Synthesis, characterisation of Schiff bases generated from salicylaldehyde with certain amino acids using a new established technique

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ABSTRACT
Amino acids are compounds that consist of an amine group, a carboxylic acid group, and a variable side chain. These molecules are very significant in biochemistry. Amino acids with uncharged amino groups can also undergo Schiff base production at physiological pH levels, presenting an additional possible pathway for metal complexes. In this investigation, four novel Schiff base amino acid compounds were identified: 5-Chlorosalicylaldehyde-glycine (H2L1), 5-Chlorosalicylaldehyde-alanine (H2L2), 5-Nitrosalicylaldehyde-glycine (H2L3), and 5-Nitrosalicylaldehyde-alanine (H2L4). Condensation reaction product of substituted salicylaldehyde. With a few amino acids, glycine and alanine, using an alternate technique. The innovation is the addition of 10-mole sodium hydroxide as a novel catalyst to the traditional process of synthesizing Schiff bases. Elements (C,H,N) and spectroscopic techniques (IR, 'H, and 13C NMR) were used to describe the four Schiff bases. These techniques were successfully used to characterize the prepared Schiff bases.

KEYWORDS
Synthesis; spectroscopic analysis; amino acid; Schiff bases

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Introduction
Schiff bases are condensation products of primary amines with carbonyl compounds and they were first reported by (Cimerman et al., 2000). The common structural feature of these compounds is the azomethine group with a general formula RHC=N–R’, where R and R’ are alkyl, aryl, cyclo alkyl or heterocyclic groups which may be variously substituted. These compounds are also known as azales, imines or azomethines. Several studies (Elmalı, 2000; Mohammed Salih et al., 2016; Singh et al., 1975) showed that the presence of a lone pair of electrons in nitrogen atom ofazomethine group is of considerable chemical and biological importance. Because of the relative easiness of preparation synthetic flexibility and the special.

Property of C=N group Schiff bases are generally excellent chelating agents (Spichiger-Keller, 1998) especially when a functional group like -OH or -SH is present close to the azomethine group so as to form a five or six membered ring with the metal ion (Cimerman et al., 2000).

Schiff bases are classified according to the number of electrons that the molecule has or to the type of atoms or donor atom group that the molecule contains. The donor atom can be nitrogen, oxygen, phosphorus or sulphur. These donor atoms that stabilize the structure of Schiff bases and that determine the bioactivity. In nitrogen compounds the presence of a -C=N- group in Schiff bases enhances bioactivity (El-Hendawy et al., 1991) and most of the nitrogen donor Schiff bases complexes have been used as precursors in different homogeneous catalytic reactions (Trávníček et al., 2001).

The objectives of this study are to synthesize four new Schiff bases by condensation reactions of glycine and α-alanine with 5-chlorosalicylaldehyde and 5-nitrosalicylaldehyde:

- [(E)-5-(chloro-2-hydroxyphenyl) methylidene] amino acetic acid, [(E)-5-(chloro-2-hydroxyphenyl) methylidene] amino propanoic acid, (E)-(2-hydroxy-5-nitrophenyl) methylidene] amino acetic acid and [(E)-(2-hydroxy-5-nitrophenyl) methylidene] amino propanoic acid. Followed by analyze and identify the structures of the synthesized Schiff bases by elemental Analysis (EA) and spectroscopic methods such as; IR, ('H and 13C) NMR.
Materials and measurements

All chemicals and solvents of the highest analytical grade were used as received from Sigma-Aldrich chemical company USA. Infrared spectral of the prepared compounds were recorded on FT-IR spectrometer 10.5.1, Frontier (MIR)- Perkin Elmer-ZnSe/Diamond-ATR. 1H and 3C NMR spectra of the prepared compounds were recorded on Bruker AVIII 40,126,500 US. The elemental analysis of prepared compounds were recorded on HKEAtech EURO EA (C,H,N).

Synthesis of Schiff Bases (H₃L₁, and H₃L₂)

To a 250 ml round bottom flask containing 150 ml absolute ethanol 10mmol of (5- chlorosalicylaldehyde (1.565g), 10mmol of glycine (0.75g) or α-alanine (0.85g) and 10mmol of NaOH were added and the content was refluxed with stirring for 5h. After cooling to room temperature the content was added to 100 ml of water in 0°C in a baker and kept in an ice bath for 2h. The yellow crystals were filtered off and washed with slightly cold water and dried in an oven (Bhanuka & Singh, 2016).

H₃L₁: [(E)-(5-chloro-2-hydroxyphenyl) methylidene] amino] acetic acid

(1.97g), (92% yield) as shiny yellow needles (from ethanol), Anal. Calc for C₂H₅ClNO₃ (213.617g/ mole), C, 50.55; H, 3.77; N, 6.56. Found: C, 50.36; H, 3.48; N, 6.53. Selected IR data (μmax/cm⁻¹): 3100 (μAr-OH), 3050 (μCarboxylOH), 1910 (μC=O), 1680 (μC=N). 1H NMR (400 MHz D₂O, δ/ppm): 8.37-8.59 (s, C-H ring), 9.90 (s, COOH), 3.37 (CH₂COOH), 8.15 (CH= N), 4.70 (D2O). 13CNMR (400 MHz, CDC3): 118.22(C-1 ring), 167.07(C-2 ring-OH), 125.30(C-3 ring), 115.93(C-4 ring), 129.79(C-5 ring), 124.74(C-6 ring), 172.66(C-7 azomethine), 42.15(C-8), 193.30(C-9).

H₃L₂: 2-[(E)-(5-chloro-2-hydroxyphenyl) methylidene] amino] propanoic acid

(2.18g), (96.80% yield) as Bright Yellow needles (from ethanol), Anal. Calc for C₃H₅ClNO (227.644g/ mole), C, 52.76; H, 4.43; N, 6.15. Found: C, 52.46; H, 4.42; N, 11.46. Selected IR data (μmax/cm⁻¹): 3059.56(μAr-OH), 3000.17(μCarboxyl-OH), 2111.68 (μC=O), 1737.05 (μC=N). 1H NMR (400 MHz, D₂O, δ/ppm): 7.37-7.57(s, C-H ring), 9.90 (s, COOH), 8.22 (CH=N), 1.49 (CH₃), 1.08 (CH₂(CH₃)), 4.70 (D2O). 13CNMR (400 MHz, CDC3): 121.57(C-1 ring), 165.47(C-2 ring-OH), 123.33(C-3 ring), 118.31(C-4 ring), 124.27(C-5 ring), 125.27(C-6 ring), 177.59(C-7 azomethine), 50.68(C-8), 193.28(C-9), 18.87(C-10).

Synthesis of Schiff Bases (H₃L₁, and H₃L₂)

To a 250 ml round bottom flask containing 150 ml absolute ethanol 10mmol (5-nitosalicylaldehyde (1.671g), 10mmol of glycine(0.75g) or α- alanine(0.85g) and 10mmol of NaOH were added and the content was refluxed with stirring for 5h. After cooling to room temperature the content was added to 100 ml of water in 0°C in a baker and kept in an ice bath for 2h. The yellow crystals were filtered off and washed with slightly cold water and dried in an oven (Bhanuka & Singh, 2016).

H₂L₃: [(E)-(2-hydroxy-5-nitrophenyl) methylidene] amino] acetic acid

(1.93g), (86% yield) as Faint Yellow needles (from ethanol), Anal. Calc for C₅H₅N,O₂ (224.17g/ mole), C, 48.17; H, 3.60; N, 12.50. Found: C, 48.08; H, 3.14; N, 12.30. Selected IR data (μmax/cm⁻¹): 2890 (μAr-OH), 2605(μCarboxyl-OH), 1725 (μC=O), 1650 (μC=N). 1H NMR (400 MHz, D₂O, δ/ppm): 8.05-8.25 (s, C-H ring), 9.92 (s, COOH), 3.45 (CH₂COOH), 8.3 (CH= N), 4.70 (D2O). 13CNMR (400 MHz, CDC3): 128.53(C-1 ring), 172.49(C-2 ring-OH), 124.00(C-3 ring), 123.25(C-4 ring), 131.18(C-5 ring), 135.10(C-6 ring), 179.68(C-7 azomethine), 41.43(C-8), 193.57(C-9).

H₂L₄: 2-[(E)-(2 hydroxynitrophenyl) methylidene] amino]

Propanoic acid

(2.194g), (92% yield) as Faint yellow needles (from ethanol), Anal. Calc for C₅H₅N,O₂ (238.197g/ mole), C, 50.42; H, 4.23; N, 11.76. Found: C, 50.32; H, 4.03; N, 11.46. Selected IR data (μmax/cm⁻¹): 3067 (μAr-OH), 2987.53(μCarboxyl-OH), 1735.89 (μC=O), 1612.30 (μC=N). 1H NMR (400 MHz, D₂O δ/ppm): 8.00 6.52 (s, C-H ring), 9.92 (s, COOH), 8.4 (CH= N), 3.67 (CH₃), 1.38 (CH₃COOH), 4.70 (D2O). 13CNMR (400 MHz, CDC3): 128.5(C-1 ring), 175.98(C-2 ring-OH), 124.00(C-3 ring), 123.26(C-4 ring), 131.18(C-5 ring), 133.99(C-6 ring), 179.70(C-7 azomethine), 50.47(C-8), 193.57(C-9), 16.18(C-10).
Scheme-1: Synthesis of Schiff Bases (H$_2$L$_1$, H$_2$L$_2$, H$_2$L$_3$, and H$_2$L$_4$)

H$_2$L$_1$; R = Cl, R' = H / H$_2$L$_2$; R = NO$_2$, R' = H / H$_2$L$_3$; R = Cl
/ R' = CH$_3$ / H$_2$L$_4$; R = NO$_2$, R' = CH$_3$

Figure 1. Structure of Schiff bases (H$_2$L$_1$, H$_2$L$_2$, H$_2$L$_3$, and H$_2$L$_4$)

Results

The synthesized Schiff bases (H$_2$L$_1$, H$_2$L$_2$, H$_2$L$_3$, and H$_2$L$_4$) were characterized using spectroscopic and H$_2$L$_1$) were characterized using spectroscopic

Figure 2. $^1$H NMR for the H$_2$L$_1$

Figure 3. $^{13}$C NMR for the H$_2$L$_1$
Figure 4. $^1$H NMR for the H$_2$L$_2$

Figure 5. $^{13}$C NMR for the H$_2$L$_2$

Figure 6. $^1$H NMR for the H$_2$L$_3$

Figure 7. $^{13}$C NMR for the H$_2$L$_3$
Figure 8. $^1$H NMR for the H$_2$L$_4$

Figure 9. $^{13}$C NMR for the H$_2$L$_4$

Figure 10. IR Spectral of the H$_2$L$_1$

Figure 11. IR Spectral of the H$_2$L$_2$
Figure 12. IR Spectral of the H$_2$L$_3$

Figure 13. IR Spectral of the H$_2$L$_4$

<table>
<thead>
<tr>
<th>Compounds</th>
<th>ν(OH)</th>
<th>ν(C=O)</th>
<th>ν(C=N)</th>
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<tr>
<td>H$_2$L$_1$</td>
<td>3100.93, 3048.92</td>
<td>1911.30</td>
<td>1678.95</td>
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<tr>
<td>H$_2$L$_2$</td>
<td>2887.64, 2604.26</td>
<td>1726.59</td>
<td>1648.21</td>
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<tr>
<td>H$_2$L$_3$</td>
<td>3059.56, 3000.17</td>
<td>2111.68</td>
<td>1737.06</td>
</tr>
<tr>
<td>H$_2$L$_4$</td>
<td>3067.38, 2987.53</td>
<td>1735.89</td>
<td>1612.30</td>
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Table 2. Elemental analysis of the Prepared Schiff Bases

<table>
<thead>
<tr>
<th>Compounds</th>
<th>H(%)(calculated)</th>
<th>C(%)(calculated)</th>
<th>N(%)(calculated)</th>
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<tr>
<td>H$_2$L$_1$</td>
<td>3.40(3.77)</td>
<td>50.39(50.35)</td>
<td>6.33(6.36)</td>
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<tr>
<td>H$_2$L$_2$</td>
<td>3.14(3.60)</td>
<td>48.08(48.17)</td>
<td>12.30(12.50)</td>
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<tr>
<td>H$_2$L$_3$</td>
<td>4.42(4.43)</td>
<td>52.46(52.76)</td>
<td>6.05(6.15)</td>
</tr>
<tr>
<td>H$_2$L$_4$</td>
<td>4.03(4.23)</td>
<td>50.32(50.42)</td>
<td>11.46(11.76)</td>
</tr>
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Table 3. $^1$H NMR of Prepared Schiff Bases H$_2$L$_1$, H$_2$L$_2$, H$_2$L$_3$ and H$_2$L$_4$

<table>
<thead>
<tr>
<th>Compounds</th>
<th>C$<em>{-}$H$</em>{-}$</th>
<th>COOH</th>
<th>CH$_2$COOH</th>
<th>CH=N</th>
<th>CH$_3$CH</th>
<th>CH$_3$CH</th>
<th>D$_2$O</th>
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</thead>
<tbody>
<tr>
<td>H$_2$L$_1$</td>
<td>7.37-6.59</td>
<td>9.90</td>
<td>3.37</td>
<td>8.15</td>
<td>-</td>
<td>-</td>
<td>4.70</td>
</tr>
<tr>
<td>H$_2$L$_2$</td>
<td>8.05-6.52</td>
<td>9.92</td>
<td>3.45</td>
<td>8.3</td>
<td>-</td>
<td>-</td>
<td>4.70</td>
</tr>
<tr>
<td>H$_2$L$_3$</td>
<td>7.37-6.57</td>
<td>9.90</td>
<td>-</td>
<td>8.22</td>
<td>1.49</td>
<td>1.08</td>
<td>4.70</td>
</tr>
<tr>
<td>H$_2$L$_4$</td>
<td>8.00-6.52</td>
<td>9.92</td>
<td>-</td>
<td>8.4</td>
<td>3.67</td>
<td>1.38</td>
<td>4.70</td>
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Table 4. $^{13}$C NMR of the Prepared Schiff Bases H$_2$L$_1$, H$_2$L$_2$, H$_2$L$_3$ and H$_2$L$_4$

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<tr>
<th>Compounds</th>
<th>C$_9$-O</th>
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<th>C$_{2OH}$</th>
<th>C$_{ring}$</th>
<th>C$_{ring}$</th>
<th>C$_{ring}$</th>
<th>C$_{ring}$</th>
<th>C$_{ring}$</th>
<th>C$_{8H2}$</th>
<th>ClO</th>
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<tbody>
<tr>
<td>H$_2$L$_1$</td>
<td>193.30</td>
<td>172.66</td>
<td>167.07</td>
<td>129.79</td>
<td>125.30</td>
<td>124.74</td>
<td>118.32</td>
<td>115.93</td>
<td>42.15</td>
<td>-</td>
</tr>
<tr>
<td>H$_2$L$_2$</td>
<td>193.57</td>
<td>179.68</td>
<td>172.49</td>
<td>131.18</td>
<td>124.00</td>
<td>135.10</td>
<td>128.53</td>
<td>123.25</td>
<td>41.43</td>
<td>-</td>
</tr>
<tr>
<td>H$_2$L$_3$</td>
<td>193.28</td>
<td>177.59</td>
<td>165.47</td>
<td>124.27</td>
<td>123.33</td>
<td>125.27</td>
<td>121.57</td>
<td>118.31</td>
<td>50.68</td>
<td>18.87</td>
</tr>
<tr>
<td>H$_2$L$_4$</td>
<td>193.57</td>
<td>179.70</td>
<td>175.98</td>
<td>131.18</td>
<td>124.00</td>
<td>133.99</td>
<td>128.5</td>
<td>123.26</td>
<td>50.47</td>
<td>16.18</td>
</tr>
</tbody>
</table>
Table 5. Structures of Prepared Schiff Bases (H₂L₁, H₂L₂, H₂L₃ and H₂L₄)

<table>
<thead>
<tr>
<th>Compounds</th>
<th>Name</th>
<th>Structure</th>
</tr>
</thead>
<tbody>
<tr>
<td>H₂L₁</td>
<td>(E)-(5-chloro-2-hydroxyphenyl) methylidene(aminol) acetic acid</td>
<td><img src="image" alt="Structure of H₂L₁" /></td>
</tr>
<tr>
<td>H₂L₂</td>
<td>2-[(E)-(5-chloro-2-hydroxyphenyl)methylidene(aminol)propanoic acid</td>
<td><img src="image" alt="Structure of H₂L₂" /></td>
</tr>
<tr>
<td>H₂L₃</td>
<td>[(E)-(2-hydroxy-5 nitrophenyl)methylidene(aminol) acetic acid</td>
<td><img src="image" alt="Structure of H₂L₃" /></td>
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<tr>
<td>H₂L₄</td>
<td>2-[(E)-(2-hydroxy-5-nitrophenyl) methylidene(aminol)propanoic acid</td>
<td><img src="image" alt="Structure of H₂L₄" /></td>
</tr>
</tbody>
</table>

Discussion

Characterization of the prepared Schiff bases by (¹H and ¹³C) NMR spectroscopy

The ¹H NMR and ¹³C NMR data are reported below. All the protons were found at their expected region. The ¹H NMR spectra of Schiff bases (H₂L₁, H₂L₂, H₂L₃ and H₂L₄) using D₂O as the solvent in (400 MHz) exhibit singlet signals at expected region of protons calculated from the integration curves and those obtained also from the values of the expected (CH₃) analyses agree with each other.

The ¹H NMR spectral data of H₂L₁, the OH proton is showed a chemical shift value of 9.90 ppm due to the involvement of one proton in -COOH in glycine amino acid and other OH group hiding due to chloro group orientation in benzene ring (Ahmed et al., 2007). This is confirmed by the presence of C₁ in benzene ring and OH group IR band at 3048 cm⁻¹ (Bhanguka & Singh, 2016). The proton observed as a signal at 8.15 ppm corresponding to azomethine group CH=N this is confirmed by hiding of the aldehyde proton (Bhanguka & Singh, 2016). The (CH₃) protons in benzene ring appeared within the (6.59-7.37) ppm range. This is confirmed by IR spectra (Bhanguka & Singh, 2016). The peak at 3.37 ppm is due to the two protons (CH₃COOH) of the glycine amino acid (Alsalam et al., 2013).

The ¹³C NMR analysis of H₂L₁, the amine carbon(C₇) was found at δ 172.66, the aromatic carbon atoms ring are shown of 811.32(C₁), 816.07(C₂), 812.30(C₃), 811.93(C₄) 812.79(C₅), 812.47(C₆). The signal at 519.30 is due to the (C=O) group, the methyl group carbon atom was shown at 842.1 (C₃H₂), all these confirmed by IR spectra and carbon atoms found by elemental analysis (Alsalam et al., 2013).

The ¹H NMR spectral data of H₂L₂ is shown, the azomethine proton (CH=N) is assigned signal at δ 8.22 ppm (Bhanguka & Singh, 2016). The OH proton has shown the chemical shift value of δ 9.90 ppm due to carbonyl proton in the amino acid and the other OH proton in the hiding due to chloro orientation in benzene ring (Ahmed et al., 2007), confirmed by IR spectra and protons elemental analysis. The ring protons have shown chemical shift at (6.57-7.37) ppm due to (C-H) (Bhanguka & Singh, 2016). The peaks at 1.08 and 1.49 ppm are assigned to the protons of amino acid due to three protons in CH₃CH and one proton in CH₃CH₃ respectively.

The ¹³C NMR analysis of H₂L₂ below. The carbon atom in azomethine (C₇=N) has shown peak at 177.59 ppm. The aromatic ring carbon atoms are shown at (C₁) 121.57 ppm, (C₂) 165.47 ppm, (C₃) 123.33 ppm, (C₄) 118.31 ppm, (C₅) 124.27 ppm and (C₆) 125.27 ppm. The carbonyl carbon atom (C₉=O) was found at 193.30 ppm [21]. The (C₉H₁) observed peak at 50.68 ppm. The (C₁₀) shown peak at 18.87 ppm. All these carbon atoms confirmed by elemental analysis and all carbon atoms agree with each other.

The ¹H NMR spectral data of H₂L₃ The (OH) proton showed a chemical shift value at to 9.92 ppm due to the amino acid hydroxyl group and the OH group proton in the aromatic ring shielded by the (NO₂) group (Ahmed et al., 2007). The azomethine proton is observed at 8.30 ppm is attributed to the CH=N (Bhanguka & Singh, 2016). The peak at 3.45 ppm is due to two protons (CH₂COOH) in glycine amino acid, whereas the peak at 9.92 ppm is assigned to one proton in (COOH) group (Alsalam et al., 2013). The protons in aromatic ring have shown a chemical shift at (6.52-8.65) ppm due to (C=H). All these protons confirmed by elemental analysis protons (Bhanguka & Singh, 2016).

The ¹³C NMR analysis of H₂L₃ the azomethine carbon (C₇) was found at 8179.68 ppm. The aromatic carbon atoms in the ring appeared at δ 128.53 ppm (C₁), 6172.49 pm (C₂), 6124.00 pm (C₃), 6123.25 pm (C₄) 6131.18 ppm (C₅), 8135.10 ppm (C₆). Signal at 8193.57 ppm due to carbonyl group (C₉=O). Methyl group carbon atom is shown at δ41.4 ppm (C₉H₂) (Bhanguka & Singh, 2016).
The $^1$H NMR spectral data of H$_2$L$_4$. The proton has shown chemical shift value at 8.4 ppm due to azomethine group (CH=N). The OH proton showed a chemical shift value at 9.92 ppm due to the carbonyl amino acid group. The proton of the OH group of the aromatic ring was not observed due to the presence and orientation of the electronegative group (NO$_2$) (Ahmed et al., 2007). This proton is further confirmed by the OH group band in the IR spectra of the ligands. The protons agree with each other by elemental analysis. The (C=H) protons in the aromatic ring appeared in the (6.52-8.00) ppm range (Bhanuka & Singh, 2016). The peak at 3.67 ppm is due to three protons (CH$_3$CH) in amino $\alpha$-alanine acid (Bhanuka & Singh, 2015). The peak at 1.38 ppm is assigned to one proton in CH$_3$CH in the amino acid.

The $^{13}$C NMR analysis of H$_2$L$_4$ the azomethine group carbon (C7) was found at 8179.70 ppm. the aromatic carbon atoms ring are shown at 128.5 ppm (C1), 173.98 ppm (C2), 6124.00 ppm(C3), 8123.26 ppm(C4) 8131.18 ppm(C5), 8133.99 ppm(C6). The signal at 8193.57 is due to (C=O) carbonyl group. The methyl group carbon atom is shown peak at 560.47 ppm (C8H$_2$) (Bhanuka & Singh, 2016). The (C10) showed a peak at 16.18 ppm, all carbon atoms confirmed by elemental analysis percentages.

**Characterization of the prepared Schiff bases by IR**

**spectroscopy**

The IR spectra of the Schiff bases H$_2$L$_1$ the sharp band at 1678.95 cm$^{-1}$ is assigned to (C=N). The formation of the latter is confirmed by disappearance of the (C=O) band of the aldehyde and the appearance of only one carbonyl of the amino acid (Warad et al., 2020). The IR band at 1911.50 cm$^{-1}$ is assigned to (C=O) and it showed a high frequency for a chloro substituent compared with nitro derivatives and salicylaldehyde carbonyl group (Alsalim et al., 2013). The absorption peaks at 3100.93 cm$^{-1}$ and 3048.92 cm$^{-1}$ are assigned to (OH) vibrations (Bhanuka & Singh, 2016).

The IR spectral data of the Schiff bases H$_2$L$_2$ show stretching vibration frequency of azomethine group (C=N) at 1648.21 (Warad et al., 2020). The absorption peak at 1726.59 cm$^{-1}$ is attributed to (C=O) vibration in amino acid (Alsalim et al., 2013). The absorption displayed two broad bands at 2887.64 and 2604.26 that may be assigned to the (OH) groups of the Schiff base (Alsalim et al., 2013).

The IR spectral data Schiff base H$_2$L$_3$ are (Warad et al., 2020). The band at 1737.06 cm$^{-1}$ is due to azomethine (C=N), that condensation between the aldehyde and amino acid (Alsalim et al., 2013). The two broad bands at 3059.56 and 3000.17 are assigned to (OH) group (Alsalim et al., 2013).

The IR spectral data of the ligand H$_2$L$_4$ are reported sharp band at 1612.30 is assigned to (C=N) (Warad et al., 2020). The peak at 1735.89 indicating a (C=O) vibrations. Two broad bands 3067.38 and 2987.53 are assigned to (OH) vibrations (Alsalim et al., 2013).

These bands in which frequencies of complexes indicating the involvement of the (C=N) metal ion coordination.

**Conclusion**

In conclusion the four new Schiff bases namely; 5-chlorosalicylaldehyde-glycine (H$_4$L$_4$), 5-chlorosalicylaldehyde-alanine (H$_4$L$_5$), 5-nitrosalicylaldehyde-glycine (H$_4$L$_6$) and 5-nitrosalicylaldehyde-alanine (H$_4$L$_7$) were prepared by consideration reaction and were characterized by using spectroscopic methods (IR, $^1$H and $^{13}$C NMR) and elemental analysis (EA).

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