the carbons of the phenyl ring attached to the imino moiety. All other phenylhydrazone derivatives (**L<sub>2</sub>B<sub>2</sub>**-**L<sub>5</sub>B<sub>5</sub>**) were characterized accordingly. Similarly all other 2",4"-dinitrophenylhydrazone derivatives (**L<sub>2</sub>C<sub>2</sub>**-**L<sub>5</sub>C<sub>5</sub>**) were characterized on the basis of their physical and spectral data.

Complete spectral data (<sup>1</sup>H NMR, <sup>13</sup>C NMR, EIMS, FTIR) of all synthesized compounds (**L<sub>2</sub>**-**L<sub>5</sub>C<sub>5</sub>**) are tabulated in Tables 2-4.

TABLE-2  
<sup>1</sup>H NMR DATA OF SYNTHESIZED COMPOUNDS L<sub>1</sub>-L<sub>5</sub>C<sub>5</sub>

Compd.	<sup>1</sup> H NMR (ppm)
<b>L<sub>1</sub></b>	δH: 6.67 (d, 1H, 15Hz), 7.54 (d, 1H, 17.6Hz), 7.00 (dd, 1H), 6.65 (dd, 1H), 7.80 (dd, 1H), 7.23 (dd, 1H), 6.61 (dd, 1H), 7.72 (dd, 1H).
<b>L<sub>2</sub></b>	7.56 (d, 1H, 15Hz), 7.90 (d, 1H, 15Hz), 7.24 (dd, 2H, 8.2, 8.5Hz), 7.22 (dd, 2H, 8.3, 2.5Hz), 7.81 (m, 2H), 7.45 (m, 1H), 7.54 (m, 2H)
<b>L<sub>3</sub></b>	3.73 (s, 3H), 7.90 (d, 1H, 13.7Hz), 7.56 (d, 1H, 15Hz), 7.19 (dd, 2H, 7.2, 1.2Hz), 6.72 (dd, 2H, 8.3, 1.02Hz), 7.71 (m, 2H, 7.9, 2.3Hz), 7.45 (m, 1H, 1.8Hz), 7.54 (m, 2H, 7.9, 2.3Hz).
<b>L<sub>4</sub></b>	6.67 (d, 1H, 12.11), 7.54 (d, 1H, 13.7Hz), 6.61 (dd, 1H, 3.2, 1.8Hz), 7.23 (d, 1H, 3.5Hz), 7.72 (d, 1H, 1.02Hz), 7.30 (m, 2H), 7.21 (m, 2H), 7.14 (m, 1H)
<b>L<sub>5</sub></b>	7.56 (d, 1H, 12.11Hz), 5.00 (s, 1H), 6.92 (m, 1H), 7.37 (m, 1H), 7.01 (m, 1H), 7.64 (m, 1H), 7.30 (m, 2H), 7.21 (m, 2H), 7.14 (m, 1H).
<b>L<sub>1</sub>A<sub>1</sub></b>	5.6 (d, 1H, 15.01Hz), 6.67 (d, 1H, 12.2Hz), 11.00 (s, 1H), 6.3 (dd, 2H), 7.4 (dd, 1H), 6.3 (dd, 2H), 7.4 (dd, 1H)
<b>L<sub>2</sub>A<sub>2</sub></b>	5.6 (d, 1H, 13.2Hz), 6.67 (d, 1H, 12.5Hz), 11.00 (1H), 7.3 (dd, 2H), 7.21 (dd, 2H), 7.6 (m, 2H), 7.3 (m, 2H), 7.14 (m, 1H).
<b>L<sub>3</sub>A<sub>3</sub></b>	5.6 (d, 1H, 13.2Hz), 6.67 (d, 1H, 11.5Hz), 10.20 (s, 1H), 7.6 (m, 2H), 7.3 (m, 2H), 7.14 (m, 1H), 7.19 (dd, 2H), 6.72 (dd, 2H), 3.73 (s, 1H).

Compd.	<sup>1</sup> H NMR (ppm)
<b>L<sub>4</sub>A<sub>4</sub></b>	5.6 (d, 1H, 14.5Hz), 6.67 (d, 1H, 11.6Hz), 11.52 (s, 1H), 7.3 (m, 2H) 7.21 (m, 2H), 7.14 (m, 1H), 6.3 (d, 1H, 3.2Hz), 6.4 (dd, 1H, 2.5, 1.2Hz), 7.54 (d, 1H, 1.5Hz)
<b>L<sub>5</sub>A<sub>5</sub></b>	5.62 (d, 1H, 12.5Hz), 6.69 (d, 1H, 13.9Hz), 5.00 (s, 1H), 6.8 (m, 1H), 7.11 (m, 1H), 6.8 (m, 1H), 7.4 (m, 1H), 7.30 (m, 2H), 7.21 (m, 2H), 7.14 (m, 1H), 6.46 (m, 2H), 7.01 (m, 1H), 6.62 (m, 1H).
<b>L<sub>1</sub>B<sub>1</sub></b>	5.6 (d, 1H, 15.2Hz), 6.6 (d, 1H, 13.02Hz), 6.3 (dd, 4H) 7.4 (dd, 2H), 7.01 (s, 1H), 6.46 (m, 2H), 7.01 (m, 2H), 6.62 (m, 1H).
<b>L<sub>2</sub>B<sub>2</sub></b>	7.90 (d, 1H, 15Hz), 7.56 (d, 1H, 15Hz), 7.6 (m, 2H) 7.31 (m, 2H), 7.14 (m, 1H), 7.02 (s, 1H), 7.22 (dd, 2H, 2.5, 6.9Hz), 6.24 (dd, 1H, 7.2, 6.2Hz), 6.6 (d, 1H, 15Hz), 7.00 (s, 1H) 6.46 (m, 2H), 7.01 (m, 2H), 6.46 (m, 2H).
<b>L<sub>3</sub>B<sub>3</sub></b>	5.6 (d, 1H, 11.9Hz), 6.6 (d, 1H, 12.7Hz), 11.52 (s, H, 7.6 (m, 2H), 7.3 (m, 2H), 7.14 (m, 1H), 7.19 (dd, 2H, 7.1, 2.2Hz), 6.72 (dd, 2H, 7.5, 1.2Hz), 3.73 (s, 3H), 6.6 (d, 1H, 15Hz), 7.00 (s, 1H) 6.46 (m, 2H), 7.01 (m, 2H),
<b>L<sub>4</sub>B<sub>4</sub></b>	5.6 (d, 1H, 13.2Hz), 6.67 (d, 1H, 11.95Hz), 11.52 (s, 1H), 6.3 (d, 1H, 2.1Hz), 6.39 (d, 1H, 1.4Hz), 7.30 (m, 2H), 7.21 (m, 2H), 7.14 (m, 1H) (d, 1H, 1.2Hz), 6.46 (m, 2H), 7.01 (m, 2H), 6.62 (m, 1H),
<b>L<sub>5</sub>B<sub>5</sub></b>	5.6 (d, 1H, 14.02Hz), 6.67 (2.5Hz), 5.00 (s, 1H), 6.8 (m, 1H), 7.11 (m, 1H), 6.8 (m, 1H), 7.4 (m, 1H), 7.30 (m, 2H), 7.21 (m, 2H), 7.14 (m, 1H), 6.46 (m, 2H), 7.01 (m, 1H), 6.62 (m, 1H)
<b>L<sub>1</sub>C<sub>1</sub></b>	5.6 (d, 1H, 15Hz), 6.6 (d, 1H, 15Hz), 6.3 (dd, 4H) 7.4 (dd, 2H), 7.01 (s, 1H), 6.98 (m, 1H), 8.33 (m, 1H), 8.87 (m, 1H).
<b>L<sub>2</sub>C<sub>2</sub></b>	7.90 (d, 1H, 15Hz), 7.56 (d, 1H, 13.8Hz), 7.02 (s, 1H) 7.6 (m, 2H), 7.3 (m, 2H), 6.14 (m, 2H), 7.24 (dd, 2H, 2.2, 5.5Hz), 7.22 (dd, 2H, 2.5, 6.9Hz), 6.90 (dd, 1H, 7.2, 6.2Hz), 8.33 (dd, 1H, 6.9, 5.5Hz), 8.87 (dd, 1H, 4.5, 6.9Hz).
<b>L<sub>3</sub>C<sub>3</sub></b>	5.6 (d, 1H, 14.2Hz), 6.6 (d, 1H, 11.9Hz), 11.52 (s, 1H) 7.6 (m, 2H), 7.3 (m, 2H), 7.14 (m, 1H), 7.19 (dd, 2H, 7.1, 2.2Hz), 6.72 (dd, 2H, 7.5, 1.2Hz), 3.73 (s, 3H), 6.98 (dd, 1H, 5.1, 6.8Hz), 8.33 (dd, 1H, 1.2, 6.7Hz), 8.87 (dd, 1H, 6.2, 7.9Hz).
<b>L<sub>4</sub>C<sub>4</sub></b>	5.6 (d, 1H, 12.2Hz), 6.67 (d, 1H, 13.9Hz), 11.52 (s, 1H), 6.3 (d, 1H, 2.1Hz), 6.39 (d, 1H, 1.4Hz), 7.4 (d, 1H, 1.2Hz), 7.30 (m, 2H), 7.21 (m, 2H), 7.14 (m, 1H), 6.98 (dd, 1H, 5.1, 6.8Hz), 8.33 (dd, 1H, 1.2, 6.7Hz), 8.87 (dd, 1H, 6.2, 7.9Hz).
<b>L<sub>5</sub>C<sub>5</sub></b>	5.6 (d, 1H, 12.2Hz), 6.67 (d, 1H, 11.9Hz), 5.00 (s, 1H), 6.8 (m, 1H), 7.11 (m, 1H), 6.8 (m, 1H), 7.4 (m, 1H), 7.30 (m, 2H), 7.21 (m, 2H), 7.14 (m, 1H), 6.98 (m, 1H), 8.33 (m, 1H), 8.87 (m, 1H).



TABLE-3  
<sup>13</sup>C NMR DATA OF SYNTHESIZED COMPOUNDS L<sub>1</sub>-L<sub>5</sub>C<sub>5</sub>

Compd.	<sup>13</sup> C NMR (ppm)
<b>L<sub>1</sub></b>	δC: 127.4 (d, 1C), 131.5 (d, 1C), 177.8 (s, 1C), 153.6 (s, 1C), 121.2 (d, 2C), 112.6 (d, 1C), 149.3 (d, 1C), 151.6 (s, 1C), 111.4 (d, 1C), 112.7 (d, 1C), 145.9 (d, 1C).
<b>L<sub>2</sub></b>	121.4 (d, 1C), 145.2 (d, 1C), 189.7 (s, 1C), 137.9 (s, 1C), 129.9 (d, 2C), 129.3 (d, 2C), 134.6 (d, 1C), 135.2 (s, 1C), 126.4 (d, 2C), 128.7 (d, 2C), 128.0 (s, 1C).
<b>L<sub>3</sub></b>	121.4 (d, 1C), 145.2 (d, 1C), 187.7 (s, 1C), 137.9 (s, 1C), 129.9 (d, 2C), 129.3 (d, 2C), 134.6 (d, 1C), 127.5 (s, 1C), 127.4 (d, 2C), 114.2 (d, 2C), 159.9 (s, 1C), 55.9 (q, 1C)
<b>L<sub>4</sub></b>	121.4 (d, 1C), 145.2 (d, 1C), 177.8 (s, 1C), 153.6 (s, 1C), 121.2 (d, 1C), 112.6 (d, C), 149.3 (d, 1C), 135.2 (s, 1C), 126.4 (d, 2C), 128.7 (d, 2C), 128.0 (d, 1C).
<b>L<sub>5</sub></b>	121.4 (d, 1C), 145.2 (d, 1C), 189.7 (s, 1C), 122.7 (s, 1C), 161.8 (s, 1C), 116.9 (d, C), 136.0 (d, 1C), 121.9 (d, 1C), 131.3 (d, 2C), 145.2 (s, 1C), 128.7 (d, 2C), 128.0 (d, 1C).
<b>L<sub>1</sub>A<sub>1</sub></b>	126.6 (d, 1C), 128.8 (d, 1C), 164.6 (s, 1C), 143.2 (s, 1C), 109.5 (d, 2C), 143.9 (d, 1C), 151.6 (s, 1C), 111.4 (s, 1C), 112.7 (d, 1C), 145.9 (d, 1C).
<b>L<sub>2</sub>A<sub>2</sub></b>	120.6 (d, 1C), 142.5 (d, 1C), 164.6 (s, 1C), 133.2 (s, 1C), 129.2 (d, 2C), 128.9 (d, 2C), 131.1 (d, 1C), 133.3 (s, 1C), 127.8 (d, 2C), 128.8 (d, 2C), 133.6 (s, 1C).
<b>L<sub>3</sub>A<sub>3</sub></b>	120.6 (d, 1C), 142.9 (d, 1C), 164.6 (s, 1C), 133.2 (s, 1C), 129.2 (d, 2C), 128.9 (d, 2C), 131.1 (d, 1C), 127.5 (s, 1C), 127.4 (d, 2C), 114.2 (d, 2C), 159.9 (s, 1C), 55.9 (q, 1C).
<b>L<sub>4</sub>A<sub>4</sub></b>	120.6 (d, 1C), 142.5 (d, 1C), 164.6 (s, 1C), 143.6 (s, 1C), 109.5 (d, 1C), 109.9 (d, C), 143.9 (d, 1C), 135.2 (s, 1C), 126.4 (d, 2C), 128.7 (d, 2C), 128.0 (d, 1C).
<b>L<sub>5</sub>A<sub>5</sub></b>	120.6 (d, 1C), 142.5 (d, 1C), 164.6 (s, 1C), 118.4 (s, 1C), 161.1 (s, 1C), 116.0 (d, C), 132.5 (d, 1C), 121.5 (s, 1C), 130.6 (d, 2C), 135.2 (s, 1C), 126.4 (d, 2C), 128.7 (d, 2C), 128 (d, 1C).
<b>L<sub>1</sub>B<sub>1</sub></b>	124.7 (d, 1C), 125.3 (d, 1C), 155.6 (s, 1C), 143.2 (s, 1C), 109.9 (d, 2C), 143.9 (d, 1C), 151.6 (s, 1C), 111.4 (s, 1C), 112.7 (d, 1C), 145.9 (d, 1C).
<b>L<sub>2</sub>B<sub>2</sub></b>	118.7 (d, 1C), 139.0 (d, 1C), 155.6 (s, 1C), 133.2 (s, 1C), 129.2 (d, 2C), 131.1 (d, 2C), 133.3 (s, 1C), 127.8 (d, 2C), 128.8 (d, 2C), 143.1 (s, 1C), 116.3 (d, 1C), 129.6 (d, 1C), 118.8 (d, 1C), 129.8 (d, 1C), 116.3 (d, 1C).
<b>L<sub>3</sub>B<sub>3</sub></b>	118.7 (d, 1C), 139 (d, 1C), 155.6 (s, 1C), 133.2 (s, 1C), 129.2 (d, 2C), 128.9 (d, 2C), 131.9 (d, 1C), 127.5 (s, 1C), 127.4 (d, 2C), 114.2 (d, 2C), 159.9 (s, 1C), 55.9 (q, 1C), 143.1 (s, 1C), 116.3 (d, 1C), 129.6 (d, 1C), 118.8 (d, 1C), 129.8 (d, 1C), 116.3 (d, 1C).

Compd.	<sup>13</sup> C NMR (ppm)
<b>L<sub>4</sub>B<sub>4</sub></b>	118.7 (d, 1C), 139 (d, 1C), 155.6 (s, 1C), 143. (s, 1C), 109.5 (d, 1C), 109.9 (d, 1C), 143.9 (d, 1C), 135.2 (s, 1C), 126.4 (d, 2C), 128.7 (d, 2C), 128 (d, 1C), 143.1 (s, 1C), 116.3 (d, 1C), 129.6 (d, 1C), 118.8 (d, 1C), 129.8 (d, 1C), 116.3 (d, 1C).
<b>L<sub>5</sub>B<sub>5</sub></b>	118.7 (d, 1C), 139.9 (d, 1C), 155.6 (s, 1C), 118.4 (s, 1C), 161.1 (s, 1C), 116.0 (d, C), 132.5 (d, 1C), 121.5 (s, 1C), 130.6 (d, 2C), 135.2 (s, 1C), 126.4 (d, 2C), 128.7 (d, 2C), 128 (d, 1C), 143.1 (s, 1C), 116.3 (d, 2C), 129.6 (d, 2C), 118.8 (d, 1C).
<b>L<sub>1</sub>C<sub>1</sub></b>	124.7 (d, 1C), 125.3 (d, 1C), 155.6 (s, 1C), 143.2 (s, 1C), 109.9 (d, 2C), 147.9 (s, 1C), 118.1 (d, 1C), 128.0 (d, 1C), 139.3 (s, 1C), 119.5 (d, 1C), 135.9 (s, 1C).
<b>L<sub>2</sub>C<sub>2</sub></b>	118.7 (d, 1C), 139.0 (d, 1C), 155.6 (s, 1C), 133.2 (s, 1C), 129.2 (d, 2C), 131.1 (d, 2C), 133.3 (s, 1C), 127.8 (d, 2C), 128.8 (d, 2C), 147.9 (s, 1C), 135.9 (s, 1C), 119.5 (d, 1C), 139.3 (s, 1C), 128 (d, 1C), 118 (d, 1C).
<b>L<sub>3</sub>C<sub>3</sub></b>	118.7 (d, 1C), 139 (d, 1C), 155.6 (s, 1C), 133.2 (s, 1C), 129.2 (d, 2C), 128.9 (d, 2C), 131.9 (d, 1C), 127.5 (s, 1C), 127.4 (d, 2C), 114.2 (d, 2C), 159.9 (s, 1C), 55.9 (q, 1C), 147.9 (s, 1C), 135.9 (s, 1C), 119.5 (d, 1C), 139.3 (s, 1C), 128 (d, 1C), 118 (d, 1C)
<b>L<sub>4</sub>C<sub>4</sub></b>	118.7 (d, 1C), 139 (d, 1C), 155.6 (s, 1C), 143. (s, 1C), 109.5 (d, 1C), 109.9 (d, 1C), 143.9 (d, 1C), 135.2 (s, 1C), 126.4 (d, 2C), 128.7 (d, 2C), 128 (d, 1C), 147.9 (s, 1C), 135.9 (s, 1C), 119.5 (d, 1C), 139.3 (s, 1C), 128 (d, 1C), 118 (d, 1C).
<b>L<sub>5</sub>C<sub>5</sub></b>	118.7 (d, 1C), 139.9 (d, 1C), 155.6 (s, 1C), 118.4 (s, 1C), 161.1 (s, 1C), 116.0 (d, C), 132.5 (d, 1C), 121.5 (s, 1C), 130.6 (d, 2C), 135.2 (s, 1C), 126.4 (d, 2C), 128.7 (d, 2C), 128 (d, 1C), 147.9 (s, 1C), 135.9 (s, 1C), 119.5 (d, 1C), 139.3 (s, 1C), 128.0 (d, 1C), 118.1 (d, 1C).

TABLE-4  
FTIR AND EIMS DATA OF SYNTHESIZED COMPOUNDS L<sub>1</sub>-L<sub>5</sub>C<sub>5</sub>

Compound	FTIR (KBr, cm <sup>-1</sup> )	Mass (m/z)
<b>L<sub>1</sub></b>	1637, 1563	188
<b>L<sub>2</sub></b>	1676, 1528	242
<b>L<sub>3</sub></b>	1618, 1569	239
<b>L<sub>4</sub></b>	1670, 1535	233
<b>L<sub>5</sub></b>	3457, 1670, 1535	224
<b>L<sub>1</sub>A<sub>1</sub></b>	1583, 1569	155
<b>L<sub>2</sub>A<sub>2</sub></b>	1560, 1559	257
<b>L<sub>3</sub>A<sub>3</sub></b>	1575, 1559	253

Compound	FTIR (KBr, cm <sup>-1</sup> )	Mass (m/z)
L <sub>4</sub> A <sub>4</sub>	1585, 1559	213
L <sub>5</sub> A <sub>5</sub>	3465, 1585, 1559	223
L <sub>1</sub> B <sub>1</sub>	1587, 1559	278
L <sub>2</sub> B <sub>2</sub>	1583, 1559	332
L <sub>3</sub> B <sub>3</sub>	1585, 1559	328
L <sub>4</sub> B <sub>4</sub>	1579, 1559	288
L <sub>5</sub> B <sub>5</sub>	3467, 1579, 1559	314
L <sub>1</sub> C <sub>1</sub>	1585, 1559	368
L <sub>2</sub> C <sub>2</sub>	1585, 1559	422
L <sub>3</sub> C <sub>3</sub>	1585, 1559	418
L <sub>4</sub> C <sub>4</sub>	1585, 1559	378
L <sub>5</sub> C <sub>5</sub>	3476, 1585, 1559	404

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