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Synthesis Of New Azo-Chalcone Compounds Derived From Imidazoline-4-one And Evaluation Of Their Biological Activity

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Abstract :

This paper will describe the synthesis, spectral investigation and the biological evaluation of some new heterocyclic compounds derivative from imidazole moiety. The compound (A) was synthesized by the reaction of BT (benzoylthiourea) with ethyl chloroacetate and this represented the start point for the synthesis of new azo compounds(1a-l) by using pyridine as solvent and catalyst.Series of azo-chalcone compounds(3a-j) which contains a chalcons and azo group in the same time were synthesized via exploitation the active methylene group in compound (A). In this work all the chemicals were used to the synthesis compounds obtained from various and deferent companies in a high purity (Sigma-Aldrich,BDH,Fluka and ROMIL-SA), in addition to all synthesized compounds have been characterized and identify by FT-IR,^{1}H-NMR and GC-Mass and the melting point

Keyword: Benzoyl chloride, Azo compounds, Chalcone and Imidazole, antimicrobial activity

1-Introduction :

Heterocyclic compounds occupy an essential part in the organic chemistry due to the wide and range of their activity and physical properties making it different from the other cyclic compounds and giving it an important role in organic chemistry fields and drug design **[1,2].** Amongst them, imidazoles are endowed with interesting biological activities **[3,4],** The practical method of composition of these compounds used for synthesis of many organic compounds **[5].** Nitrogen-containing heterogeneous compounds play an

important role in medicinal chemistry by assisting in various biological processes **[6].** Azo compounds derivatives are somewhat have essential importance in dyes **[7,8]** and internationally contribute to more than 50% of dyes due to their ease of synthesis and low cost of manufacturing. They have significant important in drugs and cosmetics industries **[9]** and have a variety of important biological activities and can serve as antibacterial [**10**].

Chalcone are still promising to conduct new drug analyzes. For this, new ways of synthesizing the alkalo derivatives which exhibited a range of pharmacological and biological effects [11]. Chalcone derivatives were reported to have a broad spectra of biological activities e.g. antimalarial [12,13], antioxidant, anti-inflammatory[14], antimicrobial [15,16]

2. MATERIAL AND METHODS

2.1 **Preparation of ethyl 2-((1-benzoyl-5-oxo-4,5-dihydro-1H-imidazol-2-yl) thioacetate(A)**

A starting material of Benzoylthiourea (BT) was Synthesis as **[1]**; A solution of BT (1.8g,0.01mol) in (30ml) 1,4-Dioxane in the presence of anhydrous potassium carbonate (K_2CO_3)(1.37g,0.01mol) was stirred at R.T. for 30min , then ethylchloroacetate (2.25ml,0.02mol) was add to the solution with stirring. The reaction mixture was refluxed for (7hrs) ;after that let the mixture cooled and add to a cool water with stirring to get the red solid precipitate which filtered off and recrystallized from ethanol:water(3:7),

Red powder; yield=75 %; m.p. 123-125 C°., IR (ν/cm-1): 3072 (C-Har), 2872-2978 (aliphatic CH), 1737(νC=O ester), 1678(νC=O imidazole ring), 1639(νC=O amide), 1599(νC=N imidazole ring).

^{1}H-NMR: (DMSO-d_6): δ,ppm= 1.2 (t, CH_3-CH_2,3H) , 4.6(s, S-CH_2,2H), 4.4 (q, COO-CH_2,2H), 4.4 (s, $COCH_2$,2H), 7.2- 8.1 (m, 5H, Aromatic).

MS, *m/z* [*M*]+: 306 (306.07). Found (calico.)**[17]**

2.2 **Synthesis of ethyl (Z)-2-((4-(2-(Aryl-phenyl)hydrazineylidene)-1-benzoyl-5-oxo-4,5-dihydro-1H-imidazol-2-yl)thio)acetate (1a-l).**

these compounds were synthesized by procedure that approbate with correspond to reference **[18].** The first solution of compound (A) (1.5 g, 0.005 mol) dissolved in pyridine (30mL) was stirring for 30min at 0-5 ^{0}C. Second solution contains a diazonium solution , which prepared by dissolved (0.005mol) of appropriate amine in HCl/H_2O in (7: 5)ml, followed by addtion $NaNO_2$ (0.69g,0.01mol in 5ml water) gradually with good stirring for 30min at 0-5 ^{o}C to perfect diazotization . The mixture of diazonium solution was added slowly to a first solution while keep temperature within (5-0) ^{o}C. The reaction mixture keep stirring and cool in ice for 4 hours, retained in refrigerator for 12h. Than the mixture was poured in water and stirring for 30min, the precipitated formed was filtered, wash several time with,then dried the precipitate and recrystallized from Dioxane/DMF(7:3).

2.2.1 Ethyl(Z)-2-((4-(2-(4-acetylphenyl)hydrazineylidene)-1-benzoyl-5-oxo-4,5-dihydro-1H-imidazol-2-yl)thio)acetate (1a)

Light orange powder , yied=84%; m.p. =192-193C°, Molecular formula ($C_{22}H_{20}N_4O_5S$) IR (ν/cm-1), υ C=O ester =1749 ; υ C=O cyclic =1726 ; υ C=O Amide =1639; υ NH=3165; υ CH Aromatic=3088 ; υ CH Aliphatic =2862-2995;υC=OArCOCH$_3$=1670.

^{1}H-NMR: (DMSO-d_6): δ,ppm= 1.23-1.25(t,3H,**CH$_3$**CH$_2$), 2.74 (s,3H, COCH$_3$) , 4.21-4.25(q,2H,COO**CH$_2$**), 4.86(s,2H,SCH$_2$), 7.38-8.01 (m,9H,ArH), 11.37(s,1H,NH).

2.2.2 (ethyl (Z)-2-((1-benzoyl-4-(2-(4-methoxyphenyl)hydrazineylidene)-5-oxo-4,5-dihydro-1H-imidazol-2-yl)thio)acetate (1b)

Orange powder , yied=86 %; m.p. =127-128C°, Molecular formula ($C_{21}H_{20}N_4O_5S$) IR (ν/cm-1) υ C=O ester =1739 ; υ C=O cyclic =1714 ; υ C=O Amide =1697; υ NH=3250; υ CH Aromatic=3049 ; υ CH Aliphatic =2835-2980;υp-OCH$_3$=825.

^{1}H-NMR:(DMSO-d_6):δ,ppm=1.20 1.23 (t,3H,CH$_3$CH$_2$) ,2.74(s,3H, OCH$_3$) ,4.18-4.22(q,2H,COOCH$_2$), 4.82(s,2H,SCH$_2$), 6.93-7.69 (m,9H,ArH), 11.31(s,1H,NH).

2.2.3 (Z)-4-(2-(1-benzoyl-2-((2-ethoxy-2-oxoethyl)thio)-5-oxo-1,5-dihydro-4H-imidazol-4-ylidene)hydrazineyl)benzoic acid. **(1c)**

Orange powder , yied=83 %; m.p. =258-259C°, Molecular formula ($C_{21}H_{18}N_4O_6S$) IR (ν/cm-1)υ C=O ester =1741 ; υ C=O cyclic =1683; υ C=O Amide =1635; υ NH=3240; υ CH Aromatic=3100 ; υ CH Aliphatic =2802-2985; υ OH acid= 2542-3171 ;υ C=O acid=1708.

^{1}H-NMR:(DMSO-d_6):δ,ppm= 1.20-1.23 (t,3H,**CH$_3$**CH$_2$) ,4.18-4.22 (q,2H,COO**CH$_2$**), 4.83(s,2H,SCH$_2$), 7,52-8.19 (m,9H,ArH), 11.56(s,1H,NH),12,75(s,1H,OH).

2.2.4 ethyl (Z)-2-((1-benzoyl-4-(2-(4-nitrophenyl)hydrazineylidene)-5-oxo-4,5-dihydro-1H-imidazol-2-yl)thio)acetate (1d):

Greenish yellow powder , yied=85 %; m.p. =219-220C°, Molecular formula ($C_{20}H_{17}N_5O_6S$) IR (ν/cm-1)υ C=O ester =1749; υ C=O cyclic =1716; υ C=O Amide =1651; υ NH=3240; υ CH Aromatic=3032 ; υ CH Aliphatic =2866-2991;υAr-NO$_2$=1537,1329**.**

^{1}H-NMR:(DMSO-d_6):δ,ppm= 1.21-1.24 (t,3H,**CH$_3$**CH$_2$) ,4.19-4.23 (q,2H,COO**CH$_2$**), 4.84(s,2H,SCH$_2$), 7.42-8.37 (m,9H,ArH), 11.78(s,1H,NH).

2.2.5 ethyl (Z)-2-((1-benzoyl-4-(2-(2-nitrophenyl)hydrazineylidene)-5-oxo-4,5-dihydro-1H-imidazol-2-yl)thio)acetate (1e):

Yellowish orange powder , yied=87 %; m.p. =155-156C°, Molecular formula ($C_{20}H_{17}N_5O_6S$) IR (ν/cm-1) υ C=O ester =1759; υ C=O cyclic =1732; υ C=O Amide =1651; υ NH=3252; υ CH Aromatic=3059 ; υ CH Aliphatic =2908-2978;υAr-NO$_2$=1529,1336.

^{1}H-NMR:(DMSO-d_6):δ,ppm= 1.21-1.24 (t,3H,**CH$_3$**CH$_2$) ,4.19-4.24 (q,2H,COO**CH$_2$**), 4.87(s,2H,SCH$_2$), 7.55-8.24 (m,9H,ArH), 11.04(s,1H,NH).

2.2.6 ethyl (Z)-2-((1-benzoyl-4-(2-(3-nitrophenyl)hydrazineylidene)-5-oxo-4,5-dihydro-1H-imidazol-2-yl)thio)acetate (1f):

Brown powder , yied=88 %; m.p. =130-131C°, Molecular formula ($C_{20}H_{17}N_5O_6S$) IR (ν/cm-1) υ C=O ester =1759; υ C=O cyclic =1716; υ C=O Amide =1639; υ NH=3242; υ CH Aromatic=3095 ; υ CH Aliphatic =2864-2985;υ Ar-NO$_2$=1523,1350**.**

^{1}H-NMR:(DMSO-d_6):δ,ppm= 1.21-1.23 (t,3H,**CH$_3$**CH$_2$) ,4.18-4.23 (q,2H,COO**CH$_2$**), 4.83(s,2H,SCH$_2$), 7.54-8.19 (m,9H,ArH), 11.62(s,1H,NH).

2.2.7 ethyl (Z)-2-((1-benzoyl-4-(2-(4-bromophenyl)hydrazineylidene)-5-oxo-4,5-dihydro-1H-imidazol-2-yl)thio)acetate (1g):

Yellowish powder , yied=89 %; m.p. =220-221C°, Molecular formula ($C_{20}H_{17}BrN_4O_4S$) IR :ν/cm-1υ C=O ester =1737; υ C=O cyclic =1701; υ C=O Amide =1639; υ NH=3111; υ CH Aromatic=3037 ; υ CH Aliphatic =2860-2999; υ p-Br= 813 , υ Ar-Br =1070**.**

^{1}H-NMR:(DMSO-d_6):δ,ppm= 1.20-1.23 (t,3H,**CH$_3$**CH$_2$) ,4.18-4.22 (q,2H,COO**CH$_2$**), 4.82(s,2H,SCH$_2$), 7.24-8.19 (m,9H,ArH), 11.40(s,1H,NH).

2.2.8 ethyl (Z)-2-((1-benzoyl-4-(2-(3-bromophenyl)hydrazineylidene)-5-oxo-4,5-dihydro-1H-imidazol-2-yl)thio)acetate (1h):

Yellowish orange powder , yied=90 %; m.p. =231-232C°, Molecular formula ($C_{20}H_{17}BrN_4O_4S$) IR (ν/cm-1) υ C=O ester =1730; υ C=O cyclic =1701; υ C=O Amide =1641; υ NH=3263; υ CH Aromatic=3059; υ CH Aliphatic =2864-2993; υ p-Br= 771 , υ Ar-Br =1051**.**

^{1}H-NMR:(DMSO-d_6):δ,ppm= 1.20-1.23 (t,3H,**CH$_3$**CH$_2$) ,4.18-4.22 (q,2H,COO**CH$_2$**), 4.83(s,2H,SCH$_2$), 7.15-7.70 (m,9H,ArH), 11.39(s,1H,NH).

2.2.9 ethyl (Z)-2-((1-benzoyl-4-(2-(2-chlorophenyl)hydrazineylidene)-5-oxo-4,5-dihydro-1H-imidazol-2-yl)thio)acetate (1i):

orange powder , yied=85 %; m.p. =240-241C°, Molecular formula($C_{20}H_{17}ClN_4O_4S$) IR (ν/cm-1) υ C=O ester =1734; υ C=O cyclic =1687; υ C=O Amide =1647; υ NH=3309; υ CH Aromatic=3068; υ CH Aliphatic =2840-2982; υ o-Cl =754 ,υ Ar-Cl= 1058**.**

^{1}H-NMR(DMSO-d_6):δ,ppm= 1.20-1.23 (t,3H,**CH$_3$**CH$_2$) ,4.18-4.23 (q,2H,COO**CH$_2$**), 4.83(s,2H,SCH$_2$), 7.04-8.19 (m,9H,ArH), 10.72(s,1H,NH).

2.2.10 ethyl (Z)-2-((1-benzoyl-5-oxo-4-(2-(p-tolyl)hydrazineylidene)-4,5-dihydro-1H-imidazol-2-yl)thio)acetate (1j)

Deep yellow powder , yied=89 %; m.p. =147-148C°, Molecular formula ($C_{21}H_{20}N_4O_4S$) IR (ν/cm-1) υ C=O ester =1741; υ C=O cyclic =1710; υ C=O Amide =1639; υ NH=3236; υ CH Aromatic=3036; υ CH Aliphatic =2916; υ p-$CH_{3=}$ 813**.**

^{1}H-NMR:(DMSO-d_6):δ,ppm=1.20-1.23(t,3H,**CH$_3$**CH$_2$),2.26(s,3H,Ar**CH3**) ,4.18-4.22(q,2H,COO**CH$_2$**), 4.82(s,2H,SCH$_2$), 7.15-8.19 (m,9H,ArH), 11.31(s,1H,NH).

2.2.11 ethyl (Z)-2-((1-benzoyl-5-oxo-4-(2-(m-tolyl)hydrazineylidene)-4,5-dihydro-1H-imidazol-2-yl)thio)acetate (1k):

Yellowish powder , yied=87 %; m.p. =153-154C°, Molecular formula ($C_{21}H_{20}N_4O_4S$) IR (ν/cm-1) υ C=O ester =1734; υ C=O cyclic =1712; υ C=O Amide =1645; υ NH=3246; υ CH Aromatic=3068; υ CH Aliphatic =2922-2966;υ m $CH_{3=}$738.

^{1}H-NMR:(DMSO-d_6):δ,ppm=1.201.23(t,3H,**CH_3**CH_2) ,2.31(s,3H,Ar**CH3**) , 4.18-4.22(q,2H,COO**CH_2**), 4.82(s,2H,SCH_2), 6.81-8.19 (m,9H,ArH), 11.30(s,1H,NH).

2.2.12 ethyl (Z)-2-((1-benzoyl-5-oxo-4-(2-phenylhydrazineylidene)-4,5-dihydro-1H-imidazol-2-yl)thio)acetate (1l):

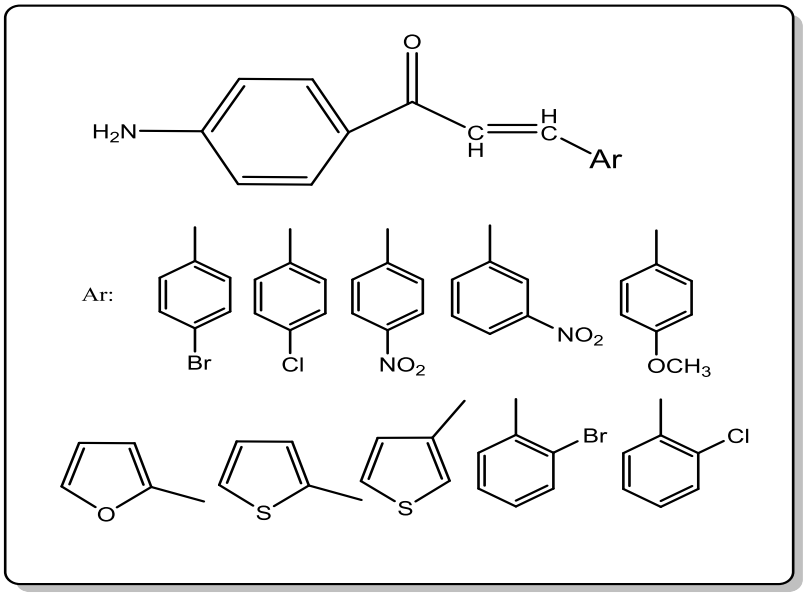
Yellow powder , yied=84 %; m.p. =185-186C°, Molecular formula ($C_{20}H_{18}N_4O_4S$) IR (ν/cm-1) υ C=O ester =1728; υ C=O cyclic =1701; υ C=O Amide =1645; υ NH=3259; υ CH Aromatic=3061; υ CH Aliphatic =2953.

^{1}H-NMR:(DMSO-d_6):δ,ppm=1.20-1.23(t,3H,**CH_3**CH_2) ,4.18-4.22 (q,2H,COO**CH_2**), 4.82(s,2H,SCH_2), 6.99-8.20 (m,10H,ArH), 11.35(s,1H,NH).

The mass spectra which used to identified the molecular weight of the synthesized azo compounds (1a),(1b),(1c),(1d),(1g),(1i),(1j) and (1l) respectively.

The molecular ion peak (M^+,m/z) were matched exactly with the molecular weight of azo compounds (452),(440),(454),(455),(490),(444), (424) and (410) respectively.

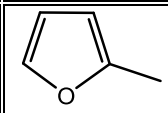
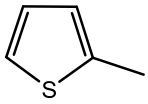
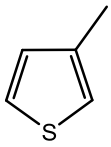
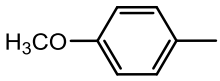
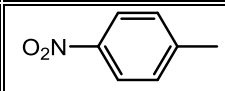
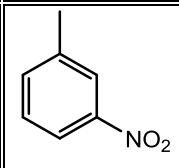
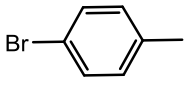
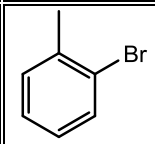
2.3 **preparation of 1-(4-aminophenyl)-3-(Aryl-phenyl)prop-2-en-1-one (2a-j) [19]:-**

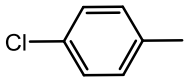
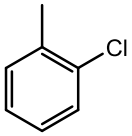


To a solution of 4-aminoacetophenone (1.35g.0.01mol) in 15ml ethanol,(10ml) %40 KOH was added and keep it stirring for 30 min.(0.01mol) of appropriate aldehyde was added to the ketone and left the reaction mixture stirring for 24hrs,then poured in 200ml distilled water with stirring for 30min.

The formed precipitate was filtered off m wish with distilled water ,dried and then recrystallized from ethanol. The physiochemical properties of the synthesis compounds are listed in **Table(1).**

Table (1) Physical properties of compounds (2a-j)

Symbols	Ar	Yield	M. P. ^{0}C	Color	Molecular formula
2a		96	109-110	Yellow	$C_{13}H_{11}NO_2$
2b		98	100-101	Yellow	$C_{13}H_{11}NOS$
2c		96	101-102	Greenish yellow	$C_{13}H_{11}NOS$
2d		83	99-100	Yellow	$C_{16}H_{15}NO_2$
2e		70	218-219	Orange	$C_{15}H_{11}N_2O_3$
2f		66	213-214	Orange	$C_{15}H_{11}N_2O_3$
2g		72	162-163	Light yellow	$C_{15}H_{12}BrNO$
2h		96	154-155	Deep yellow	$C_{15}H_{12}BrNO$

Symbols	Ar	Yield	M. P. ^{0}C	Color	Molecular formula
2i		75	149-150	Light yellow	$C_{12}H_{15}ClNO$
2j		87	146-147	Deep yellow	$C_{12}H_{15}ClNO$

2.4 **Synthesis of ethyl 2-(((Z)-1-benzoyl-4-(2-(4-((E)-3-(Aryl-phenyl)acryloyl)phenyl)hydrazineylidene)-5-oxo-4,5-dihydro-1H-imidazol-2-yl)thio)acetate (3a-j):-**

In the same way that used to synthesis the compounds (1a-l).

The first solution A (1.5 g, 0.005 mol) dissolved in pyridine (30mL) was stirring for 30min at 0-5 ^{0}C. Second solution contains a diazonium solution , which prepared by dissolved (0.005mol) of appropriate amine(2a-j) in HCl/H_2O in (7: 5)ml, followed by addtion $NaNO_2$ (0.69g,0.01mol in 5ml water) gradually with good stirring for 30min at 0-5 ^{o}C to perfect diazotization . The mixture of diazonium solution was added slowly to a first solution while keep temperature within (5-0) ^{o}C. The reaction mixture keep stirring and cool in ice for 4 hours, retained in refrigerator for 12h. Than the mixture was poured in water and stirring for 30min, the precipitated formed was filtered, wash several time with,then dried the precipitate and recrystallized from Dioxane/DMF(5:5).

2.4.1Ethyl2-(((Z)-1-benzoyl-4-(2-(4-((E)-3-(furan-2yl)acryloyl)phenyl) hydrazineylidene)-5-oxo-4,5-dihydro-1H-imidazol-2-yl)thio)acetate (3a)

Deep brown powder , yied=88 %; m.p. =265-266C°, Molecular formula ($C_{27}H_{22}N_4O_6S$) IR (ν/cm-1**)** υ C=O ester=1737; υ C=O cyclic=1712; υ C=O α,β-unsat=1647; υ C=O Amide=1635; υ NH=3238; υ CHArom.= 3045; υ CHAlip.= 2937, 2982; υ C=C =1602**.**

^{1}H-NMR:(DMSO-d_6):δ,ppm=1.23-1.25(t,3H,**CH_3**CH_2) ,4.21-4.25 (q,2H, COO**CH_2**), 4.86(s,2H,SCH_2), 6.70-8.22 (m,14H,ArH and CH=CH) ,11.65(s,1H,NH).

2.4.2Ethyl2-(((Z)-1-benzoyl-5-oxo-4-(2-(4-((E)-3-(thiophen-2-yl)acryloyl) phenyl)hydrazineylidene)-4,5-dihydro-1H-imidazol-2-yl)thio)acetate (3b)

Orange powder , yied=87 %; m.p. = 280-281C°, Molecular formula ($C_{27}H_{22}N_4O_5S_2$) IR (ν/cm-1**)** υ C=O ester=1741; υ C=O cyclic=1712; υ C=O α,β-unsat=1683; υ C=O Amide=1637; υ NH=3244; υ CHArom.= 3097; υ CHAlip.= 2874, 2995; υ C=C =1606.

^{1}H-NMR(DMSO-d_6):δ,ppm=1.23-1.25(t,3H,**CH_3**CH_2) ,4.21-4.25 (q,2H, COO**CH_2**), 4.86(s,2H,SCH_2), 7.20-8.22 (m,14H,ArH and CH=CH) ,11.37(s,1H,NH).

2.4.3Ethyl2-(((Z)-1-benzoyl-5-oxo-4-(2-(4-((E)-3-(thiophen-3-yl)acryloyl) phenyl)hydrazineylidene)-4,5-dihydro-1H-imidazol-2-yl)thio)acetate (3c)

Deep orange powder , yied=85 %; m.p. = 290-291C°, Molecular formula ($C_{27}H_{22}N_4O_5S_2$) IR (ν/cm-1**)** υ C=O ester=1749; υ C=O cyclic=1705; υ C=O α,β-unsat=1651; υ C=O Amide=1635; υ NH=3250; υ CHArom.= 3007; υ CHAlip.= 2802, 2985; υ C=C =1604.

^{1}H-NMR(DMSO-d_6):δ,ppm=1.23-1.25(t,3H,**CH_3**CH_2) ,4.21-4.25 (q,2H, COO**CH_2**), 4.86(s,2H,SCH_2), 7.42-8.22 (m,14H,ArH and CH=CH) ,11.64(s,1H,NH).

2.4.4Ethyl2-(((Z)-1-benzoyl-4-(2-(4-((E)-3-(4-methoxyphenyl) acryloyl) phenyl)hydrazineylidene)-5-oxo-4,5-dihydro-1H-imidazol-2-yl)thio) acetate (3d):

orange powder , yied=88 %; m.p. = 266-267C°, Molecular formula ($C_{30}H_{26}N_4O_6S$) IR (ν/cm-1**)** υ C=O ester=1741; υ C=O cyclic=1718; υ C=O α,β-unsat=1656; υ C=O Amide=1639; υ NH=3250; υ CHArom.= 3024; υ CHAlip.= 2835, 2939; υ C=C =1602;υp-OCH_3=812.

^{1}H-NMR(DMSO-d_6):δ,ppm=1.231.25(t,3H,**CH$_3$**CH$_2$) ,3.58(s,3H,OCH$_3$) ,4.21-4.25 (q,2H,COO**CH$_2$**), 4.86(s,2H,SCH$_2$), 7.40-8.24 (m,15H,ArH and CH=CH) ,11.66(s,1H,NH).

2.4.5Ethyl2-(((Z)-1-benzoyl-4-(2-(4-((E)-3-(4-nitrophenyl)acryloyl) phenyl) hydrazineylidene)-5-oxo-4,5-dihydro-1H-imidazol-2-yl)thio)acetate (3e)

orange powder , yied=93 %; m.p. = 240-241C°, Molecular formula ($C_{29}H_{23}N_5O_7S$) IR (ν/cm-1**)** υ C=O ester=1743; υ C=O cyclic=1712; υ C=O α,β-unsat=1647; υ C=O Amide=1633; υ NH=3242; υ CHArom.= 3064; υ CHAlip.= 2937, 2991; υ C=C =1602;υ Ar-NO$_2$=1539,1330.

^{1}H-NMR(DMSO-d_6):δ,ppm=1.22-1.25(t,3H,**CH$_3$**CH$_2$) ,4.20-4.25 (q,2H, COO**CH$_2$**), 4.85(s,2H,SCH$_2$), 7.44-8.30 (m,15H,ArH and CH=CH) ,11.60(s,1H,NH).

2.4.6Ethyl2-(((Z)-1-benzoyl-4-(2-(4-((E)-3-(3-nitrophenyl)acryloyl) phenyl) hydrazineylidene)-5-oxo-4,5-dihydro-1H-imidazol-2-yl)thio)acetate (3f)

Light orange powder , yied=90 %; m.p. = 260-261C°, Molecular formula ($C_{29}H_{23}N_5O_7S$) IR (ν/cm-1**)** υ C=O ester=1743; υ C=O cyclic=1720; υ C=O α,β-unsat=1660; υ C=O Amide=1649; υ NH=3219; υ CHArom.= 3029; υ CHAlip.= 2860, 2982; υ C=C=1608;υAr-NO$_{2=}$1525,1356.

^{1}H-NMR(DMSO-d_6):δ,ppm=1.23 1.26(t,3H,**CH$_3$**CH$_2$) ,4.21-4.25 (q,2H, COO**CH$_2$**), 4.85(s,2H,SCH$_2$), 7.47-8.34 (m,15H,ArH and CH=CH) ,11.65(s,1H,NH).

2.4.7Ethyl2-(((Z)-1-benzoyl-4-(2-(4-((E)-3-(4-bromophenyl)acryloyl) phenyl)hydrazineylidene)-5-oxo-4,5-dihydro-1H-imidazol-2-yl)thio) acetate (3g)

Yellowish orange powder , yied=90 %; m.p. = 242-243C°, Molecular formula ($C_{29}H_{23}BrN_4O_5S$) IR (ν/cm-1**)** υ C=O ester=1751; υ C=O cyclic=1697; υ C=O α,β-unsat=1658; υ C=O Amide=1637; υ NH=3215; υ CHArom.= 3063; υ CHAlip.= 28702980; υ C=C =1606.

^{1}H-NMR(DMSO-d_6):δ,ppm=1.23-1.25(t,3H,**CH$_3$**CH$_2$) ,4.21-4.25 (q,2H, COO**CH$_2$**), 4.85(s,2H,SCH$_2$), 7.46-8.23 (m,15H,ArH and CH=CH) ,11.63(s,1H,NH)

.2.4.8Ethyl2-(((Z)-1-benzoyl-4-(2-(4-((E)-3-(2-bromophenyl)acryloyl) phenyl)hydrazineylidene)-5-oxo-4,5-dihydro-1H-imidazol-2-yl)thio)acetate (3h)

Deep yellow powder , yied=85 %; m.p. = 238-239C°, Molecular formula ($C_{29}H_{23}BrN_4O_5S$) IR (ν/cm-1**)** υ C=O ester=1741; υ C=O cyclic=1722; υ C=O α,β-unsat=1658; υ C=O Amide=1631; υ NH=3240; υ CHArom.= 3030; υ CHAlip.= 2856, 2980; υ C=C =1606;υ o-Br =756.

^{1}H-NMR(DMSO-d_6):δ,ppm=1.23 1.25(t,3H,**CH$_3$**CH$_2$) ,4.20-4.25 (q,2H, COO**CH$_2$**), 4.85(s,2H,SCH$_2$), 7.44-8.24 (m,15H,ArH and CH=CH) ,11.63(s,1H,NH).

2.4.9Ethyl2-(((Z)-1-benzoyl-4-(2-(4-((E)-3-(4-chlorophenyl)acryloyl)phenyl) hydrazineylidene)-5-oxo-4,5-dihydro-1H-imidazol-2-yl)thio)acetate (3i)

Yellowish orange powder , yied=86 %; m.p. = 230-231C°, Molecular formula ($C_{29}H_{23}ClN_4O_5S$) IR (ν/cm-1**)** υ C=O ester=1751; υ C=O cyclic=1697; υ C=O α,β-unsat=1656; υ C=O Amide=1637; υ NH=3215; υ CHArom.= 3014; υ CHAlip.= 2872, 2978; υ C=C =1608;υ p-Cl=819**.**

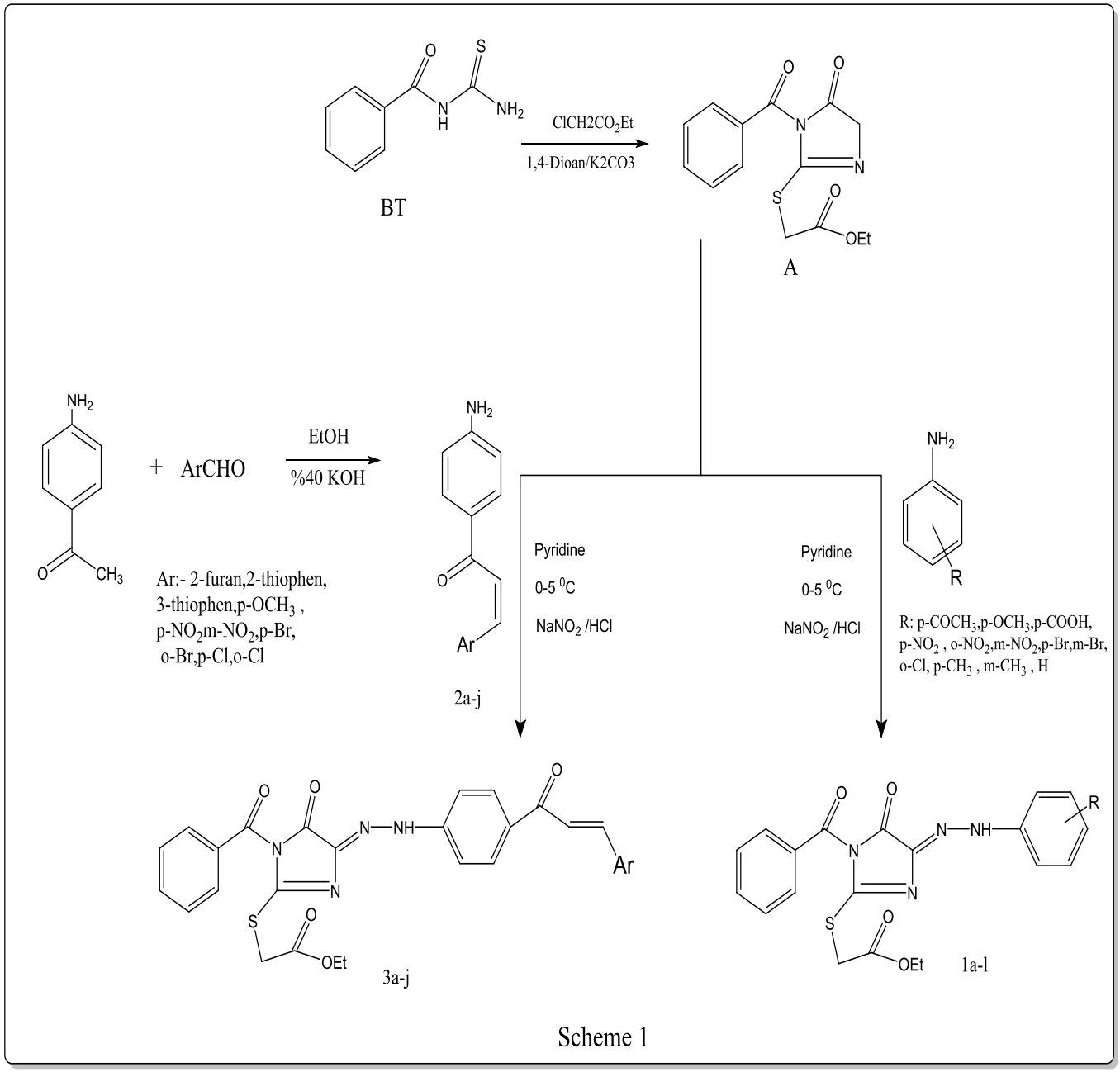
^{1}H-NMR(DMSO-d_6):δ,ppm=1.23-1.25(t,3H,**CH$_3$**CH$_2$) ,4.21-4.25 (q,2H, COO**CH$_2$**), 4.86(s,2H,SCH$_2$), 7.46-8.25 (m,15H,ArH and CH=CH) ,11.63(s,1H,NH).

2.4.10Ethyl2-(((Z)-1-benzoyl-4-(2-(4-((E)-3-(2-chlorophenyl)acryloyl) phenyl)hydrazineylidene)-5-oxo-4,5-dihydro-1H-imidazol-2-yl)thio)acetate (3j)

Light orange powder , yied=97 %; m.p. = 224-225C°, Molecular formula ($C_{29}H_{23}ClN_4O_5S$) IR (ν/cm-1**)** υ C=O ester=1741; υ C=O cyclic=1722; υ C=O α,β-unsat=1658; υ C=O Amide=1643; υ NH=3209; υ CHArom.= 3066; υ CHAlip.= 2858, 2991; υ C=C =1606;υ o-Cl=759.

^{1}H-NMR(DMSO-d_6):δ,ppm=1.23-1.25(t,3H,**C**$\mathbf{H_3}$CH_2) ,4.20-4.25 (q,2H, COO**C**$\mathbf{H_2}$), 4.85(s,2H,SCH_2), 7.44-8.24 (m,15H,ArH and CH=CH) ,11.63(s,1H,NH).

The mass spectra which used to identify the molecular weight for the synthesized compounds (3a),(3c),(3d),(3e),(3g) and (3i) respectively . The molecular ion peak (M^+,m/z) were matched exactly with the molecular weight of azo copounds (530),(546),(570),(585),(619) and (575) respectively .



Scheme 1

Results and Discussion:

The synthesis of (A,chalcones and azo derivatives) were shown in (Scheme 1).

In the recent decades, imidazole moiety and imidazole compounds derivatives were interest of organic chemists due to their biological importance and therapeutic considered and used as a source in pharmaceutical chemistry to developed many kinds of drugs. It can be used as an antihypertensive agent ,an inhibitor for virus (HIV), antifungal ,anticancer, antibacterial , anticonvulsant and antimicrobial.The active methylene group in the imidazole moiety was the start point for the synthesis a new derivatives with different groups by reaction with aromatic aldehyde to give chalcones (COC=CH) or coupling reaction with the aryl diazonium salt to prepare azo compounds (N=N) and some heterocyclic derivatives like pyrazole,purine**.**

The reaction of active methylene group (-CH-C=O) in imidazoline ring with aryldiazonium salt is familiar as the Japp-klingemann synthesis [20].Using of pyridine as proton acceptor and solvent make the reaction more accelerator.

The new azo compounds (1a-l) were identified by the using of spectroscopic methods including FT-IR,^{1}H-NMR and GC-Mass.The FT-IR, all the synthesized azo show occurrence the stretching vibration bands of (NH) group at the range (3111-3491)cm^{-1} as well the stretching vibration band of (C=O) group of ester,imidazoline and amid in addition to the aromatic functional groups.

The ^{1}H-NMR spectrum of the compounds (1a-l) were showed disappearance of the signs at (s,4.4,2H) of the active methylene group of compound (A) and appearance a singlet signal at(10.72-11.78)ppm due to (NH azo group) .In addition to a signal of substituents on aryl amine like ($COCH_3$,OCH_3,COOH and CH_3),the aromatic and aliphatic protons .

The mass spectrum shown the molecular ion peak (M^+,m/z) are match exactly with the molecular weight of the azo compounds (452),(440),(454), (455) ,(490) ,(444), (424) and (410) respectively .

Compound (A) will reacted with a series of chalcons (2a-j) that contains amine group through the reaction of active methylene group of compound (A) with aryldiazonium salt to be obtained of new azo-chalcons compounds. The newly azo-chalcon compounds (73a-j) were identified by the using of spectroscopic methods FT-IR,^{1}H-NMR and GC-Mass.The FT-IR spectra were showed occurrence the stretching vibration band of (NH)group at the range (3215-3250)cm^{-1} and the stretching vibration band of (C=CH chalcons group) at the range (1602-1608)cm^{-1} ,as will as the stretching vibration band of (C=O) group of ester,amid,cyclic amid and α,β-unsaturated carbonyl group.

As in compounds (1a-l) the ^{1}H-NMR spectrum of the compounds (3a-j) were showed disappearance of the signs at (s,4.4,2H) of the active methylene group of compound (A) and appearance a singlet signal at(11.37-11.65)ppm due to (NH azo group) .In addition to a signal of (CH=CH chalcons groups) which were overlapping with signals of aromatic protons, the aromatic and aliphatic protons.

The mass spectrum shown the molecular ion peak (M^+,m/z) are match exactly with the molecular weight of the azo-chalcons compounds (530),(546),(570),(585),(619) and (575) respectively

Biological Activity

The antibacterial activity of the synthesized compounds (BTIO, 1a-l and 3a-j) versus different types of bacteria including Gram-positive ; *Staphylococcus epidermidis*, *Staphylococcus aureus* and Gram-negative *Escherichia coli*,*Klibsiella spp*. in addition the activity versus fungal *Candida albicans* ,all the result data will summarized in(Table 2).

All the compounds were dissolved in DMSO which used as solvent and control.

The strains of the tested bacteria result in a different values of inhibition zone size output from the efficiency of the synthesized compounds which have higher activity versus Gram-positive bacteria better than Gram-negative bacteria that may be result from the difference of the chemical composition of the synthesized compounds**.**

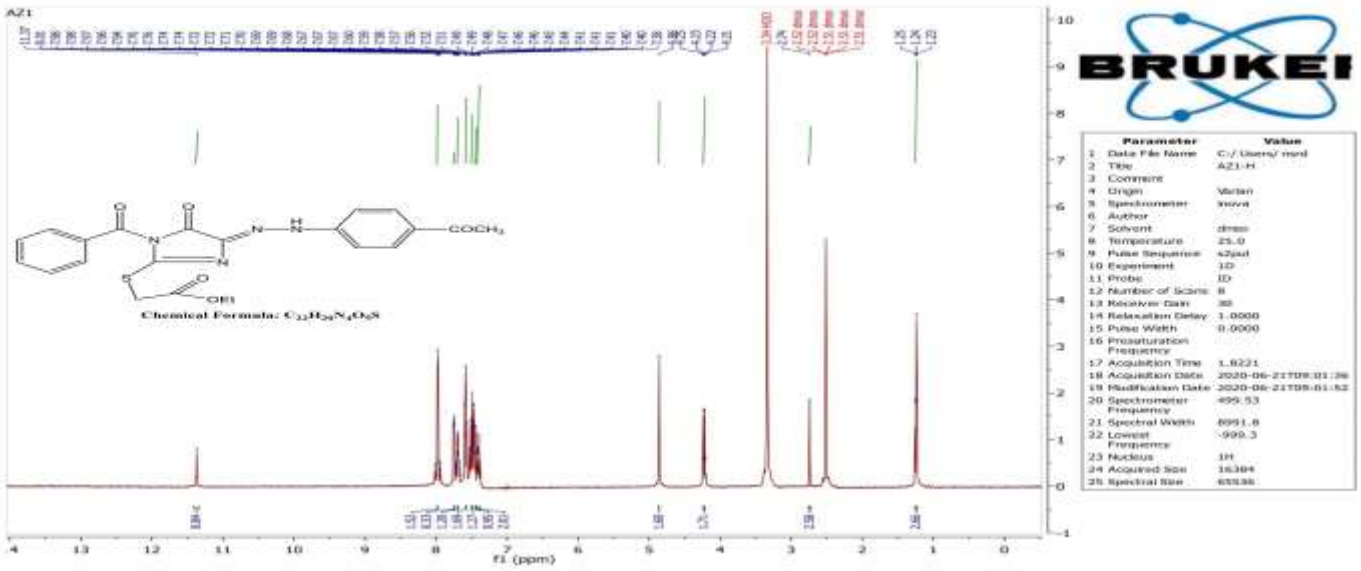
The **1b** and **3g** compounds appeared a highest and premium activity versus all types of bacteria and fungal , this activity may be resulted from the substituents group (p-OCH_3,p-Br) on the phenyl ring or for the imidazole ring or due the the azo –chalcons groups.

Therefor,Chalcones,imidazile and azo derivatives have a vast range application in pharmaceutical field that result in obtained huge attention by equal in synthetic chemists and medicinal and increase of resistant of the microorganism to therapeutic drugs[21-27]

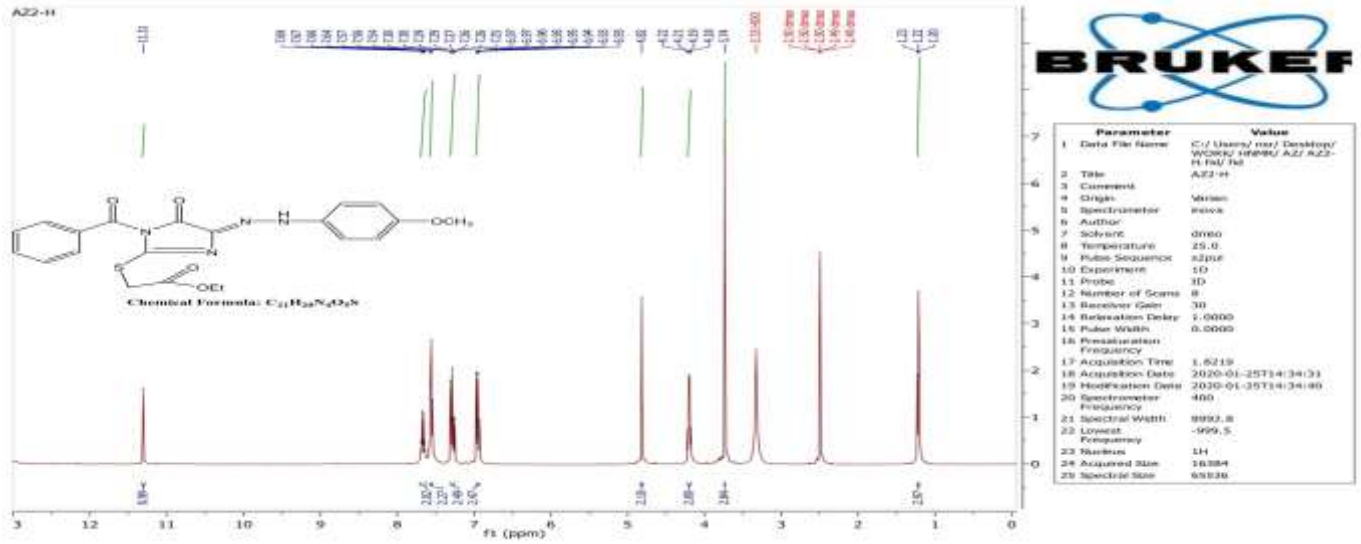
(Table 2)The inhibition effect zone (mm) of the synthesized compounds (1000 µg/ml) versus different bacteria and fungal

Compound	Gram-positive		Gram-negative		*Candida albicans*
	Staphylococcus aureus	*Staphylococcus Epidermidis*	*Escherichia coli*	*Klebsiella sp*	
1a	11	15	0	17	0
1b	13	14	12	19	10
1c	0	10	0	16	0
1d	0	11	15	0	0
1e	17	0	12	11	13
1f	11	10	12	0	11
1g	10	15	0	11	0
1h	0	11	11	14	11
1i	12	11	10	0	12
1j	13	13	17	0	0

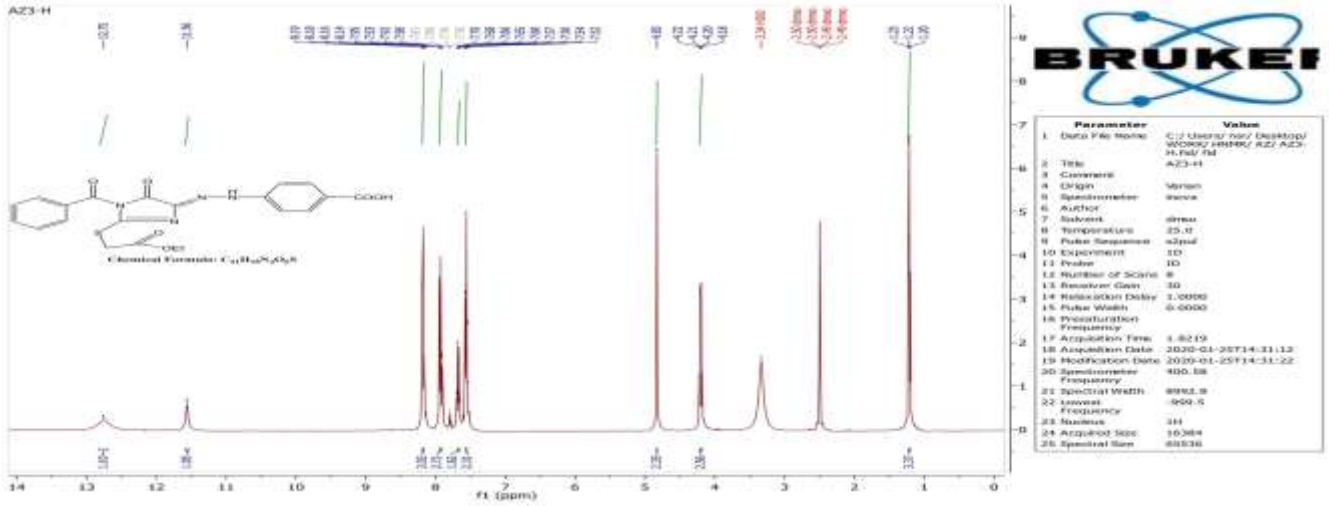
Compound	Gram-positive		Gram-negative		*Candida albicans*
	Staphylococcus aureus	*Staphylococcus Epidermidis*	*Escherichia coli*	*Klebsiella sp*	
1k	14	15	11	0	10
1l	11	10	10	0	0
3a	11	11	0	11	0
3b	0	10	0	17	11
3c	11	11	10	0	11
3d	12	11	14	11	11
3e	11	10	0	14	11
3f	0	11	0	0	0
3g	14	11	11	16	11
3h	0	13	11	0	0
3i	11	10	13	0	15
3j	0	13	0	0	12



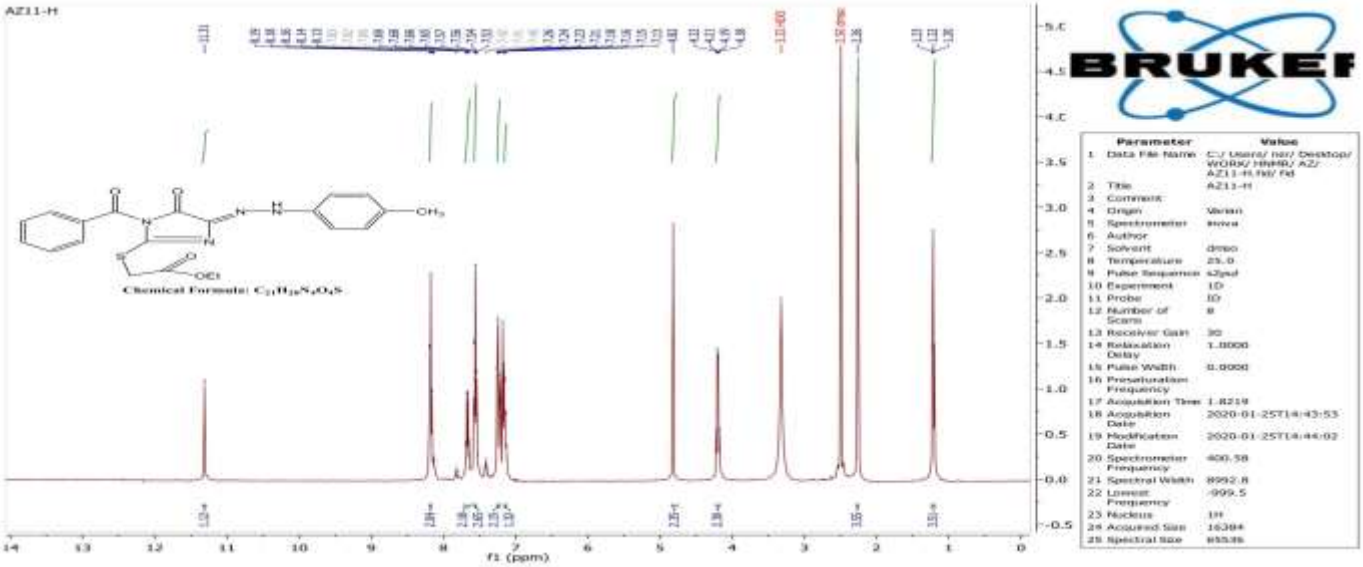
^{1}H-NMR Spectrum of compound(1a)



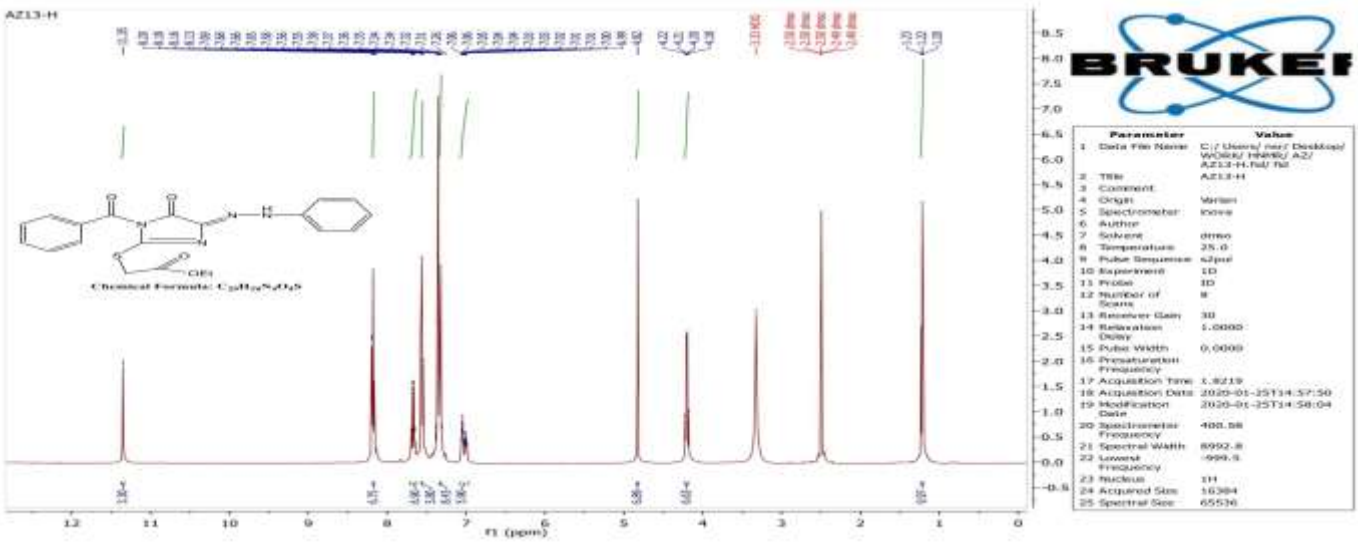
^{1}H-NMR Spectrum of compound(1b)



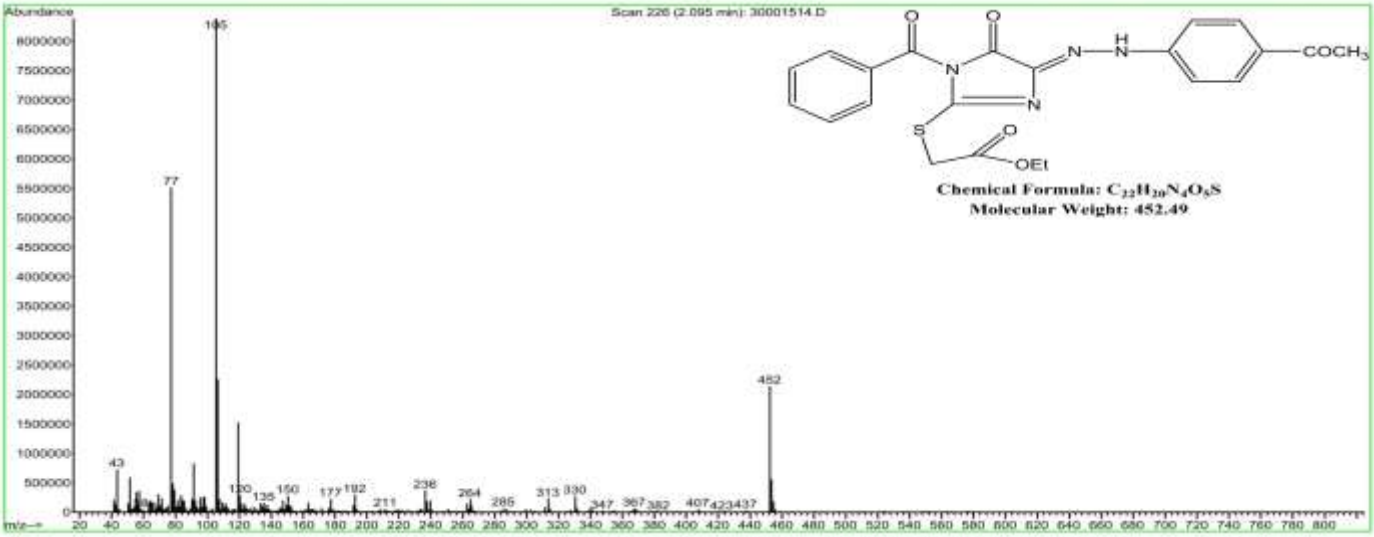
^{1}H-NMR Spectrum of compound(1c)



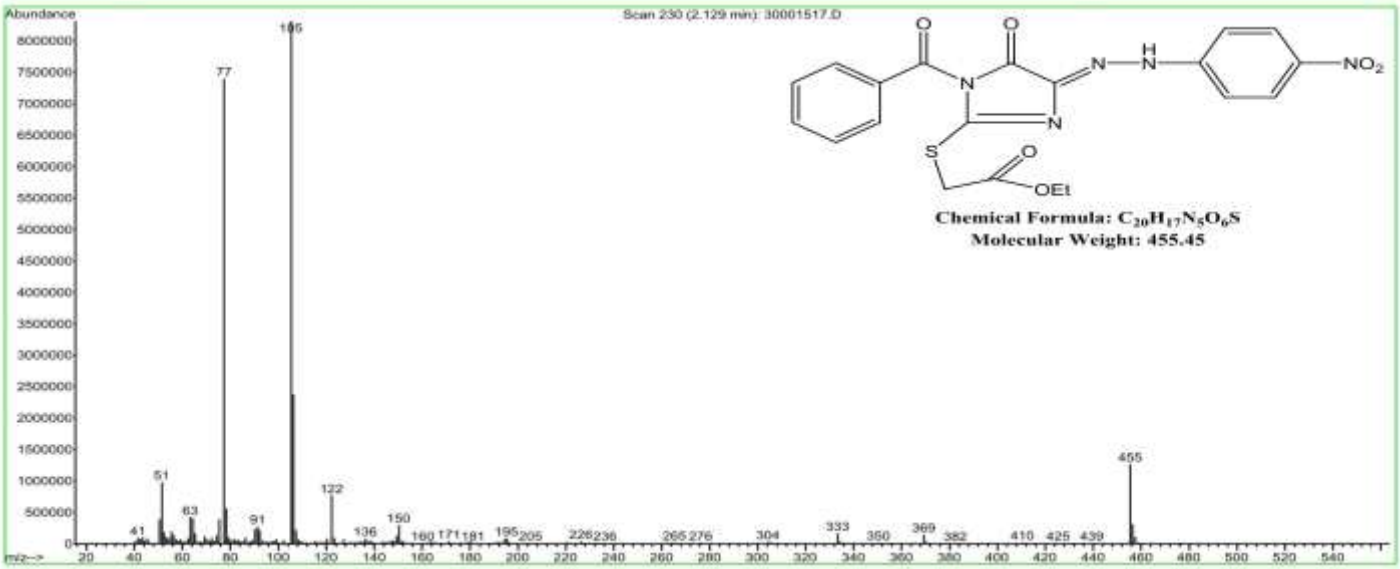
^{1}H-NMR Spectrum of compound(1j)



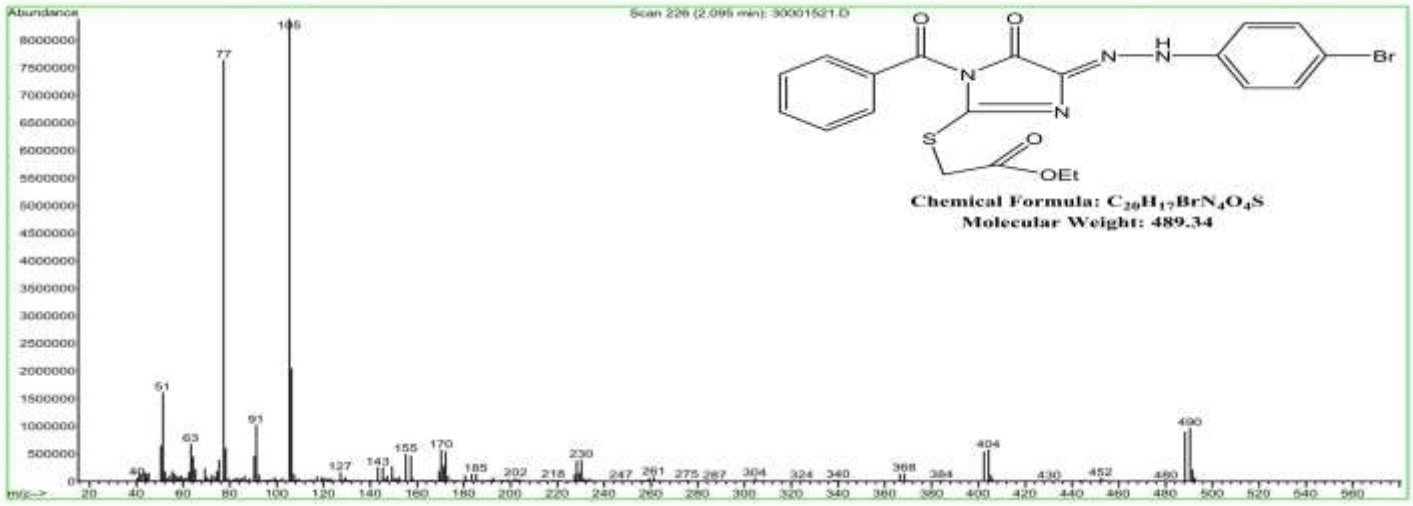
^{1}H-NMR Spectrum of compound(1l)



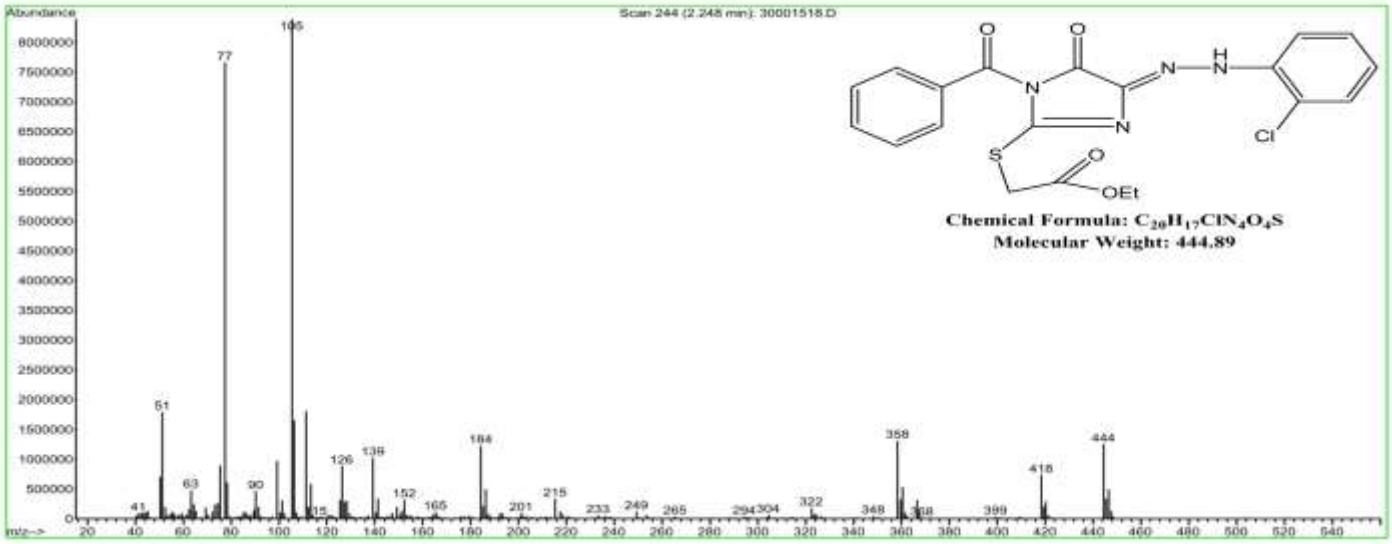
Mass Spectrum of compound(1a)



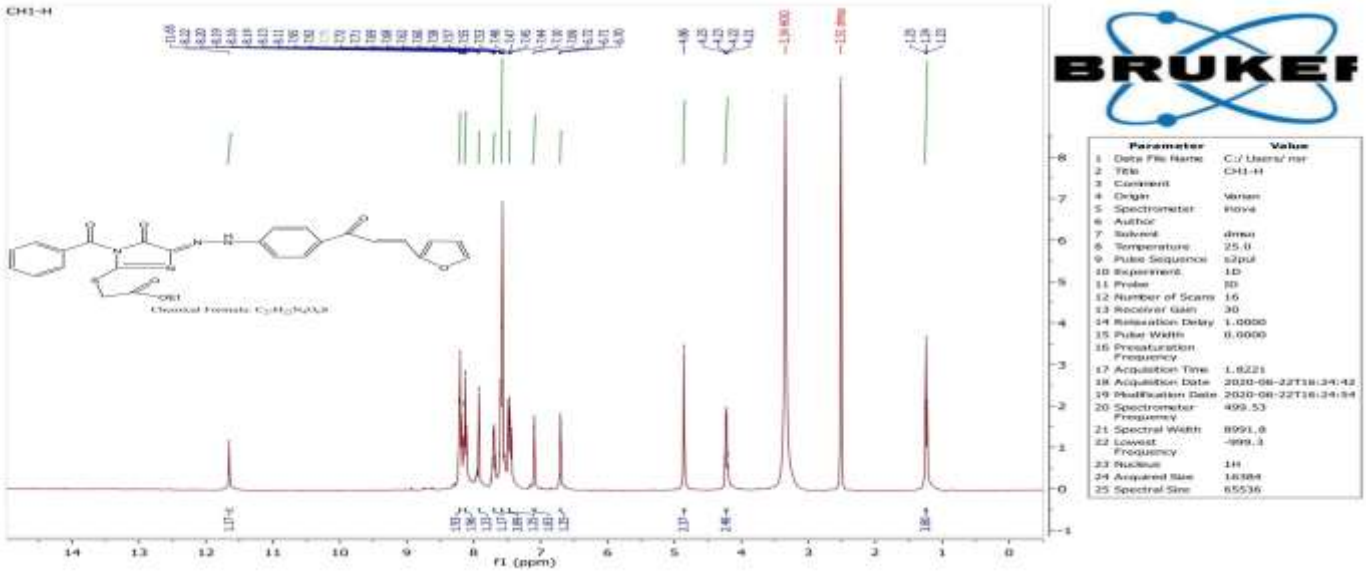
Mass Spectrum of compound(1d)



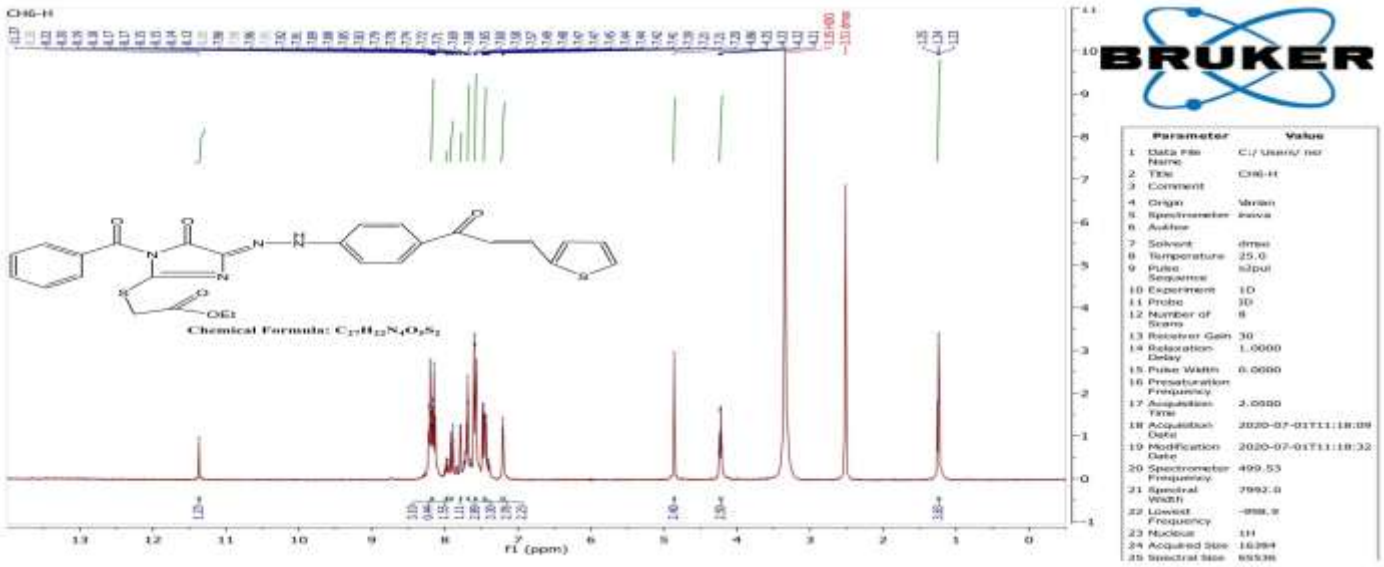
Mass Spectrum of compound(1g)



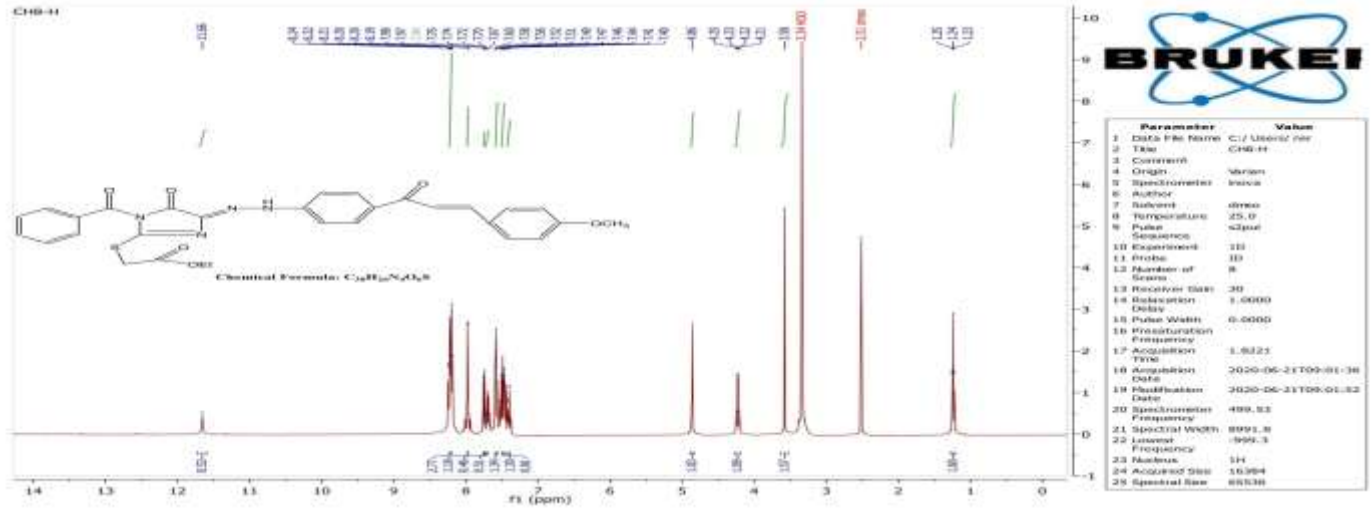
Mass Spectrum of compound(1i)



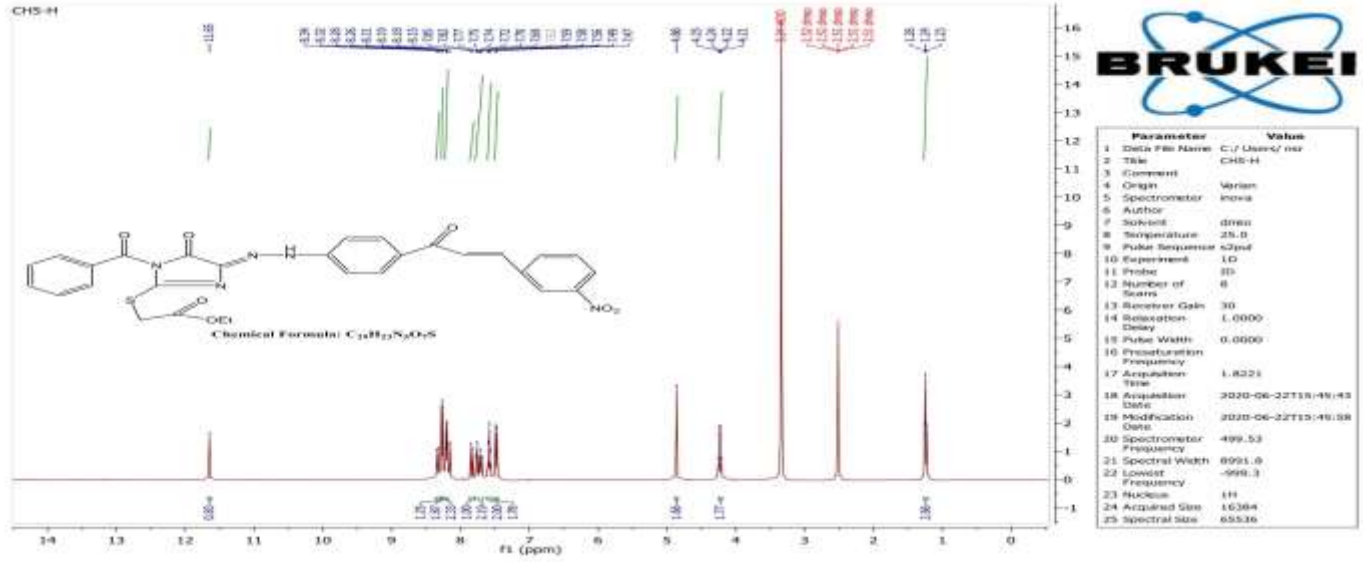
^{1}H-NMR Spectrum of compound(3a)



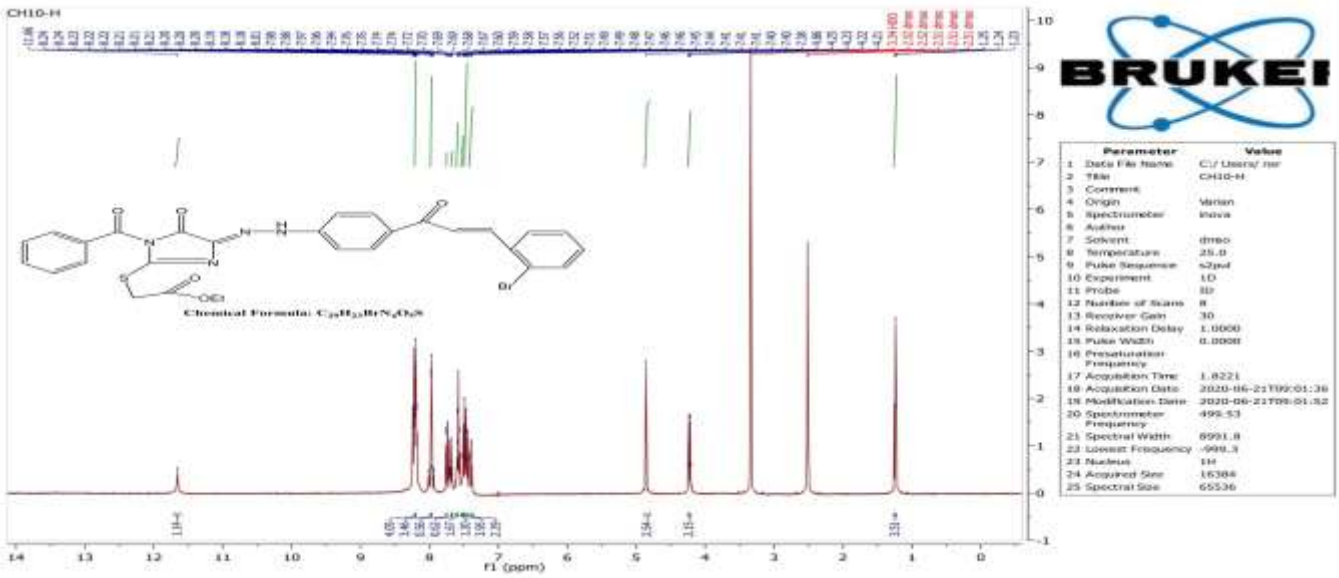
^{1}H-NMR Spectrum of compound(3b)



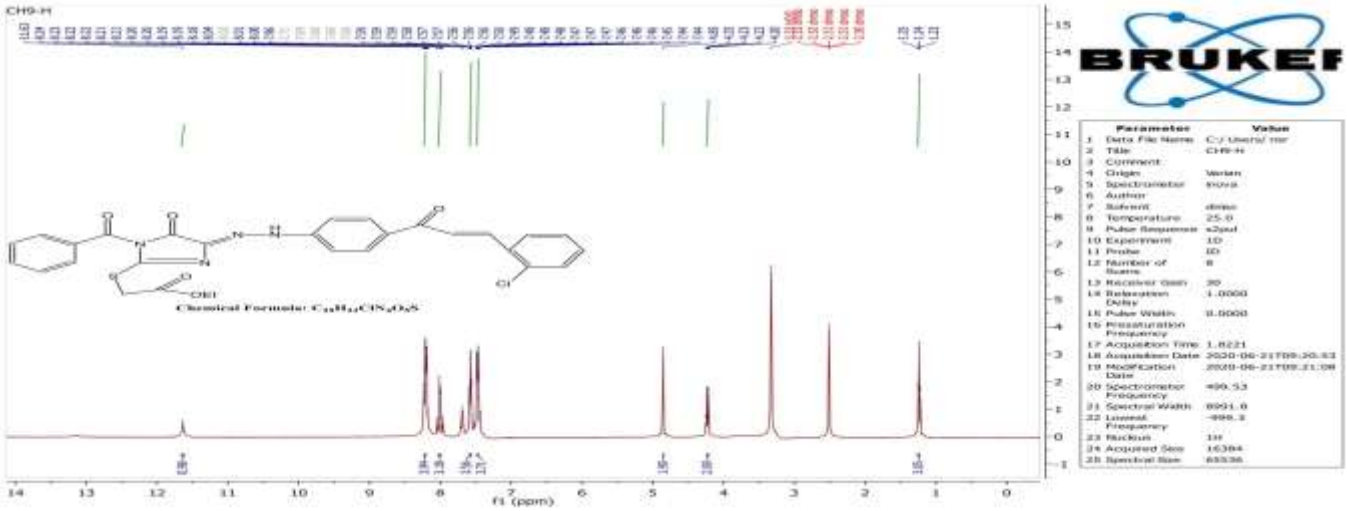
^{1}H-NMR Spectrum of compound(3d)



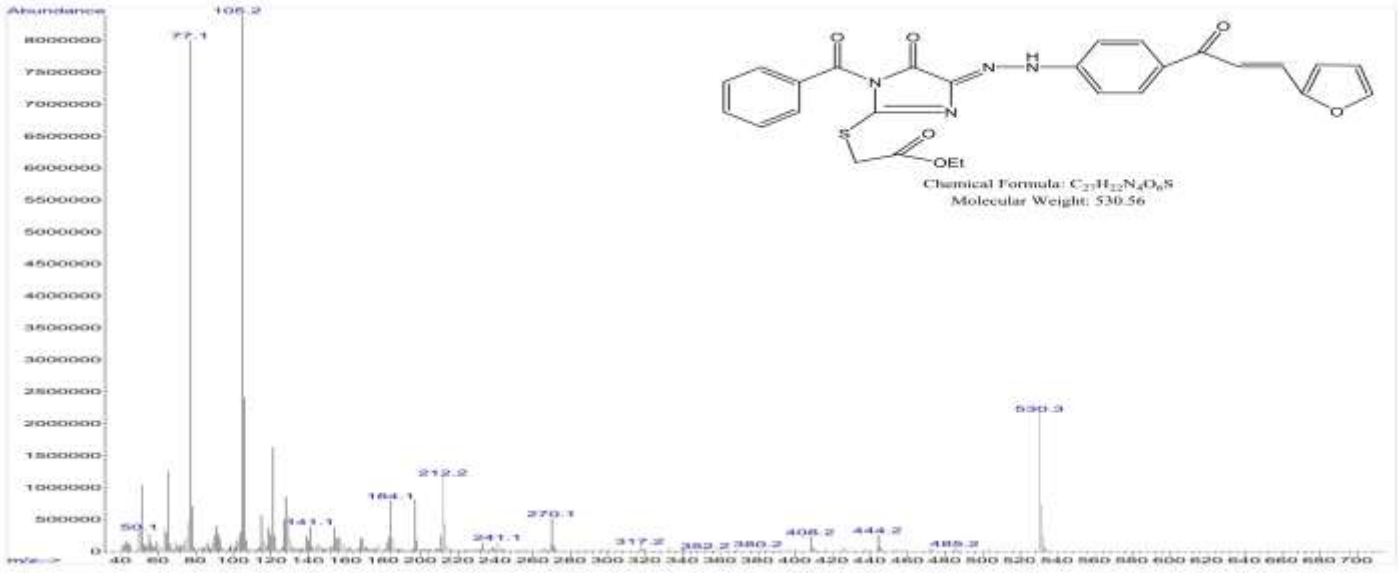
^{1}H-NMR Spectrum of compound(3f)



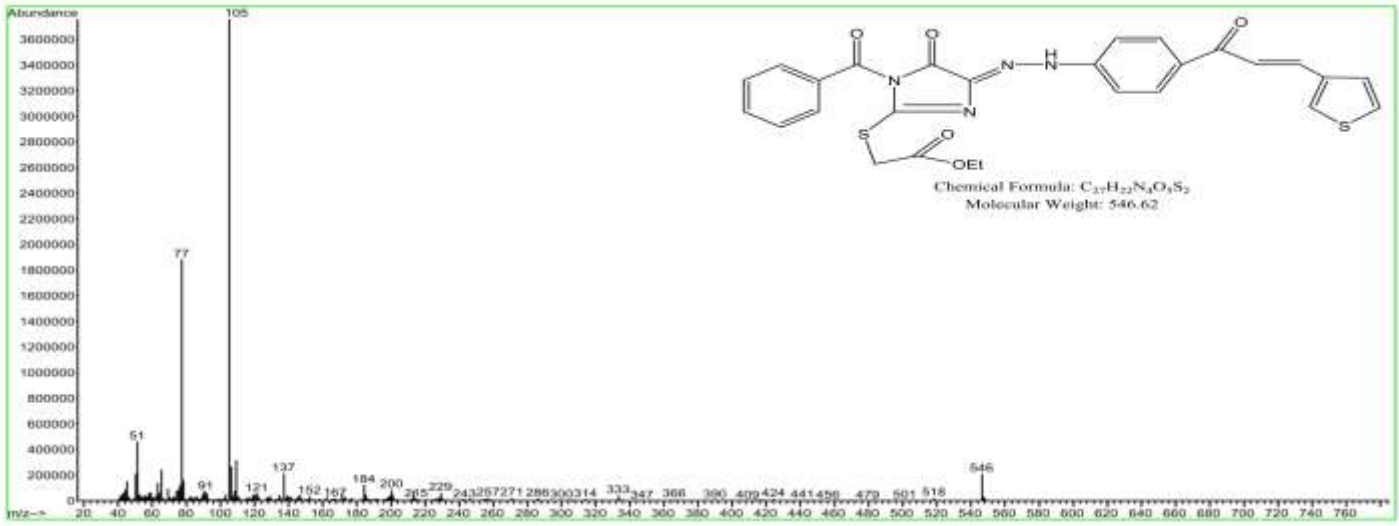
^{1}H-NMR Spectrum of compound(3h)



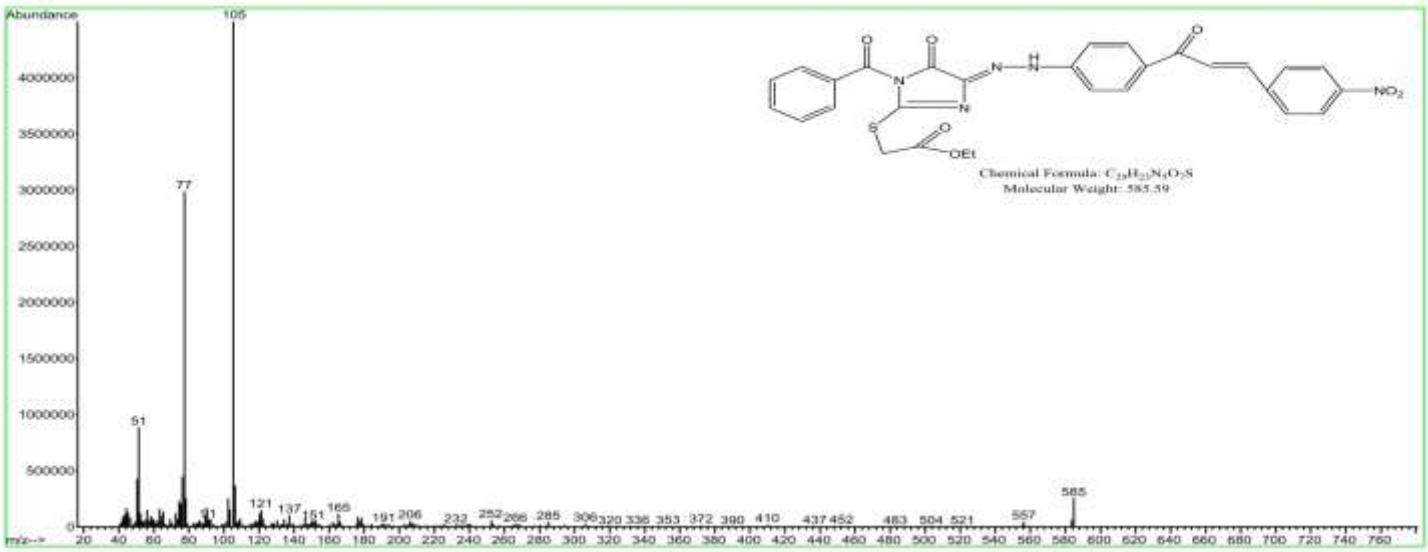
^{1}H-NMR Spectrum of compound(3j)



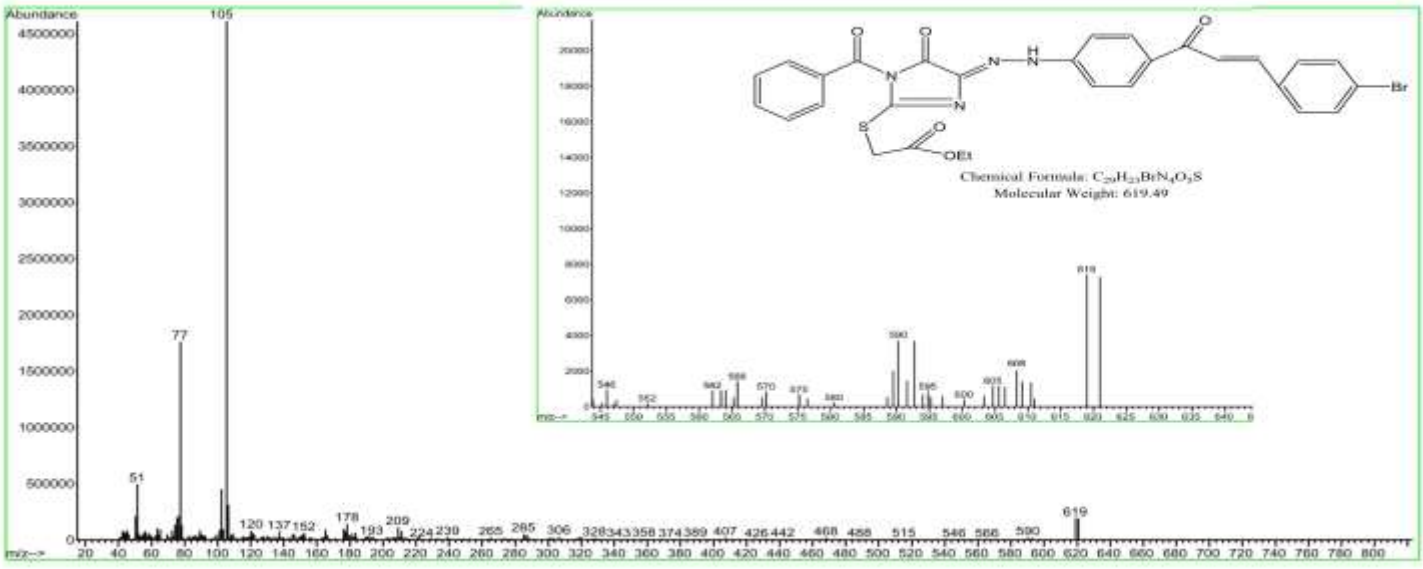
Mass Spectrum of compound(3a)



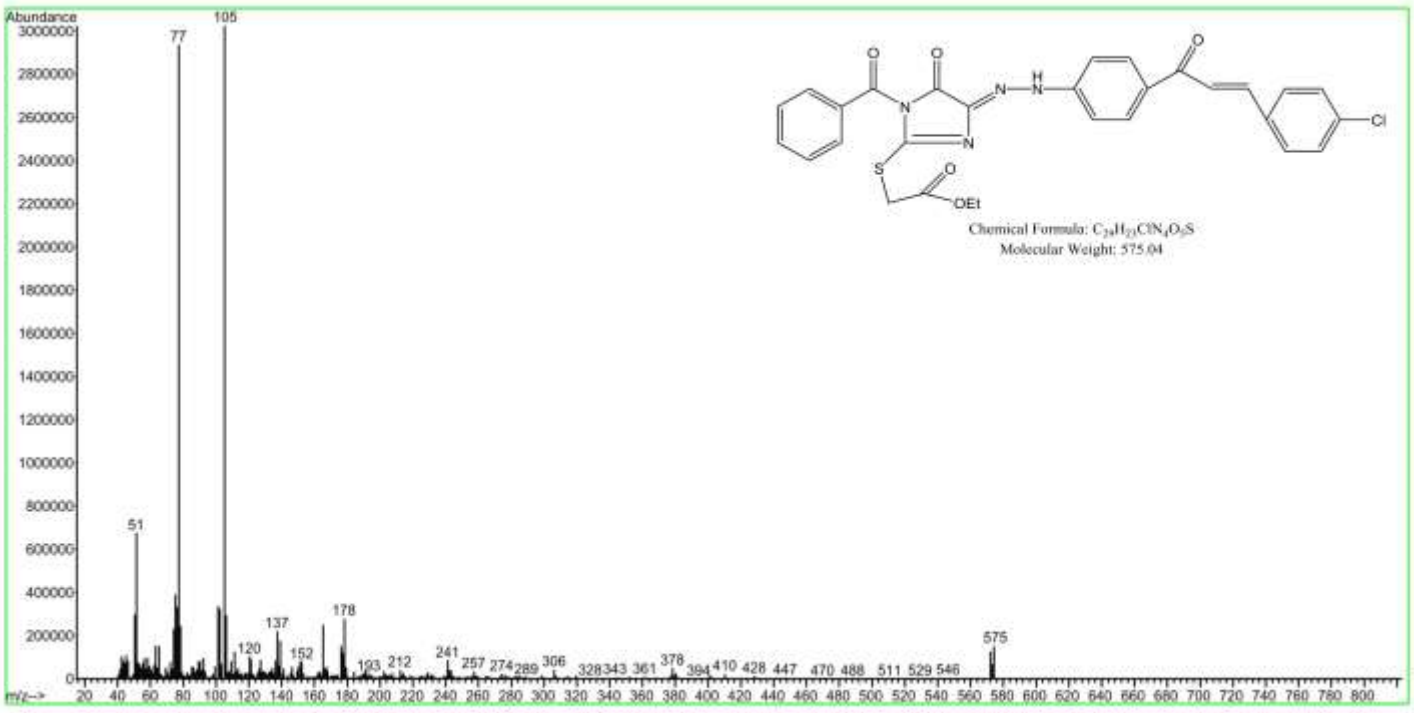
Mass Spectrum of compound(3c)



Mass Spectrum of compound(3e)



Mass Spectrum of compound(3g)



Mass Spectrum of compound(3h)

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