5. RESULTS AND DISCUSSION

The structures of newly synthesized novel 2-alkyl substituted oleo-benzimidazole derivatives (I-aa' to I-cd') were supported by IR, $^1$H NMR, $^{13}$C NMR, MS and elemental analyses.

IR spectra of all the compounds were taken on Fourier Transform Infrared (FTIR) Nicolet 5700 instrument using KBr pallets and also as liquid films.

The compounds (I-aa', I-ab', I-ba', I-bb', I-ca' & I-cb') showed IR strong absorption bands at 3456 - 3440 cm$^{-1}$ for -OH functional group in alkyl chain. All the compounds (I-aa' to I-cd') had -NH stretching bands at 3326 - 3210 cm$^{-1}$ in all imidazole ring of oleo-benzimidazole derivatives, respectively. The characteristic -C=N stretching bands at 1630 - 1612 cm$^{-1}$ were observed in all the compounds (I-aa' to I-cd'), respectively.

The $^1$H NMR spectra of the 5-substituted oleo-benzimidazoles (I-aa' to I-cd') were recorded on Bruker Avanace-300 (300 MHz) model instrument using CDCl$_3$ and DMSO as a solvent and TMS as internal standard.

The $^1$H NMR spectra of all the compounds (I-aa' to I-cd') exhibited structure revealing proton signals at $\delta$ 7.0 - 7.6 (multiplet, aromatic protons), $\delta$ 7.1 - 7.3 (s, 1H, -NH which is merged with aromatic protons and disappeared on D$_2$O addition) $\delta$ 3.5 - 3.9 (multiplet, 2H, -CH$_2$OH), $\delta$
3.3 - 3.6 (singlet, 1H, -OH, disappeared on D2O addition), δ 4.2 - 4.8 (multiplet, 2H, -CH=CH-), δ 2.3 - 2.5 (singlet, 2H, 2 x [-CH-]), δ 1.1 - 1.6 (broad multiplet, shielded methylene protons) and δ 0.8 - 1.2 (singlet, 3H, terminal -CH3).

The 13C NMR spectra of all the compounds (I-aa' to I-cd') showed sharp singlet signals at δ 168 - 184 for imidazole carbon, at δ 128 - 146 for aromatic carbon atoms, δ 119 - 129 for sp2 hybridized carbons and at δ 10 - 94 saturated carbon atoms and tertiary carbon atoms with DMSO solvent signals.

The mass spectra of the 2-alkyl substituted oleo-benzimidazole derivatives (I-aa' to I-cd') were recorded on Shimazu mass spectrometer (GCMS) with ionization energy maintained at 70eV. Thus, all the compounds (I-aa' to I-cd') showed the corresponding molecular ion peaks (M +1). The X-ray analysis of the compound(s) is under progress.

Spectral details

**Compound (Iaa'):** Yield: 74 %; colourless crystals (ethanol), m.p 130-132

δ ppm: 3.3 - 3.6 (singlet, 1H, -OH, disappeared on D2O addition), δ 4.2 - 4.8 (multiplet, 2H, -CH=CH-), δ 2.3 - 2.5 (singlet, 2H, 2 x [-CH-]), δ 1.1 - 1.6 (broad multiplet, shielded methylene protons) and δ 0.8 - 1.2 (singlet, 3H, terminal -CH3).

The mass spectra of the 2-alkyl substituted oleo-benzimidazole derivatives (I-aa' to I-cd') were recorded on Shimazu mass spectrometer (GCMS) with ionization energy maintained at 70eV. Thus, all the compounds (I-aa' to I-cd') showed the corresponding molecular ion peaks (M +1). The X-ray analysis of the compound(s) is under progress.

Spectral details

**Compound (Iaa'):** Yield: 74 %; colourless crystals (ethanol), m.p 130-132

δ ppm: 3.3 - 3.6 (singlet, 1H, -OH, disappeared on D2O addition), δ 4.2 - 4.8 (multiplet, 2H, -CH=CH-), δ 2.3 - 2.5 (singlet, 2H, 2 x [-CH-]), δ 1.1 - 1.6 (broad multiplet, shielded methylene protons) and δ 0.8 - 1.2 (singlet, 3H, terminal -CH3).

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Spectral details

**Compound (Iaa'):** Yield: 74 %; colourless crystals (ethanol), m.p 130-132

δ ppm: 3.3 - 3.6 (singlet, 1H, -OH, disappeared on D2O addition), δ 4.2 - 4.8 (multiplet, 2H, -CH=CH-), δ 2.3 - 2.5 (singlet, 2H, 2 x [-CH-]), δ 1.1 - 1.6 (broad multiplet, shielded methylene protons) and δ 0.8 - 1.2 (singlet, 3H, terminal -CH3).

The 13C NMR spectra of all the compounds (I-aa' to I-cd') showed sharp singlet signals at δ 168 - 184 for imidazole carbon, at δ 128 - 146 for aromatic carbon atoms, δ 119 - 129 for sp2 hybridized carbons and at δ 10 - 94 saturated carbon atoms and tertiary carbon atoms with DMSO solvent signals.

The mass spectra of the 2-alkyl substituted oleo-benzimidazole derivatives (I-aa' to I-cd') were recorded on Shimazu mass spectrometer (GCMS) with ionization energy maintained at 70eV. Thus, all the compounds (I-aa' to I-cd') showed the corresponding molecular ion peaks (M +1). The X-ray analysis of the compound(s) is under progress.

Spectral details

**Compound (Iaa'):** Yield: 74 %; colourless crystals (ethanol), m.p 130-132

δ ppm: 3.3 - 3.6 (singlet, 1H, -OH, disappeared on D2O addition), δ 4.2 - 4.8 (multiplet, 2H, -CH=CH-), δ 2.3 - 2.5 (singlet, 2H, 2 x [-CH-]), δ 1.1 - 1.6 (broad multiplet, shielded methylene protons) and δ 0.8 - 1.2 (singlet, 3H, terminal -CH3).
DMSO carbons), MS: m/z 377 (M +1). Anal. Calcd. for C_{12}H_{36}N_{2}O_{3} : C 70.21, H 9.57, N 7.44, Found: C 70.12, H 9.42, N 7.12.

**Compound (lab):** Yield: 79 %; colourless crystals (ethanol), m.p 180-181 °C. IR (KBr cm⁻¹): 3456 cm⁻¹ (-OH stretching), 3326 cm⁻¹ (-NH stretching), 1615 cm⁻¹ (-C=N). \(^1\)H NMR (300 MHz, DMSO, 6ppm) 7.3 – 7.6 (m, 4H, Ar-H), 7.3 (s, 1H, -NH), 4.5 (m, 2H, -CH=CH-), 3.8 (m, 2H, -CH₂OH), 3.6 (s, 1H, -OH), 1.3 (bm, 24H, -[C₆H₂]). \(^{13}\)C NMR (300 MHz, DMSO, 6ppm) 180 (imidazole carbon), 130 – 140 (aromatic carbons), 120 – 126 (sp² hybridized carbons), 10– 85 (saturated carbons and tertiary carbons with DMSO carbons). MS: m/z 343 (M +1). Anal. Calcd. for C_{22}H_{34}N_{2}O : C 77.19, H 9.94, N 8.18, Found: C 77.12, H 9.86, N 8.12.

**Compound (lac):** Yield: 76 %; colourless crystals (ethanol), m.p 210-211 °C. IR (KBr cm⁻¹): 3316 (NH), 1628(C=N-), \(^1\)H NMR (300 MHz, DMSO, 6ppm) 7.2 – 7.4 (m, 4H, Ar-H), 7.4 (s, 1H, -NH ), 4.4 (m, 2H, -CH=CH-), 1.6 (bm, 28H), 0.9 (s, 3H, -CH₃). \(^{13}\)C NMR (300 MHz, DMSO 6ppm) 175 (imidazole carbon), 125 – 126 (sp² hybridized carbons), 129 - 136 (aromatic carbons) 12 – 93 (saturated carbons and tertiary carbons with DMSO carbons). MS: m/z 355 (M +1). Anal. Calcd. for C_{24}H_{38}N_{2} : C 81.33, H 10.73, N 7.90; Found: C 81.23, H 10.62, N 7.88.

**Compound (lad):** Yield: 79 %; colourless crystals (ethanol), m.p 153- 154 °C. IR (KBr cm⁻¹): 3324 (NH), 1625(C=N-), \(^1\)H NMR (300 MHz, DMSO, 6ppm) 7.3 – 7.6 (m, 4H, Ar-H) 7.6 (s, 1H, -NH ), 4.8 (m, 2H, -CH=CH-), 1.3
\( ^{13} \text{C NMR} \) (300 MHz, DMSO \( \delta \) ppm) 175 (imidazole carbon) 122 - 126 (sp\(^2\) hybridized carbons), 129 - 143 (aromatic carbons), 10 - 91 (saturated carbons and tertiary carbons with DMSO carbons). MS: m/z 257 (M+1). Anal. Calcd. for \( \text{C}_{17}\text{H}_{24}\text{N}_{2} \): C 79.68, H 9.37, N 10.93; Found: C 79.66, H 9.33, N 10.89.

**Compound (Iba):** Yield: 74 \%; colourless crystals (ethanol), m.p 164-165°C. IR (KBr cm\(^{-1}\)): 3312 (-NH), 1626(-C=\text{N}-).\(^1\) NMR (300 MHz, DMSO, \( \delta \) ppm) 7.1 - 7.4 (m, 4H, aromatic protons), 7.3(s, 1H, -NH), 3.8 (m, 2H, -\( \text{CH}_2\)OH) 3.4 (s, 3H, 3 x [-\text{OH}]), 2.5 (s, 2H), 1.3 (bm, 24H, ~[\text{CH}_2]~) shielded methylene protons). \(^{13}\)C NMR (300 MHz, DMSO, \( \delta \) ppm) 171 -182 (imidazole carbon), 128 - 138 (aromatic carbons), 12 - 86 (saturated carbons and tertiary carbons with DMSO carbons). MS: m/z 455 (M+1). Anal. Calcd. for \( \text{C}_{22}\text{H}_{35}\text{N}_{2}\text{O}_{3}\text{Br} \): C 58.02, H 7.69, N 6.15; Found: C 57.96, H 7.62, N 6.02.

**Compound (Ibb'):** Yield: 75 \%; colourless crystals (ethanol), m.p 161-162°C. IR (KBr cm\(^{-1}\)): 3452 cm\(^{-1}\) (-OH ), 3322 (NH), 1614(C=\text{N}-).\(^1\) NMR (300 MHz, DMSO, \( \delta \) ppm) 7.1 - 7.5 (m, 4H, aromatic protons), 7.3 (s, 1H, - \( \text{NH} \)), 4.3 (m, 2H, -\( \text{CH}=\text{CH} \)), 3.7 (m, 2H, -\( \text{CH}_2\)OH), 3.4 (s, 1H, -\( \text{OH} \)), 1.2 (bm, 24H, ~[\text{CH}_2]~). \(^{13}\)C NMR (300 MHz, DMSO, \( \delta \) ppm) 179 (imidazole carbon), 127 - 138 (aromatic carbons), 119 - 124 (sp\(^2\) hybridized carbons), 12- 88 (saturated carbons and tertiary carbons with DMSO carbons). MS:
Compound (Ibc′): Yield: 80%; colourless crystals (ethanol), m.p 220-222°C. IR (KBr cm⁻¹): 3321(NH), 1624(C=N-).¹H NMR (300 MHz, DMSO, δ ppm) 7.0 - 7.5 (m, 4H, Ar-H), 7.0(s, 1H, -NH), 4.2(m, 2H, -CH=CH-), 1.3 (bm, 28H, -[CH₂]), 0.8 (s, 3H, terminal -CH₃). ¹³C NMR (300 MHz, DMSO, δ ppm) 180 (imidazole carbon), 124 - 128 (sp² hybridized carbons), 131 - 136 (aromatic carbons) 10 - 92 (saturated carbons and tertiary carbons with DMSO carbons). MS: m/z 434 (M+1). Anal. Calcd. for C₂₄H₃₇N₂Br: C 66.51, H 8.54, N 6.41; Found: C 66.36, H 8.42, N 6.39.

Compound (Ibd′): Yield: 75%; colourless crystals (ethanol), m.p 182-183°C. IR (KBr cm⁻¹): 3320(NH), 1622(C=N-).¹H NMR (300 MHz, DMSO, δ ppm) 7.1 - 7.5(m, 4H, Ar-H), 7.4 (s, 1H, -NH), 4.4 (m, 2H, -CH=CH-), 1.2 (bm, 16H, -[CH₂]). ¹³C NMR (300 MHz, DMSO, δ ppm) 182 (imidazole carbon), 120 - 126 (sp² hybridized carbons), 130 - 144 (aromatic carbons), 12 - 88 (saturated carbons and tertiary carbons with DMSO carbons). MS: m/z 336(M+1). Anal. Calcd. for C₁₇H₂₃N₂Br: C 60.07, H 7.16, N 8.35; Found: C 60.01, H 7.09, N 8.28.

Compound (Ica′): Yield 79%; colourless crystals (ethanol), m.p 197-198°C. IR (KBr cm⁻¹): 3440 cm⁻¹ (-OH), 3310(-NH), 1622(C=N-).¹H NMR (300 MHz, DMSO, δ ppm) 7.2 - 7.4 (m, 4H, Ar-H), 7.4(s, 1H, -NH ), 3.5 (m, 2H, -CH₂OH), 3.3 (s, 3H, 3 x [-OH]), 2.3 (s, 2H, 2 x [-CH⁻]), 1.2 (bm,
Compound (Icb): Yield: 72%; colourless crystals (ethanol), m.p 211-212
°C. IR (KBr cm⁻¹): 3450 cm⁻¹ (-OH), 3318(-NH), 1612(C=N-).³H NMR (300 MHz, DMSO, δ ppm) 7.0 - 7.5(m, 4H, Ar-H) 7.4 (s, 1H, -NH), 4.2 (m, 2H, -CH=CH-), 3.8 (m, 2H, -CH₂OH), 3.4 (s, 1H), 1.1 (bm, 2H, -[CH₂]).³C NMR (300 MHz, DMSO, δ ppm) 182 (imidazole carbon), 128 - 139 (aromatic carbons), 120 - 125 (sp² hybridized carbons), 14-90 (saturated carbons and tertiary carbons with DMSO carbons). MS: m/z 388 (M+1). Anal. Calcd. for C₂₂H₃₅N₃O₅: C 68.21, H 8.52, N 10.85; Found: C 68.17, H 8.43, N 10.70.

Compound (Icc'): Yield: 80%; colourless crystals (ethanol), m.p 191-192
°C. IR (KBr cm⁻¹): 3324 (-NH), 1628(C=N-).¹H NMR (300 MHz, DMSO, δ ppm) 7.1 - 7.6(m, 4H, Ar-H) 7.6 (s, 1H, -NH), 4.3 (m, 2H, -CH=CH-), 1.2 (bm, 28H, -[CH₂]), 1.2 (s, 3H, -CH₃).³C NMR (300 MHz, DMSO, δ ppm) 184 (imidazole carbon), 125 - 129 (sp² hybridized carbons), 132 - 137 (aromatic carbons) 14 - 94 (saturated carbons and tertiary carbons with DMSO carbons). MS: m/z 400 (M+1). Anal. Calcd. for C₂₄H₃₇N₃O₂: C 72.18, H 9.27, N 10.52; Found: C 72.06, H 9.15, N 10.44.
Compound (Icd'): Yield: 73 %; colourless crystals (ethanol), m.p 225-226
°C. IR (KBr cm
$^{-1}$): 3326 (-NH), 1618 (C=\(N\)-).\(^1\)H NMR (300 MHz, DMSO, \(\delta\) ppm) 7.2 – 7.6 (m, 4H, aromatic protons), 7.4 (s, 1H, -NH), 4.3 (m, 2H, -\(CH=CH\)-), 1.3 (bm, 16H, \[-CH_2\]). The \(^{13}\)C NMR (300 MHz, DMSO, \(\delta\) ppm) 179 (imidazole carbon) 122 – 128 (sp\(^2\) hybridized carbons), 132-146 (aromatic carbons), 14 – 92 (saturated carbons and tertiary carbons with DMSO carbons). MS: \(m/z\) 302 (M+1). Anal. Calcd. for C\(_{17}\)H\(_{23}\)N\(_3\)O\(_2\) : C 67.74, H 7.64, N 12.64; Found: C 67.29, H 7.49, N 12.51.

The details regarding each spectrum of the compounds (Iaa'-Icd') are given in Table 2.

The IR, \(^1\)H NMR, \(^{13}\)C NMR and GC-MS of the compound Iac' are enclosed as Spectrum No. (1-4) for reference.
Table 1

<table>
<thead>
<tr>
<th>Comp.</th>
<th>Elemental Analyses</th>
<th>Yield(%)</th>
<th>M.P.(°C)</th>
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<tr>
<td></td>
<td>Carbon(%)</td>
<td>Hydrogen (%)</td>
<td>Nitrogen(%)</td>
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<tr>
<td></td>
<td>Cald. Found</td>
<td>Cald. Found</td>
<td>Cald. Found</td>
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<tr>
<td>I-aa'</td>
<td>70.21</td>
<td>70.12</td>
<td>9.57</td>
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<td>I-ab'</td>
<td>77.19</td>
<td>77.12</td>
<td>9.94</td>
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<td>I-ac'</td>
<td>81.33</td>
<td>81.23</td>
<td>10.73</td>
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<td>I-ad'</td>
<td>79.68</td>
<td>79.66</td>
<td>9.37</td>
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<td>I-ba'</td>
<td>58.02</td>
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<td>I-bb'</td>
<td>62.70</td>
<td>62.68</td>
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<td>I-ca'</td>
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<td>I-cb'</td>
<td>68.21</td>
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<td>8.52</td>
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<td>I-ce'</td>
<td>72.18</td>
<td>72.06</td>
<td>9.27</td>
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<td>I-cd'</td>
<td>67.74</td>
<td>67.29</td>
<td>7.64</td>
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## TABLE 2
Spectral Analysis

<table>
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<tr>
<th>SL. NO</th>
<th>COMPOUND STRUCTURE</th>
<th>INFRARED CM⁻¹</th>
<th>¹H NUCLEAR MAGNETIC RESONANCE VALUES IN PPM</th>
<th>¹³C NUCLEAR MAGNETIC RESONANCE VALUES IN PPM</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><img src="image1" alt="Compound 1" /></td>
<td>3446 cm⁻¹ -OH stretching, for hydroxyl group. 3316 cm⁻¹ -NH stretching, for -NH function. 1630 cm⁻¹ -C=N- stretching, for -C=N- function.</td>
<td>7.2 – 7.4 (m, 4H, aromatic protons) 7.2 – 7.3 (s, 1H, -NH which is merged with aromatic protons and disappeared on D₂O addition) 3.9 (m, 2H, -CH₂OH) 3.6 (s, 3H, 3 x [-OH], disappeared on D₂O addition) 2.4 (s, 2H, 2 x [-CH-]) 1.4 (bm, 24H, -[C₆H₂] shielded methylene protons)</td>
<td>170 – 180 (imidazole carbon) 130 – 140 (aromatic carbons) 10 – 80 (saturated carbons and tertiary carbons with DMSO carbons)</td>
</tr>
<tr>
<td>2</td>
<td><img src="image2" alt="Compound 2" /></td>
<td>3456 cm⁻¹ -OH stretching, for hydroxyl group. 3326 cm⁻¹ -NH stretching, for -NH function. 1615 cm⁻¹ -C=N- stretching, for -C=N- function.</td>
<td>7.3 – 7.6 (m, 4H, aromatic protons) 7.3 – 7.4 (s, 1H, -NH which is merged with aromatic protons and disappeared on D₂O addition) 4.5 (m, 2H, -CH=CH-) 3.8 (m, 2H, -CH₂OH) 3.6 (s, 1H, -OH, disappeared on D₂O addition) 1.3 (bm, 24H, -[CH₂] shielded methylene protons)</td>
<td>170 – 180 (imidazole carbon) 130 – 140 (aromatic carbons) 120 – 126 (sp² hybridized carbons) 10 – 85 (saturated carbons and tertiary carbons with DMSO carbons)</td>
</tr>
<tr>
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<td>4</td>
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<tr>
<td>3.</td>
<td><img src="structure1.png" alt="Structure" /></td>
<td>3320 cm(^{-1}) (-\text{NH stretching, for -NH function.})</td>
<td>7.2 - 7.4 (m, 4H, aromatic protons)</td>
<td>172 - 180 (imidazole carbon)</td>
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<td></td>
<td>1628 cm(^{-1}) (-\text{C=N- stretching, for -C=N- function.})</td>
<td>7.3 - 7.4 (s, 1H, -NH which is merged with aromatic protons and disappeared on D(_2)O addition)</td>
<td>125 - 126 (sp(^2) hybridized carbons)</td>
</tr>
<tr>
<td>4</td>
<td><img src="structure2.png" alt="Structure" /></td>
<td>3324 cm(^{-1}) (-\text{NH stretching, for -NH function.})</td>
<td>7.3 - 7.6 (m, 4H, aromatic protons)</td>
<td>129 - 136 (aromatic carbons)</td>
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<tr>
<td></td>
<td></td>
<td>1625 cm(^{-1}) (-\text{C=N- stretching, for -C=N- function.})</td>
<td>7.4 - 7.6 (s, 1H, -NH which is merged with aromatic protons and disappeared on D(_2)O addition)</td>
<td>12 - 93 (saturated carbons and tertiary carbons with DMSO carbons)</td>
</tr>
<tr>
<td>5</td>
<td><img src="structure3.png" alt="Structure" /></td>
<td>3442 cm(^{-1}) (-\text{OH stretching, for hydroxyl group.})</td>
<td>7.1 - 7.4 (m, 4H, aromatic protons)</td>
<td>168 - 178 (imidazole carbon)</td>
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<tr>
<td></td>
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<td>3312 cm(^{-1}) (-\text{NH stretching, for -NH function.})</td>
<td>7.2 - 7.3 (s, 1H, -NH which is merged with aromatic protons and disappeared on D(_2)O addition)</td>
<td>122 - 126 (sp(^2) hybridized carbons)</td>
</tr>
<tr>
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<td>1626 cm(^{-1}) (-\text{C=N- stretching, for -C=N- function.})</td>
<td>3.8 (m, 2H, -CH(_2)OH)</td>
<td>129 - 143 (aromatic carbons)</td>
</tr>
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<td></td>
<td></td>
<td></td>
<td>3.4 (s,3H, 3 x [-OH], disappeared on D(_2)O addition)</td>
<td>10 - 91 (saturated carbons and tertiary carbons with DMSO carbons)</td>
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</tbody>
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173
<table>
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<tr>
<td>6.</td>
<td><img src="image1.png" alt="Image" /></td>
<td>3452 cm(^{-1}) -OH stretching, for hydroxyl group. 3322 cm(^{-1}) -NH stretching, for -NH function. 1614 cm(^{-1}) -C/N- stretching, for -C=N- function.</td>
<td>7.1 - 7.5 (m, 4H, aromatic protons) 7.3-7.5 (s, 1H, -NH which is merged with aromatic protons and disappeared on D(_2)O addition) 4.3 (m, 2H, -CH=CH-) 3.7 (m, 2H, -CH(_2)OH) 3.4 (s, 1H, -OH, disappeared on D(_2)O addition) 1.2 (bm, 24H, -[CH(_2)] shielded methylene protons)</td>
<td>174 - 179 (imidazole carbon) 119 - 124 (sp(^2) hybridized carbons) 127 - 138 (aromatic carbons) 12 - 88 (saturated carbons and tertiary carbons with DMSO carbons)</td>
</tr>
<tr>
<td>7.</td>
<td><img src="image2.png" alt="Image" /></td>
<td>3321 cm(^{-1}) -NH stretching, for -NH function. 1624 cm(^{-1}) -C/N- stretching, for -C=N- function.</td>
<td>7.0 - 7.5 (m, 4H, aromatic protons) 7.1 - 7.3 (s, 1H, -NH which is merged with aromatic protons and disappeared on D(_2)O addition) 4.2 (m, 2H, -CH=CH-) 1.3 (bm, 28H, -[CH(_2)] shielded methylene protons) 0.8 (s, 3H, terminal -CH(_3))</td>
<td>170 - 180 (imidazole carbon) 124 - 128 (sp(^2) hybridized carbons) 131 - 136 (aromatic carbons) 10 - 92 (saturated carbons with DMSO carbons)</td>
</tr>
<tr>
<td>8.</td>
<td><img src="image3.png" alt="Image" /></td>
<td>3320 cm(^{-1}) -NH stretching, for -NH function. 1622 cm(^{-1}) -C/N- stretching, for -C=N- function.</td>
<td>7.1 - 7.5 (m, 4H, aromatic protons) 7.2 - 7.4 (s, 1H, -NH which is merged with aromatic protons and disappeared on D(_2)O addition) 4.4 (m, 2H, -CH=CH-) 1.2 (bm, 16H, -[CH(_2)] shielded methylene protons)</td>
<td>170 - 182 (imidazole carbon) 120 - 126 (sp(^2) hybridized carbons) 130 - 144 (aromatic carbons) 12 - 88 (saturated carbons and tertiary carbons with DMSO carbons)</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
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<td>4</td>
<td>5</td>
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<tr>
<td>9.</td>
<td>(\text{O}_2\text{N} \text{N} \text{H} \text{H} \text{OH} \text{OH} )</td>
<td>(3440 \text{ cm}^{-1} ) -OH stretching, for hydroxyl group.</td>
<td>7.2 - 7.4 (m, 4H, aromatic protons)</td>
<td>172 - 184 (imidazole carbon)</td>
</tr>
<tr>
<td></td>
<td>(I-cb')</td>
<td></td>
<td>7.3 - 7.4 (s, 1H, -NH which is merged with aromatic protons and disappeared on D(_2)O addition)</td>
<td>130 - 140 (aromatic carbons)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3.5 (m, 2H, -CH(_2)OH)</td>
<td>12 - 90 (saturated carbons and tertiary carbons with DMSO carbons)</td>
</tr>
<tr>
<td></td>
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<td>3.3 (s, 3H, 3 x [-OH], disappeared on D(_2)O addition)</td>
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<td>2.3 (s, 2H, 2 x [-CH(_2)])</td>
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<td></td>
<td>1.2 (bm, 24H, [-CH(_2)] shielded methylene protons)</td>
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<tr>
<td>10</td>
<td>(\text{O}_2\text{N} \text{N} \text{H} \text{H} \text{OH} \text{OH} )</td>
<td>(3450 \text{ cm}^{-1} ) -OH stretching, for hydroxyl group.</td>
<td>7.0 - 7.5 (m, 4H, aromatic protons)</td>
<td>170 - 182 (imidazole carbon)</td>
</tr>
<tr>
<td></td>
<td>(I-cb')</td>
<td></td>
<td>7.3 - 7.4 (s, 1H, -NH which is merged with aromatic protons and disappeared on D(_2)O addition)</td>
<td>120 - 125 (sp(^2) hybridized carbons)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>4.2 (m, 2H, -CH=CH-)</td>
<td>128 - 139 (aromatic carbons)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3.8 (m, 2H, -CH(_2)OH)</td>
<td>14 - 90 (saturated carbons and tertiary carbons with DMSO carbons)</td>
</tr>
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<td></td>
<td></td>
<td>3.4 (s, 1H, -OH, disappeared on D(_2)O addition)</td>
<td></td>
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<tr>
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<td></td>
<td></td>
<td>1.1 (bm, 24H, [-CH(_2)] shielded methylene protons)</td>
<td></td>
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<td>1</td>
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<tr>
<td>11</td>
<td><img src="image" alt="Chemical Structure" /></td>
<td>3324 cm⁻¹ -NH stretching, for -NH function. 1628 cm⁻¹ -C=N- stretching, for -C=N- function.</td>
<td>7.1 - 7.6 (m, 4H, aromatic protons) 7.4 - 7.6 (s, 1H, -NH which is merged with aromatic protons and disappeared on D2O addition) 4.3 (m, 2H, -CH=CH-) 1.2 (bm, 28H, -[CH₂] shielded methylene protons) 1.2 (s, 3H, terminal -CH₃)</td>
<td>173 - 184 (imidazole carbon) 125 - 129 (sp₂ hybridized carbons) 132 - 137 (aromatic carbons) 14 - 94 (saturated carbons and tertiary carbons with DMSO carbons)</td>
</tr>
<tr>
<td>12</td>
<td><img src="image" alt="Chemical Structure" /></td>
<td>3326 cm⁻¹ -NH stretching, for -NH function. 1618 cm⁻¹ -C=N- stretching, for -C=N- function.</td>
<td>7.2 - 7.6 (m, 4H, aromatic protons) 7.3 - 7.4 (s, 1H, -NH which is merged with aromatic protons and disappeared on D2O addition) 4.3 (m, 2H, -CH=CH-) 1.3 (bm, 16H, -[CH₂] shielded methylene protons)</td>
<td>168 - 179 (imidazole carbon) 122 - 128 (sp₂ hybridized carbons) 132 - 146 (aromatic carbons) 14 - 92 (saturated carbons and tertiary carbons with DMSO carbons)</td>
</tr>
</tbody>
</table>
(CH₂)₇ CH=CH(CH₂)₇CH₃

l-ac'