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Synthesis of New Oxazepine and Thaizolidine Compounds derived from Pyrimidine-2(1H)-one

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Abstract

In this paper the compounds (11-20) (methyl pyrimidine - 2(1H)-one and others phenyl pyrimidine -2(1H)- one) that had been already prepared from α, β unsaturated carbonyl compounds that are called chalcones, these compounds are usually prepared from the reaction of different aldehydes (4-methoxy benzaldehyde, 2-nitro benzaldehyde, 3-nitrobenzaldehyde, 4-N,N—dimethyle amino benzaldehyde, benzaldehyde, 4-nitro benzaldehyde) with different ketones (acetone, acetophenone, 2-nitro acetophenone, 3-nitro acetophenone) After preparing and purifying them a suitable mesurment for physical, chemical and spectroscopic properties had been made to get chalcones that reacted with urea under known chemical conditions to get the pyrimidinone compounds that we need. Pyrimidine compounds had been reacted with two aromatic amines (2,4-dinitro aniline and 4- amino acetophenone) using glacial acetic acid as catalyst in absolute ethanol giving a new compounds of schiff's bases (21-40). New thiazolidine 4-one (41-50) had been synthesized from the reacting of Schiff's bases (21-30) with thioglycolic acid in absolute ethanol. 1,3-oxazepine derivatives. (51-60) had been prepared from reaction between Schiff's bases (31-40) and malic anhydrid in absolut ethanol. The structures of the Synthesized compounds had been estimated by IR, ^{1}H- NMR and some physical data.

Keywords: pyrimidine, Schiff's bases, Thiazolidine, 1,3- oxazepine

تحضير مركبات اوكسازبين وثايازولدين جديدة مشتقة من مركبات بيريميدين-2(1H)- اون

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الخلاصة

في هذا البحث تم تحضـــير المركبات (11–20) (مثيل بريميدين–2–(1H)– أون ومركبات اخرى من فنيل بريميدين–2(1H) – أون والتي تم تحضـيرها مسـبقا من مركبات كاربونيل α و β غير المشـبعة والتي يطلق عليها اسـم الجالكونات(1–10) والتي تحضـــر من مفاعلة الديهايدات مختلفة (4– ميثوكســـي بنزالديهايد , 2– نايتروبنزالديهايد , 3– نايتروبنزالديهايد , 4– نايتروبنزالديهايد , N,N–4–ثنائي مثيل امينو بنزالديهايد , بنزالديهايد) مع كيتونات مختلفة (اســـيتون , اســـيتوفينون , 2–

نايترواسيتوفينون , 3- نايترواسيتوفينون) وبعد تحضير هذه المركبات وتنقيتها واجراء قياسات لخواصها الفيزيائية والكيميائية والطيفية التي تمكنا من اجراءها للحصول على الجالكونات والتي تم مفاعلتها مع اليوريا وحسب الظروف الكيميائية المعروفة للحصول على مركبات البيريميدنيون المطلوبة. مركبات البريميدين تم مفاعلتها مع الامينات الاروماتية (4،2- ثنائي نايتروانيلين و 4- امينو اسيتوفينون) باستخدام حامض الخليك الثلجي كحفاز بوجود الايثانول المطلق ليعطي مركبات جديدة من قواعد شيف (40-21). مركبات جديدة من ثايازولدين-4- أون (50-41) تم تحضيرها من مفاعلة قواعد شيف (30-21) مع حامض الثايوكلايكوليك في الايثانول المطلق. حضرت مشتقات 1،3- اوكسازبين (60-51) من مفاعلة قواعد شيف (40-31) مع ماليك انهيدريد في الايثانول المطلق. تم تشخيص المركبات المحضرة باستخدام طيف الاشعة تحت الحمراء وطيف الرنين النووي المغناطيسي وبعض الخواص الفيزيائية.

الكلمات المفتاحية: بيريميدين، قواعد شيف، ثايازولدين، اوكسازبين.

INTRODUCTION

Pyrimidines were used as substrates in the preparation of many schiff's bases which undergo ring closure (cyclo addition and replacement reaction) [1] to prepare thia- zolidine derivatives which have various pharmacological activities such as antibacterial [2], anti-fungal [3], anti-Cancer [4], anti con-vulsant [5] and herbicidal actions [6]. 1,3-oxazipene derivatives also Synthesized from the reaction of Schiff's bases with maleic anhydrid these compounds have been found to exhibit biological activites including anti-bacterial, antifungal [7,8], anticancer [9].

EXPERIMENTAL

All reagents and compounds are from Fluka and BDH. Melting points are measured using: Electro thermal IA 9100 melting points apparatus type (not corrected). FT-IR Spectra were recorded on BRUKER ALPHLA FTIR Germany. ^{1}H-NMR spectra were recorded by NMREADY 60 PRO. Using DMSO-d6 as a solvent in college of education and science Ibn al-haitham in Baghdad/Iraq.

Synthesis of chalcones (1-10) [10,11]

0.1 mole of benzaldehyde or one of its compensations dissolved in 10 ml of EtOH was added to 0.1 mole of acetone or acetophenone or one of its compensations that had been also dissolved in 10 ml of EtOH ,the mixture was stirred in aqueous alkali (40% NaOH) in room temprature for 5 hours. Table (1) involves physical properties as reported in the literature[12]

Synthesis of Pyrimidine-2(1H)-one (1-10) [13]:

(0.01) mole of chalcones (1-10) had been dissolved in EtOH abs. This was added to (0.01) mole of urea which dissolved in 20 ml of EtONa then reflux the mixture for 12 hours. The solvent had been concentrated and poured into ice cold water with constant stirring then it was neutralize with acid Solid produce filtered and washed with water. Table (2) involves the physical properties.

Synthesis of Schiff's Bases (21-40) [14]:

(0.01) mole of pyrimidines compounds (11-20) was added to (0.01) mole of aromatic amine (2,4-dinitro aniline , 4- amino acetophenon in abs. EtOH (25) ml with some drops of glacial acetic acid is had been stirred for 4 hours . Table (3,4) involves the physical properties.

Synthesis of Thiazolidine Derivatives (41-50) [15-17]:

(0.001) mole of Schiff's bases (21-30) in abs. EtOH (15 ml) was added to (0.001) mole of thioglycolic acid, this mixture was refluxed for 5 hours, and treated with potassium bicarbonate to produce a compound, then product filtered. Table (5) includes the physical properties.

Synthesis of 1,3- Oxazepine Derivatives (51-60)[18]:

Mixture of Schiff's bases (31-40) (0.0004) mole was added to (0.0006 mole) of maleic anhydride in (20) ml of abs. Ethanol was refluxed for 6 hours. The product was filtered and washed with water. Table (6) involves the physical properties

Table (1)The Physical Properties of Compound (1-10)

Comp. No.	R	R_1	Molecular formula	M. Wt	m.p°c	Colour	Yield %
1	4-OCH_3	CH_3	$C_{11}H_{12}O_2$	176	66-68	Yellow	89
2	4-NO_2	C_6H_5	$C_{15}H_{11}NO_3$	253	151-153	Light Brown	81
3	3-NO_2	C_6H_5	$C_{15}H_{11}NO_3$	253	129-131	Yellow	64
4	4-$N(CH_3)_2$	C_6H_5	$C_{17}H_{17}NO$	251	63-65	Orange	65
5	H	3-$NO_2C_6H_4$	$C_{15}H_{11}NO_3$	253	118-120	Brown	71
6	2-NO_2	C_6H_5	$C_{15}H_{11}NO_3$	253	131-134	Yellow	75
7	H	C_6H_5	$C_{15}H_{12}O$	208	123-126	Yellow	88
8	4-NO_2	3-$NO_2C_6H_4$	$C_{15}H_{10}N_2O_5$	294	177-179	Brown	81
9	4-NO_2	2-$NO_2C_6H_4$	$C_{15}H_{10}N_2O_5$	294	181-184	Dark Brown	73
10	H	2-$NO_2C_6H_4$	$C_{15}H_{11}NO_3$	253	84-86	Brown	63

Table (2)The Physical Properties of Compound (11-20)

Comp. No.	R	R_1	Molecular formula	M. Wt	m.p. °c	Colour	Yield %
11	4-OCH_3	CH_3	$C_{12}H_{12}N_2O_2$	216	253-255	Creamy	72
12	4-NO_2	C_6H_5	$C_{16}H_{11}N_3O_3$	293	336-339	Dark Brown	63
13	3-NO_2	C_6H_5	$C_{16}H_{11}N_3O_3$	293	297-299	Pale Brown	77
14	4-$N(CH_3)_2$	C_6H_5	$C_{18}H_{17}N_3O$	291	151-154	Pale Brown	60
15	H	3-$NO_2C_6H_4$	$C_{16}H_{11}N_3O_3$	293	263-265	Dark Brown	86
16	2-NO_2	C_6H_5	$C_{16}H_{11}N_3O_3$	293	285-288	Brown	81
17	H	C_6H_5	$C_{16}H_{12}N_2O$	248	222-225	Yellow	85
18	4-NO_2	3-$NO_2C_6H_4$	$C_{16}H_{10}N_4O_5$	338	285-289	Dark Brown	76
19	4-NO_2	2-$NO_2C_6H_4$	$C_{16}H_{10}N_4O_5$	338	315-318	Dark Brown	70
20	H	2-$NO_2C_6H_4$	$C_{16}H_{11}N_3O_3$	293	253-255	Brown	80

Table (3)The Physical Properties of Compound (21-30)

Comp. No.	R	R_1	Molecular formula	M. Wt	m.p°c	Colour	Yield %
21	4-OCH_3	CH_3	$C_{24}H_{17}N_5O_5$	329	101-104	Light green	90
22	4-NO_2	C_6H_5	$C_{20}H_{15}NO_2$	410	68-70	Brown	81
23	3-NO_2	C_6H_5	$C_{24}H_{14}N_4O_3$	410	68-71	Dark Brown	76
24	4-$N(CH_3)_2$	C_6H_5	$C_{24}H_{18}N_4O_3$	407	62-65	Brown	73
25	H	3-$NO_2C_6H_4$	$C_{26}H_{23}N_4O$	410	82-85	Dark Brown	63
26	2-NO_2	C_6H_5	$C_{24}H_{18}N_4O_3$	410	277-280	Brown	77
27	H	C_6H_5	$C_{24}H_{18}N_4O$	365	162-165	Yellow	88
28	4-NO_2	3-$NO_2C_6H_4$	$C_{24}H_{18}N_4O_3$	455	88-90	Brown	78
29	4-NO_2	2-$NO_2C_6H_4$	$C_{24}H_{18}N_4O_3$	455	95-96	Light orange	59
30	H	2-$NO_2C_6H_4$	$C_{24}H_{19}N_3O$	410	75-78	Dark Yellow	91

Table (4) The Physical Properties of Compound (31-40)

Comp. No.	R	R_1	Molecular formula	M. Wt	m.p°c	Colour	Yield %
31	4-OCH_3	CH_3	$C_{18}H_{12}N_5O_5$	378	118-120	Light Yellow	85
32	4-NO_2	C_6H_5	$C_{22}H_{14}N_6O_6$	458	272-275	Light Brown	67
33	3-NO_2	C_6H_5	$C_{22}H_{14}N_6O_6$	458	171-174	Pale Brown	65
34	4-$N(CH_3)_2$	C_6H_5	$C_{22}H_{12}N_6O_6$	456	148-151	Light green	89
35	H	3-$NO_2C_6H_4$	$C_{22}H_{14}N_6O_6$	458	168-170	Light green	63
36	2-NO_2	C_6H_5	$C_{22}H_{14}N_6O_6$	458	167-170	Dark Yellow	72
37	H	C_6H_5	$C_{22}H_{15}N_5O_4$	413	169-172	Yellow	82
38	4-NO_2	3-$NO_2C_6H_4$	$C_{22}H_{13}N_7O_8$	503	206-209	Dark Brown	75
39	4-NO_2	2-$NO_2C_6H_4$	$C_{22}H_{13}N_7O_8$	503	217-220	Dark Brown	81
40	H	2-$NO_2C_6H_4$	$C_{22}H_{14}N_6O_6$	458	159-161	Brown	66

Table (5) The Physical Properties of Compound (41-50)

Comp. No.	R	R_1	Molecular formula	M. Wt	mp°c	Colour	Yield %
41	4-OCH_3	CH_3	$C_{22}H_{17}N_3O_3S$	403	180-183	Creamy	79
42	4-NO_2	C_6H_5	$C_{26}H_{20}N_4O_4S$	484	284-286	Light Brown	81
43	3-NO_2	C_6H_5	$C_{26}H_{20}N_4O_4S$	484	275-278	Brown	78
44	4-$N(CH_3)_2$	C_6H_5	$C_{28}H_{25}N_4O_2S$	481	273-275	Yellow	85
45	H	3-$NO_2C_6H_4$	$C_{26}H_{20}N_4O_4S$	484	103-105	Light green	81
46	2-NO_2	C_6H_5	$C_{26}H_{20}N_4O_4S$	484	245-248	Dark Brown	80
47	H	C_6H_5	$C_{26}H_{21}N_3O_2S$	439	76-78	Yellow	88
48	4-NO_2	3-$NO_2C_6H_4$	$C_{26}H_{20}N_4O_4S$	484	88-90	Brown	66
49	4-NO_2	2-$NO_2C_6H_4$	$C_{26}H_{20}N_4O_4S$	529	76-78	Yellow	91
50	H	2-$NO_2C_6H_4$	$C_{26}H_{20}N_4O_4S$	484	95-98	Dark Brown	73

Table (6) The Physical Properties of Compound (51-60)

Comp. No.	R	R_1	Molecular formula	M. Wt	mp°c	Colour	Yield %
51	4-OCH_3	CH_3	$C_{20}H_{17}N_5O_8$	483	95-98	Light Yellow	65
52	4-NO_2	C_6H_5	$C_{24}H_{16}N_6O_9$	532	111-114	Brown	55
53	3-NO_2	C_6H_5	$C_{24}H_{16}N_6O_9$	532	333-335	Pale Brown	71
54	4-$N(CH_3)_2$	C_6H_5	$C_{26}H_{22}N_6O_7$	530	85-87	Red	83
55	H	3-$NO_2C_6H_4$	$C_{24}H_{16}N_6O_9$	532	148-151	Light green	67
56	2-NO_2	C_6H_5	$C_{24}H_{16}N_6O_9$	532	327-330	Dark Brown	74
57	H	C_6H_5	$C_{24}H_{17}N_5O_7$	487	226-229	Yellow	81
58	4-NO_2	3-$NO_2C_6H_4$	$C_{24}H_{15}N_5O_{11}$	577	267-269	Brown	85
59	4-NO_2	2-$NO_2C_6H_4$	$C_{24}H_{15}N_5O_{11}$	577	287-290	Dark Brown	87
60	H	2-$NO_2C_6H_4$	$C_{24}H_{16}N_6O_9$	532	181-184	Light Brown	77

RESULTS AND DISCUSSIONS

New schiff's bases were synthesized by reactions of pyrimidines compounds with different aromatic amine in abs. EtOH with some drops of glacial acetic acid. The FTIR spectra of Schiff's bases compounds (21-40) showed the absence of peak of carbonyl but a new peak was appeared at (1588-1656)cm^{-1} which is attributed to a new (C=N) group as in [19]. Table (7,8) showed some spectral data. Figure (1), (3) showed IR spectrum for compounds (29, 35).

Thiazolidine compounds were prepared from the reaction of Schiff's bases (21-30) with thioglycolic acid in abs. EtOH. FTIR spectrum showed new peak appeared at (669-776) which is attributed to a new (C-S) group and another peak appeared at (1555-1643) cm^{-1} is attributed to (C=N) group as in [20], Table (9) referred to some spectral data. Figure (5), showed IR spectrum for compound (49). 1,3- Oxazepine compound prepared from the reaction of Schiff's bases (31-40) with maleic anhydride in abs. EtOH. FT-IR spectrum showed a new peak at (1684-1711) cm^{-1} that is attributed to (O-C) Lactane and another peak appeared at (1620_1654) cm^{-1} attributed to (N - C=O) Lactame. Table (9) showed some spectral data [18]. Figure (7) showed IR spectrum for compound (54).

The ^{1}H-NMR spectrum showed these bands:

Compound (31); ^{1}H-NMR (DMSO, 60MHz): δ = 7.18 - 8.77(m, 7H, Ar-H), 7.02 (s,C=C-H,1H), 5.39 (b, N-H,1H),1.59(s,O-CH_3), 1.1 (s ,-CH_3, 3H). [19].

Figure (2) showed NMR spectrum of compound (31).

Compound (29): ^{1}H-NMR (DMSO,60MHz): δ= 6.43-7.68 (dd, Ar-H), 5.94 (m,5H,Ar-H), 2.4 (b,1H, N-H).

Figure (2) showed NMR spectrum of compound (29).

Compound (49):^{1}H-NMR (DMSO,60MHz): δ= 6.43-7.68 (dd,8H,Ar-H), 5.95 (m,5H,Ar-H,C=C-H), 2.83 (b,^{1}H,N-H), 2.4-2.67(b,5H,CH_3,CH_2),[20].

Figure (6) showed NMR spectrum of compound (49).

Compound (54):^{1}HNMR (DMSO,60MHz): δ= 6.99-8.77(m,12H, Ar-H), 6.14-6.30 (d,3H,C=C-H), 3.01(s,1H, N-H), 1.16(s,3H,CH_3),

Figure (8) showed NMR spectrum of compound (54).

Table (7) Some Spectral Data of Compounds (21-30)

Comp. No	R	R_1	N-H	C-H Ar	C-H Alph.	C=O	C=N	Others
21	4-OCH_3	CH_3	3387	3097	2851	1700	1638	1551 C=C 1170 C-O-C Asy 1021 C-O-C Sym
22	4-NO_2	C_6H_5	3320	3115	2905	1684	1642	1542 NO_2Asy 1351 NO_2Sym 1580 C=C
23	3-NO_2	C_6H_5	3352	3052	2928	1710	1655	1485 NO_2Asy 1351 NO_2Asy 1588 C=C
24	4-$N(CH_3)_2$	C_6H_5	3216	3033	2917	1675	1588	1520 C=C
25	H	3-$NO_2C_6H_4$	3218	3081	2908	1685	1639	1553 NO_2Asy 1356 NO_2Sym 1578 C=C
26	2-NO_2	C_6H_5	3219	3058	2968	1730	1655	1588 C=C 1526 NO_2Asy 1345 NO_2Sym
27	H	C_6H_5	3353	3105	2999	1725	1656	1599 C=C
28	4-NO_2	3-$NO_2C_6H_4$	3343	3110	2942	1686	1637	1578 C=C 1524 NO_2Asy 1404 NO_2Sym
29	4-NO_2	2-$NO_2C_6H_4$	3214	3018	2854	1718	1640	1551 C=C 1510 NO_2Asy 1354 NO_2Sym
30	H	2-$NO_2C_6H_4$	3363	3031	2922	1686	1642	1588 C=C 1524 NO_2Asy 1406 NO_2Sym

Table (8) Some Spectral Data of Compounds (31-40)

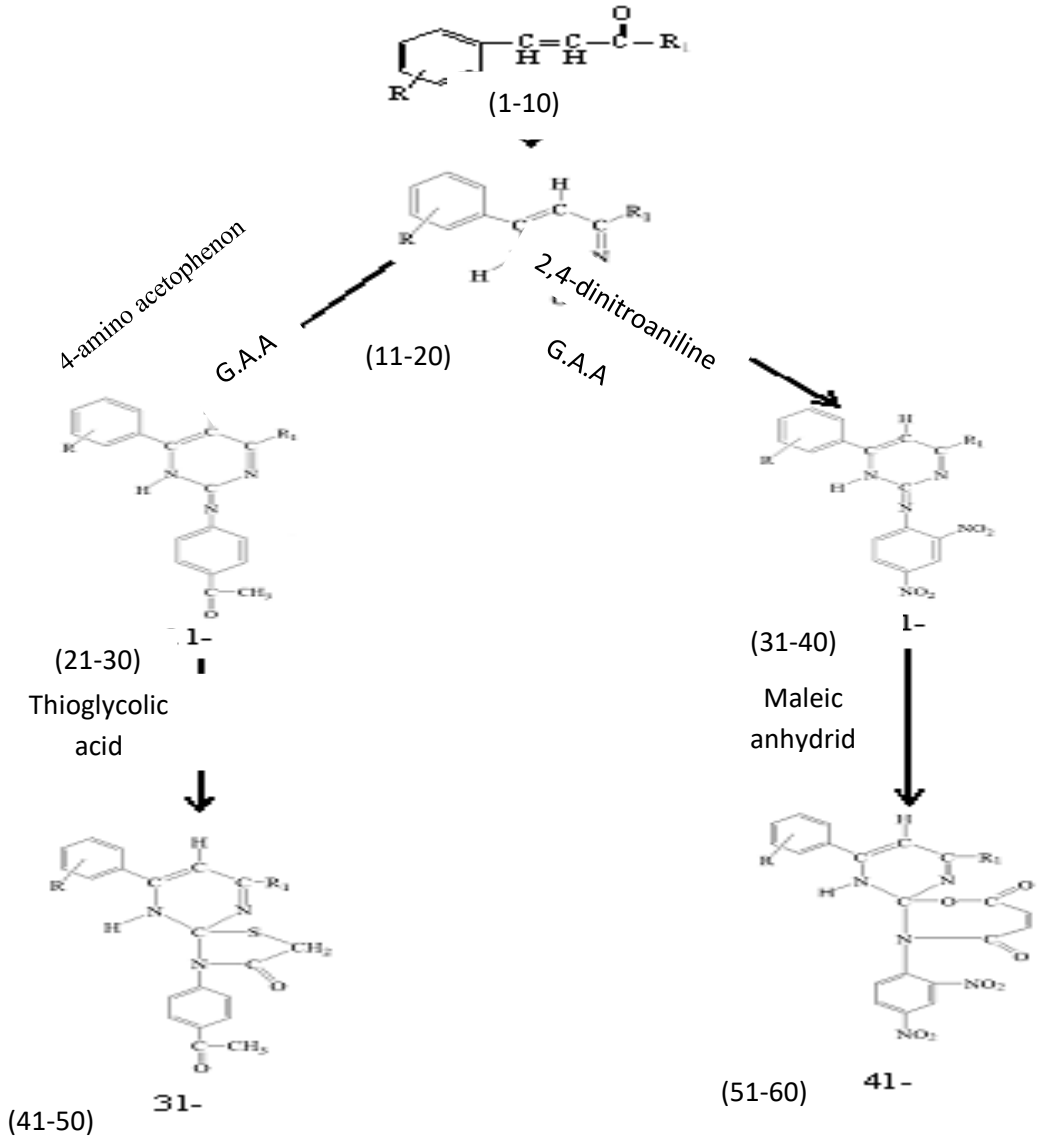
Comp. No.	R	R_1	N-H	C-H Ar	C-H alph.	C=N	Others
31	4-OCH_3	CH_3	3329	3158	2985	1630	1403 COC Asy 1251 C-O-C Sym 1550 NO_2Asy 1333 NO_2Sym
32	4-NO_2	C_6H_5	3353	3090	2850	1640	1526 NO_2Asy 1326 NO_2Sym
33	3-NO_2	C_6H_5	3325	3099	2845	1620	1504 NO_2Asy 1326 NO_2Sym
34	4-$N(CH_3)_2$	C_6H_5	3326	3096	2902	1592	1504 NO_2Asy 1379 NO_2Sym
35	H	3-$NO_2C_6H_4$	3324	3099	2935	1618	1490 NO_2Asy 1325 NO_2Sym
36	2-NO_2	C_6H_5	3326	3125	2850	1605	1556 NO_2Asy 1328 NO_2Sym
37	H	C_6H_5	3175	3072	2833	1623	1507 NO_2Asy 1330 NO_2Sym
38	4-NO_2	3-$NO_2C_6H_4$	3331	3166	2878	1627	1555 NO_2Asy 1328 NO_2Sym
39	4-NO_2	2-$NO_2C_6H_4$	3326	3024	2940	1633	1552 NO_2Asy 1326 NO_2Sym
40	H	2-$NO_2C_6H_4$	3326	3043	2953	1621	1504 NO_2Asy 1324 NO_2Sym

Table (9) Some Spectral Data of Compounds (41- 50)

Comp. No	R	R_1	N-H	C-H Ar	C-H Alph.	C=O	C=N	C=C	C=S	Others
41	4-OCH_3	CH_3	3200	3030	2850	1684	1578	1460	673	1109 cocAsy 1027coc Sym
42	4-NO_2	C_6H_5	3268	3015	2919	1640	1574	1490	676	1498 NO_2Asy 1340 NO_2Sym
43	3-NO_2	C_6H_5	3383	3075	2980	1655	1595	1479	665	1488 NO_2Asy 1354 NO_2Sym
44	4-$N(CH_3)_2$	C_6H_5	3216	3091	2981	1684	1573	1488	673	----------
45	H	3-$NO_2C_6H_4$	3215	3129	2910	1702	1555	1468	686	1504 NO_2Asy 1378 NO_2Sym
46	2-NO_2	C_6H_5	3442	3109	2920	1685	1576	1458	776	1374 NO_2Sym 1203 NO_2Sym
47	H	C_6H_5	3374	3051	2950	1700	1610	1578	669	----------
48	4-NO_2	3-$NO_2C_6H_4$	3264	3119	2870	1675	1633	1569	672	1389 NO_2Sym 1212 NO_2Sym
49	4-NO_2	2-$NO_2C_6H_4$	3319	3080	2830	1695	1641	1578	669	1425 NO_2Sym 1357 NO_2Sym
50	H	2-$NO_2C_6H_4$	3374	3120	2920	1685	1643	1569	672	1389 NO_2Sym 1222 NO_2Sym

Table (10) Some Spectral Data of Compounds (41-50)

Comp. No.	R	R_1	N-H	C-H Ar	C-H Alph.	$-\overset{O}{\overset{\|}{C}}-$ Lacton	$-\overset{O}{\overset{\|}{C}}-$ Lactam	C=N	Others
51	4-OCH_3	CH_3	3328	3055	2930	1703	1621	1579	1501 NO_2Asy 1327 NO_2Sym 1418 C=C Ar 1170 C-O-C Asy 1064 C-O-C Sym
52	4-NO_2	C_6H_5	3285	3045	2855	1695	1630	1559	1504 NO_2Asy 1328 NO_2Sym 1416 C=C Ar
53	3-NO_2	C_6H_5	3351	3061	2830	1695	1644	1605	1509 NO_2Asy 1324 NO_2Sym 1416 C=C Ar
54	4-$N(CH_3)_2$	C_6H_5	3326	3021	2918	1711	1620	1576	1506 NO_2Asy 1325 NO_2Sym 1427 C=C Ar
55	H	3-$NO_2C_6H_4$	3327	3103	2930	1712	1620	1578	1501 NO_2Asy 1325 NO_2Sym 1422 C=C Ar
56	2-NO_2	C_6H_5	3251	3056	2969	1708	1654	1587	1525 NO_2Asy 1345 NO_2Sym 1457 C=C Ar
57	H	C_6H_5	3316	3174	2908	1700	1653	1570	1507 NO_2Asy 1301 NO_2Sym 1457 C=C AR
58	4-NO_2	3-$NO_2C_6H_4$	3354	3080	2968	1684	1635	1552	1524 NO_2Asy 1388 NO_2Sym 1461 C=C Ar
59	4-NO_2	2-$NO_2C_6H_4$	3293	3085	2918	1690	1640	1553	1510 NO_2Asy 1377 NO_2Sym 1459 C=C Ar
60	H	2-$NO_2C_6H_4$	3281	3078	2855	1688	1651	1563	1501 NO_2Asy 1328 NO_2Sym 1458 C=C Ar



R= 4-OCH_2, 4-NO_2, 4-$N(CH_3)_2$, 2-NO_2, H

R1= CH_3, 3-$NO_2C_6H_5$, 2-$NO_2C_6H_5$

Scheme (1) illustrates the prepared compounds (1-60)

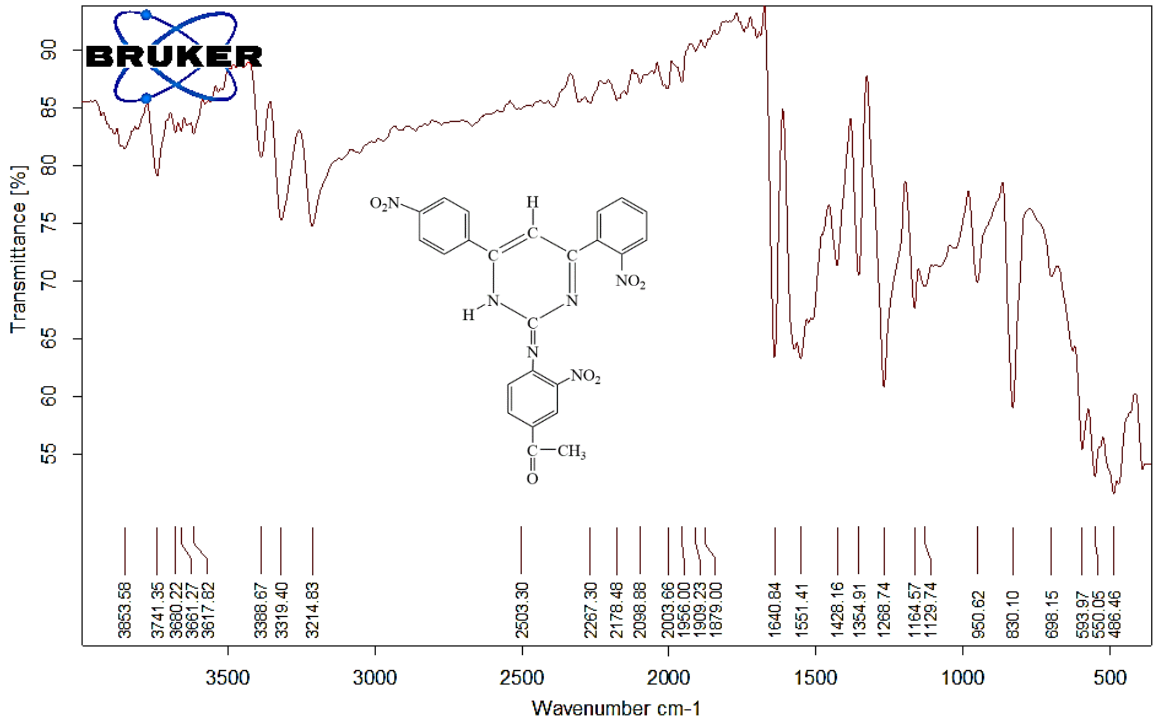


Fig (1): IR spectrum of the compound (29)

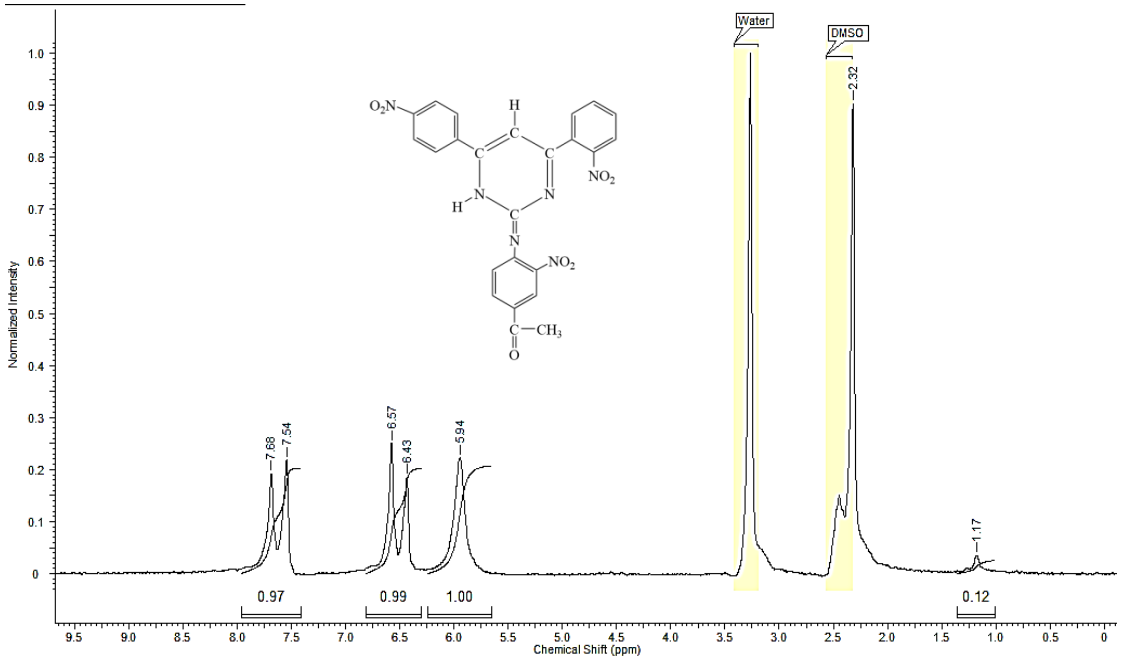


Fig (2): NMR spectrum of the compound (29)

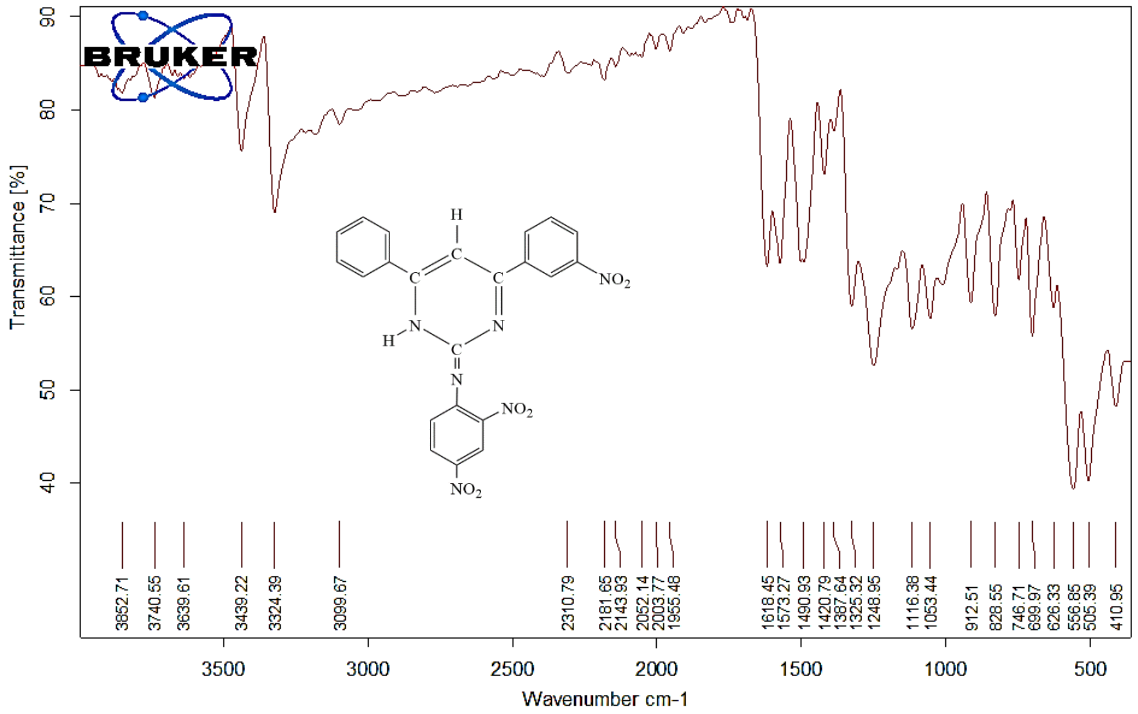


Fig (4): IR spectrum of the compound (35)

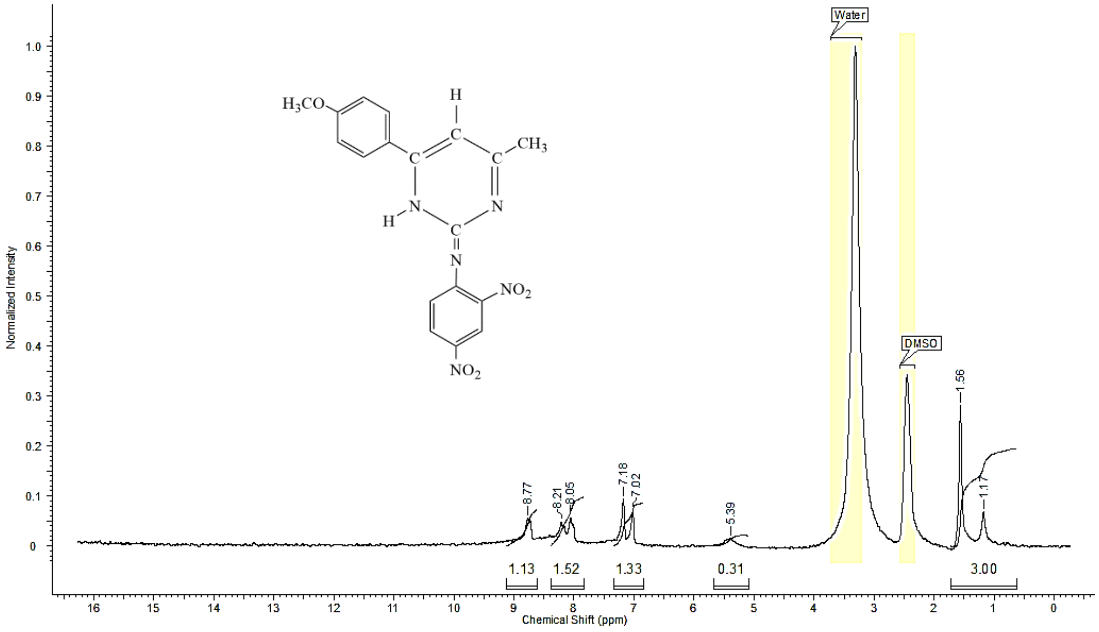


Fig (4): NMR spectrum of the compound (31)

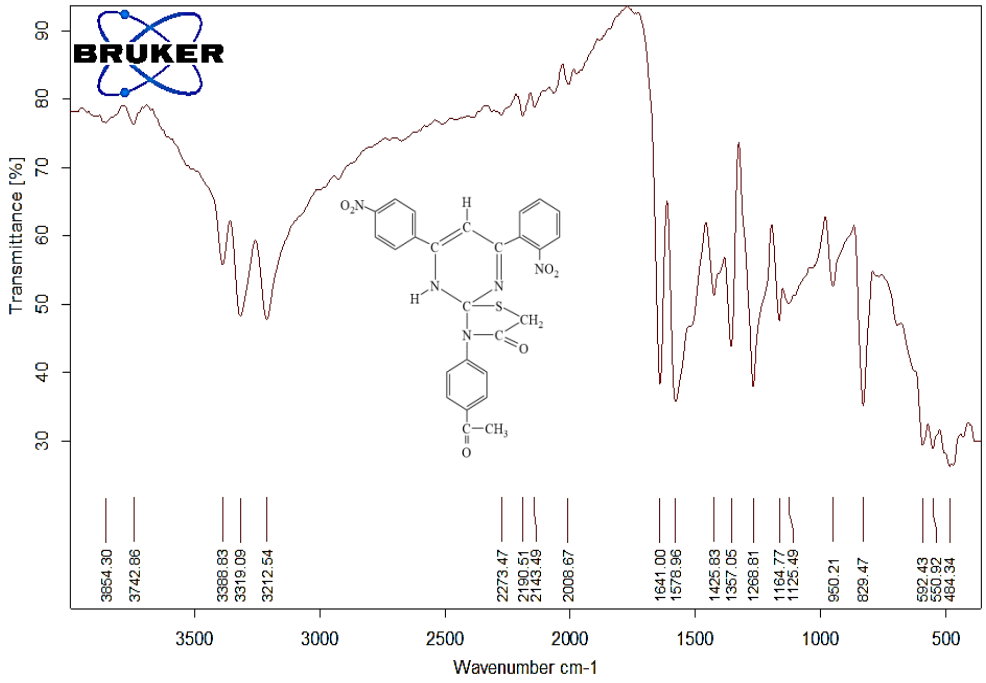


Fig (5): IR spectrum of the compound (49)

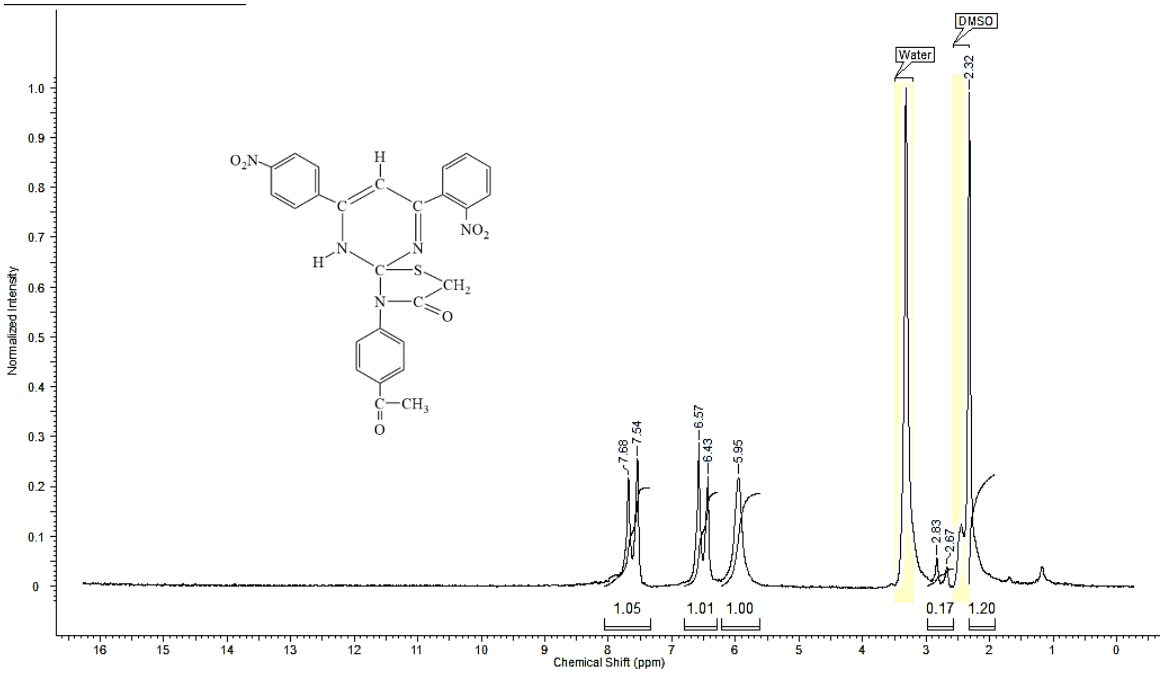


Fig (6): NMR spectrum of the compound (49)

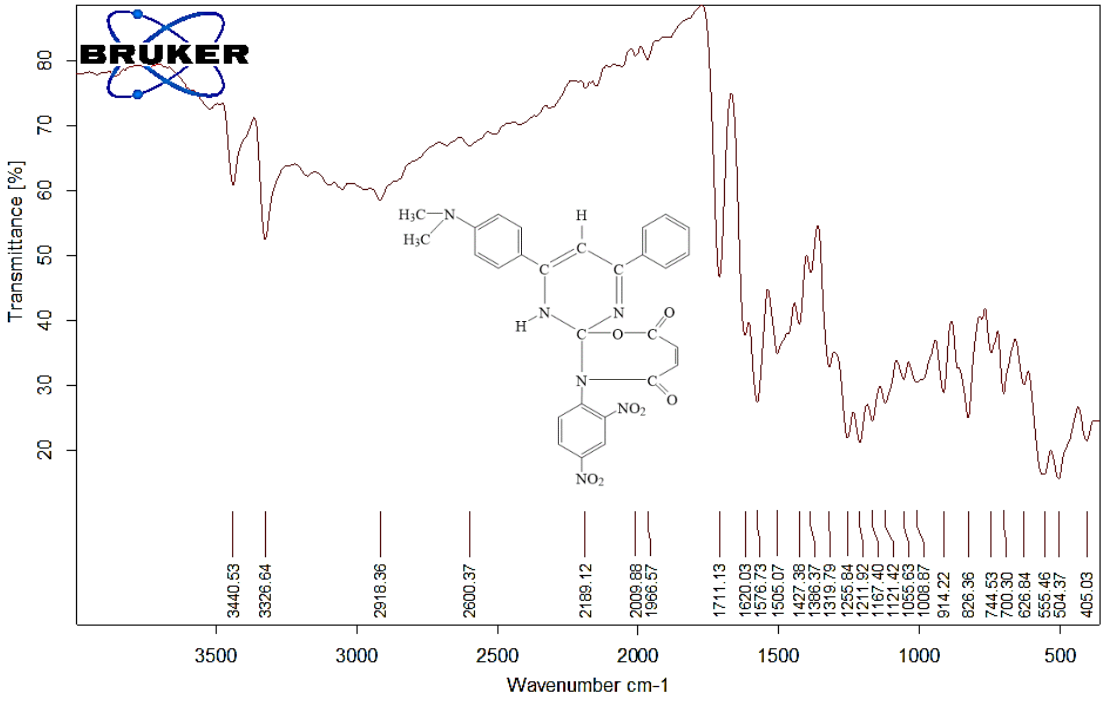


Fig (7): IR spectrum of the compound (54)

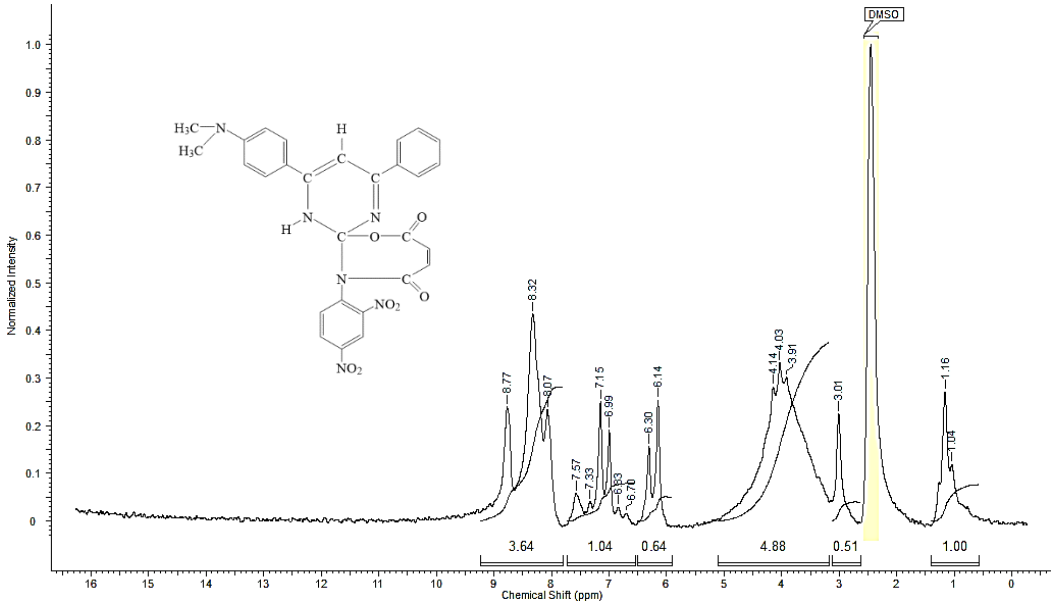


Fig (8): NMR spectrum of the compound (54)

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