



## UTILITY OF DIKETONE IN HETEROCYCLIC SYNTHESIS: SYNTHESIS OF NEW SUBSTITUTED PYRIMIDINES AND FUSED PYRIMIDINE OF POTENTIAL BIOSIGNIFICANT INTEREST

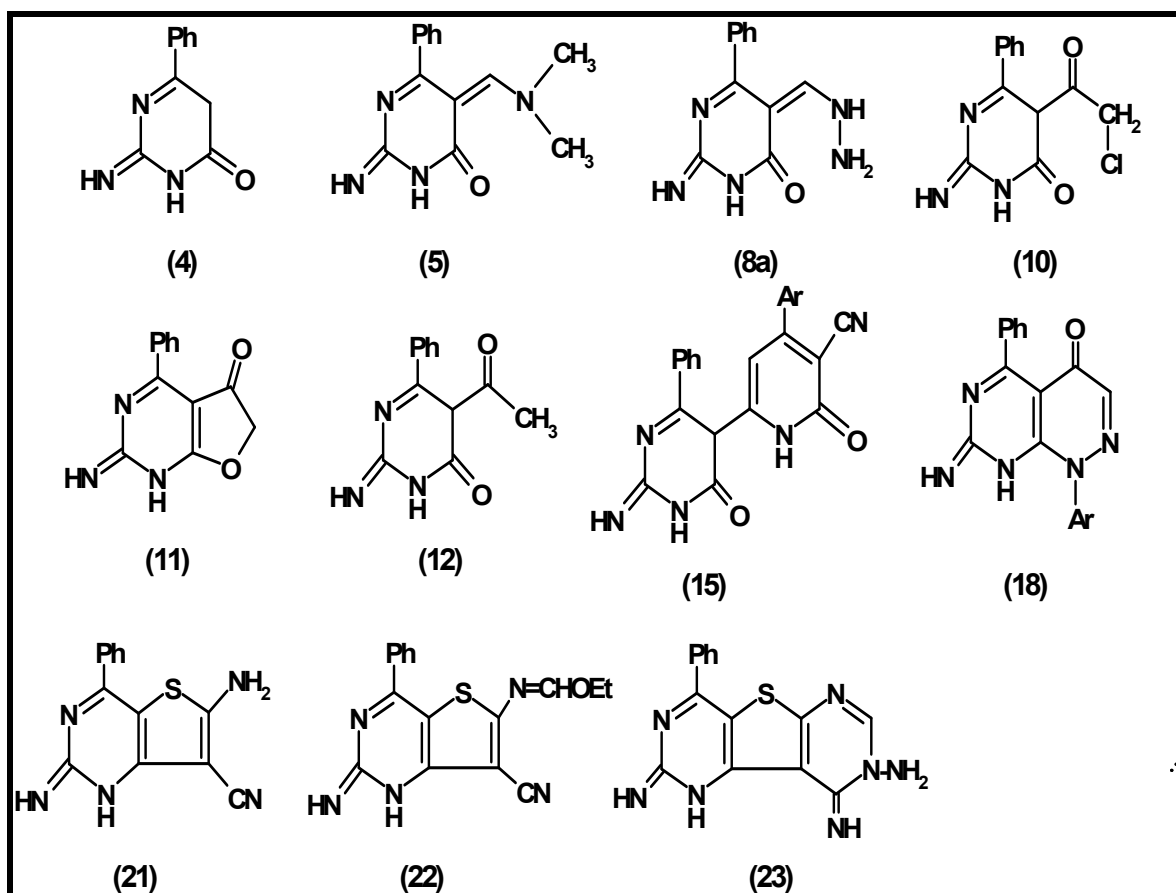
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### ABSTRACT

Many heterocyclic compounds were prepared from the reaction of 2-imino-6-phenyl-2,3-dihydropyrimidin-4(5H)-one 4 with some bifunctional nucleophiles and electrophiles reagents under mild conditions. The structure of the synthesized compounds were established *via* their elemental and spectral analysis. Some of the products were also screened *in vitro* for their biological activity.

**Key words:** Iminopyrimidine, pyrazolopyrimidin, dihydropyrimidin, dihydropyridine carbonitrile, pyrimidin-6-ylformimidate.



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## INTRODUCTION

Azoles and azines have displayed a broad spectrum of biological effects. Pyrimidine and its derivatives attracted considerable attention as they are present in some biologically active heterocycles and many examples of biological activities found for small molecules based on pyrimidine moiety can be referred. Most importantly, they are of great importance in fundamental metabolism for uracil, thiamine and cytosine, that are three bases found in the nucleotide and hence pyrimidine bases play significant role in vital biochemical processes for humans and animals<sup>[1,2]</sup>. The biological activity of some isolated alkaloids has been attributed to the presence of the dihydropyrimidinone moiety in the molecules<sup>[3,4]</sup> and the conformation of the pyrimidine ring<sup>[3,5,6]</sup>. Other derivatives of dihydropyrimidine have interesting biological properties such as antimicrobial<sup>[7]</sup>, antiviral<sup>[8]</sup> and anticancer<sup>[9]</sup>, activities and moreover were found to be useful in the treatment of benign prostatic hyperplasia<sup>[10]</sup>. More recently, these partly reduced pyrimidine derivatives have emerged as anti-inflammatory agents<sup>[11]</sup>. Very recently, S-alkylpyrimidines possessing antifungal and antibacterial activities have been also reported in the literature<sup>[12]</sup>.

## RESULTS AND DISCUSSION

The key intermediate 2-imino-6-phenyl-2,3-dihydropyrimidin-4(5H)-one **4** was prepared in good yield from the reaction of ethyl benzoyl acetate **1** with guanidine hydrochloride in refluxing ethanol in the presence of catalytic amount of piperidine *via* intermediacy of acyclic intermediates **2** and **3**. The structure of the latter product **4** was established on the basis of its elemental analysis and spectral data. Thus, the infrared spectrum of compound **4** revealed absorption bands at 3420, 3400, 3029, 2920, 1678  $\text{cm}^{-1}$  for amino, aromatic,

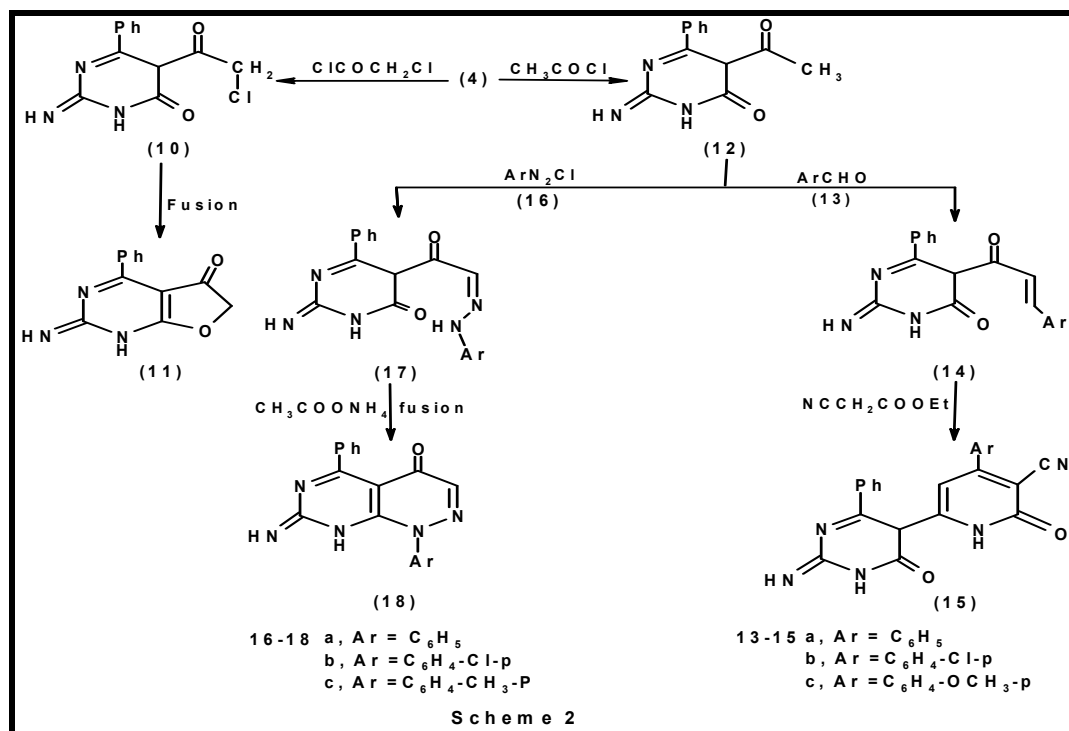
aliphatic and carbonyl function groups, respectively. <sup>1</sup>H-NMR spectrum of compound **4** showed the following signals at  $\delta$  4.19(s, 2H, CH<sub>2</sub>), 6.10-7.95 (m, 6H, aromatic H and NH), 10.83 (s, 1H, NH); Also, its mass spectrum showed a molecular ion peak at  $m/z$  187 (M<sup>+</sup>).

The active methylene group in compound **4** was exploited to synthesize novel heterocyclic compounds by reaction with some electrophilic and nucleophilic reagents. Thus, condensation of **4** with dimethylformamide-dimethylacetal (DMF-DMA) in dioxane afforded the pyrimidine derivative **5** in a quantitative yield as demonstrated in (scheme 1) [14JCSP36]. Treatment of pyrimidine derivative **5** with hydrazine hydrate and phenyl hydrazine in refluxing ethanol afforded the acyclic hydrazide derivatives **8a,b**. Structures **8a,b** were confirmed by its correct elemental analyses and spectral data. For example, the <sup>1</sup>HNMR of **8a** revealed the presence of singlet signal at  $\delta$  = 5.89 ppm corresponding to the olefinic protons and singlet signal at  $\delta$  = 6.10 ppm corresponding to NH<sub>2</sub> and a multiplet signal at  $\delta$  = 6.62-8.28 ppm corresponding to aromatic protons and the amino protons appeared as a hump signal at 10.88-10.90 ppm. Trials to prepare the fused compound **9** were failed under a variety of mild conditions (Scheme 1).

The behavior of iminopyrimidine **4** toward acetyl chloride and its derivatives aiming at exploring its synthetic potentiality toward preparation of new fused pyrimidine derivatives was also investigated.

Thus, when imino pyrimidine **4** is allowed to react with chloroacetylchloride in dry toluene afforded 5-(2-chloroacetyl)-2-imino-6-phenyl-2,3-dihydropyrimidin-4(5H)-one **10**. The structure of the newly synthesized compound was confirmed by IR, <sup>1</sup>HNMR, and mass spectra. Compound **10** underwent an intramolecular





The  $^1\text{H-NMR}$  spectrum of compound 8a recorded in DMSO- $d_6$  revealed a signal at  $\delta = 10.85$  ppm which could be attributed to hydrazone NH group.

Similarly, iminopyrimidine 12 coupled readily with aryl diazonium salts 16b-c in the same reaction conditions to give 17b-c as demonstrated in (scheme 2). Compounds 17a-c could be cyclized to the corresponding dihydropyridazino[3,4-d]pyrimidine 18a-c upon fusion of aryl hydrazones 17a-c in the presence of ammonium acetate (scheme 2).

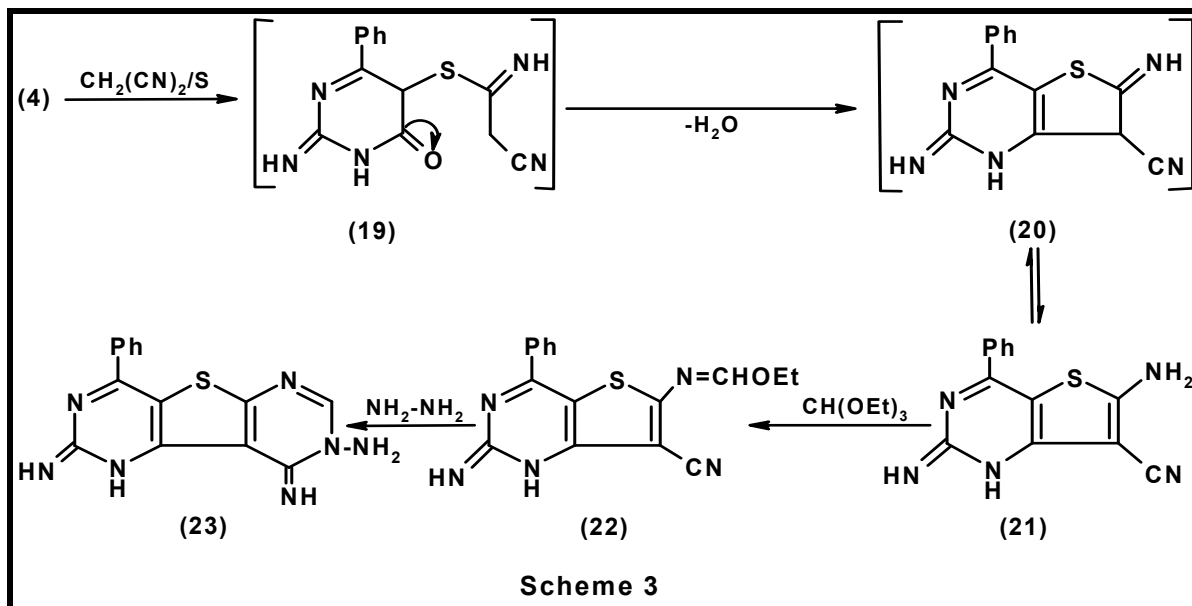
In addition to this, the behaviour of 2-imino-6-phenyl-2,3-dihydropyrimidin-4(5H)-one 4 toward active methylene reagent and elemental sulfur was also investigated. Thus, compound 4 reacted with a mixture of malononitrile and elemental sulfur to afford the dihydrothieno[3,2-d]pyrimidine-7-carbonitrile 21.

Assignment of structure 21 for the reaction product was based on its compatible spectroscopic data. Thus, its IR

spectrum showed absorption band at 3330, 3200  $\text{cm}^{-1}$  for (NH $_2$ /NH), and 2212  $\text{cm}^{-1}$  for (CN) group.  $^1\text{H-NMR}$  in (DMSO- $d_6$ ) revealed the following signals at  $\delta = 6.13$  (s, 2H, NH $_2$ ), 6.47-7.99 (m, 5H, aromatic H), 11.65 (s, 1H, NH), 11.98 (s, 1H, NH).

The mass spectrum of the same compound revealed a molecular ion peak at 267 ( $M^+$ ) and a number of fragments which agree with the proposed structure. Refluxing of compound 21 with triethylorthoformate in the presence of acetic anhydride yielded the ethoxymethylene amino derivatives 22. The IR spectrum of 22 showed bands at 3341, 3211 (2NH), 2936-2860 (CH-aliph) and 2216 (CN)  $\text{cm}^{-1}$ .  $^1\text{H-NMR}$  spectrum in (DMSO- $d_6$ ) revealed the following signals at  $\delta = 1.29$  (t, 3H, CH $_3$ ), 4.28 (q, 2H, CH $_2$ ), 6.10 (s, 1H, =CH), 6.60-8.24 (m, 6H, aromatic H and NH), 10.81 (s, 1H, NH).

Attempts cyclization of 22 using hydrazine hydrate aiming at preparation of a series of fused pyrimidine succided and afforded the 4,6-diimino-8-phenyl-5,6-dihydro-4H-9-thia-1,3,5,7-tetraaza-fluoren-3-ylamine 23 in a quantitative yield.



## Experimental

### Instrumentation

Melting points were determined using a Büchi apparatus and are uncorrected. The purity of compound was confirmed by TLC using Merck silica gel 60F<sub>254</sub> plates using toluene, ethyl acetate and methanol as a mobile phase and spots were visualized under UV radiation. IR spectra (KBr) were recorded on a Bruker-Vector 22 instrument (Bruker) and frequencies are expressed in  $\text{cm}^{-1}$ .  $^1\text{H}$  NMR spectra were recorded in DMSO-*d*<sub>6</sub> on a Varian Gemini spectrometer at (400,300 MHz and 200 MHz) with TMS as the internal reference.

Chemical shifts were reported on a ppm scale ( $\delta$ ) relative to TMS as a standard. EI-mass spectra were recorded with a HP D5988 A 1000 MHz instrument (Hewlett-Packard). Elemental analyses were performed at the Microanalytical Centre at the Faculty of Science and Microanalytical unit, faculty of pharmacy, Cairo University, Egypt.

### Preparation of 2-imino-6-phenyl-2,3-dihydropyrimidin-4(5H)-one(4)

A mixture of guanidine hydrochloride (0,01mol) and ethyl benzoylacetate

(0,01mol) in ethanol (30 ml) containing catalytic amount of piperidine was heated under reflux for 16 hrs. The solid product formed was filtered off, washed with benzene and crystallized from benzene to give (1;85%) as white crystals, m.p.292-294 °C. IR (KBr)  $\nu \text{ cm}^{-1}$ = 3420,3400 (2NH), 3029 (CH-arom), 2920 (CH-aliph), 1678 (C=O)  $\text{cm}^{-1}$ ;  $^1\text{H}$ -NMR (DMSO-*d*<sub>6</sub>)  $\delta$ = 4,19(s, 2H, CH<sub>2</sub>), 6,10-7,95 (m, 6H, aromatic H and NH),10,83 (s, 1H, NH); MS:  $m/z$  (%) 187 ( $\text{M}^+$ ).

### Preparation of 5-((dimethylamino)methylene) -2 - imino -6 - phenyl- 2, 3-dihydropyrimidin -4 (5H) -one (5)

A mixture of 4 (0.01 mol) and DMF-DMA (0.01 mol) in dioxane (30 ml) was heated under reflux for 6 hr. The reaction mixture was allowed to cool. The separated solid was filtered off, washed with ethanol and crystallized from dioxane to give (2;66%) as white crystals, m.p. 270-272°C; IR (KBr)  $\nu \text{ cm}^{-1}$ = 3306,3188 (2NH), 3064 (CH-arom), 2930 (CH-aliph), 1680 (C=O)  $\text{cm}^{-1}$ ;  $^1\text{H}$ -NMR (DMSO-*d*<sub>6</sub>)  $\delta$ = 3.33 (s, 6H, 2CH<sub>3</sub>), 6.09 (s, 1H, CH-oliffinic), 6.62-7.95 (m, 6H, aromatic H and NH), 10.86 (hump, 1H, NH ); MS=  $m/z$  (%) 242 ( $\text{M}^+$ ).

**Preparation of 5-(hydrazinylmethylene)-2-imino-6-phenyl-2,3-dihydropyrimidin-4(5H)-one(8a-b)**

A mixture of 5 (0.01 mol), hydrazine hydrate and phenyl hydrazine (0.01 mol) in ethanol (30 ml) was heated under reflux for 24 hr. The reaction mixture was allowed to cool and poured into crushed ice then acidified with HCl. The separated solid was filtered off and crystallized from the proper solvent to give (8a-b). 8a formed as brown crystals from dioxan; yield (68%); m.p.260-262°C; IR (KBr)  $\nu$   $\text{cm}^{-1}$ =3400,3347 (NH<sub>2</sub>/NH), 3078 (CH-arom), 1654 (C=O)  $\text{cm}^{-1}$ ; <sup>1</sup>H-NMR (DMSO-*d*<sub>6</sub>)  $\delta$ = 5,89(s, 1H, CH-oliffinic), 6.10(s, 2H, NH<sub>2</sub>), 6.62-8.28 (m, 6H, Ar-H and NH), 10.88-10.90 (hump, 2H, 2NH); MS= *m/z* (%) 229 (M<sup>+</sup>).

**Preparation of 5-(2-chloroacetyl)-2-imino-6-phenyl-2,3-dihydropyrimidin-4(5H)-one (10)**

A mixture of 4 (0.01 mol) and chloroacetylchloride (0.01 mol) in dry toluene (30 ml) at 0-5°C. The reaction mixture was stirred for 4hr. at room temperature and reflux for 6hr. The solid obtained was washed with petroleum ether (40-60)°C. The solid obtained was crystallized from dioxane to give (10; 80%) as yellow crystals; m.p.280-282 °C; IR (KBr)  $\nu$   $\text{cm}^{-1}$ = 3357 (NH), 3067 (CH-arom), 2927 (CH-aliph), 1700 , 1651 (2C=O) $\text{cm}^{-1}$ ; <sup>1</sup>H-NMR (DMSO-*d*<sub>6</sub>)  $\delta$ = 2.73 (s, 1H, CH-Pyrimidine), 4.27 (s, 2H, CH<sub>2</sub>), 6.12-8.01 (m, 5H, aromatic H), 11.70-12.15 (hump, 2H, 2NH); MS: *m/z* (%) 265 (M<sup>+</sup>).

**Preparation of 2-imino-4-phenyl-1,2-dihydrofuro[2,3-d]pyrimidin-5(6H)-one (11)**

Compound 10 (0.5g) in dry toluene (20 ml) was fused for 8hr. at 290°C. The separated solid was filtered off and crystallized from dioxane to give (11; 75%) as yellow crystals; m.p.270-272°C. IR (KBr)  $\nu$   $\text{cm}^{-1}$ = 3448, 3400 (2NH), 3058 (CH-arom), 2966 (CH-aliph), 1650 (C=O)  $\text{cm}^{-1}$ ; <sup>1</sup>H-NMR (DMSO-*d*<sub>6</sub>)  $\delta$ = 4.47 (s, 2H, CH<sub>2</sub>), 7.48-7.93 (m, 5H, aromatic H), 11.85

(hump, 1H, NH); 12.00 (hump, 1H, NH); MS= *m/z* (%) 227 (M<sup>+</sup>).

**Preparation of 5-acetyl-2-imino-6-phenyl-2,3-dihydropyrimidin-4(5H)-one(12)**

Compound 4 (0.01mol) and acetyl chloride (0,01mol) in acetic anhydride (10 ml) and sodium acetate (2gm) was heated under reflux for 9 hr. The reaction mixture was allowed to cool and poured into crushed ice then acidified with HCl. The separated solid was filtered off, washed with water and crystallized from dioxane to give (12; 75%) as white crystals, m.p.270-272°C. IR (KBr)  $\nu$   $\text{cm}^{-1}$ = 3350 , 3166 (2NH), 3076 (CH-arom), 2922 (CH-aliph), 1683, 1652 (2C=O)  $\text{cm}^{-1}$ ; <sup>1</sup>H-NMR (DMSO-*d*<sub>6</sub>)  $\delta$ = 2.20 (s, 3H, CH<sub>3</sub>), 3.40 (hump, 1H, CH-pyrimidine), 6.26 (s , 1H , NH), 7.49-7.93 (m, 6H, aromatic H and NH); MS= *m/z* (%) 229 (M<sup>+</sup>).

**Preparation of compounds (15)**

**1-Preparation of of 2-imino-6-phenyl-5-(3-phenylacryloyl)- 2,3-dihydropyrimidin-4(5H)-one(14)**

A mixture of 12 (0.01 mol), appropriate aromatic aldehydes 13 (0,01mol) and 10% aqueous sodium hydroxide (10 ml) in ethanol (20 ml) was stirred at room temperature for about 3hr. The resulting solid was filtered off, washed with water, dried and crystalized from the proper solvent to give (14). Formed as white crystals from dioxane; yield (82%); m.p.270-272°C; IR (KBr)  $\nu$   $\text{cm}^{-1}$ = 3447, 3419 (2NH), 3067 (CH-arom), 2930 (CH-aliph), 1743 , 1650 (2C=O)  $\text{cm}^{-1}$ ; <sup>1</sup>H-NMR (DMSO-*d*<sub>6</sub>)  $\delta$ = 3.00 (s, 1H,CH-pyrimidine), 6.10 (s, 1H, =CH), 6.61 (s, 1H, =CH), 6.95-7.95 (m, 11H, aromatic H and NH); 10.81 (hump, 1H, NH) ; MS= *m/z* (%) 317 (M<sup>+</sup>).

**2-Preparation of 6-(2-imino-6-oxo-4-phenyl-1,2,5,6-tetrahydropyrimidin-5-yl)-2-oxo-4-phenyl-1,2-dihydropyridine-3-carbonitrile (15)**

A mixture of 14 (0, 01 mol), ethylcyanoacetate (0,01mol) and ammonium

acetate (2g) were fused for 6 hr. The reaction mixture was left to stand, and then triturated with ethanol. The solid product so formed was collected by filtration and crystallized from the proper solvent to give (15). Formed as yellow crystals from Dioxan; yield (73%); m.p.280-282°C; IR (KBr)  $\nu$   $\text{cm}^{-1}$  = 3403, 3344, 3293 (3NH), 2967(CH-aliph), 2206(CN), 1650,1600 (2C=O)  $\text{cm}^{-1}$ ;  $^1\text{H-NMR}$  (DMSO- $d_6$ )  $\delta$  = 2.93 (s, 1H, CH-pyrimidine), 6.21 (s, 1H, =CH-Pyridine), 7.00-7.91 (m, 10H, aromatic H), 10.59 (s, 1H, NH), 11.68 (s, 1H, NH), 11.78 (s, 1H, NH); MS =  $m/z$  (%) 383 ( $\text{M}^+$ +2).

### Preparation of compounds (18)

#### First step

A cold suspension of aryl diazonium salts 16 (0.002 mol) (prepared from 0.002 mol of aromatic amine with the appropriate quantities of sodium nitrite and hydrochloric acid) was gradually added to a cold solution (0-5°C) of 12 (0.002 mol) in ethanol (30 ml) containing anhydrous sodium acetate (2g) with continuous stirring for 1 hr. The resulting reaction product was filtered off, washed with water and crystallized from the proper solvent to give compounds (17).

#### Preparation of 2-imino-6-phenyl-5-(2-(2-phenylhydrazono) acetyl)-2,3-dihydropyrimidin - 4(5H)-one(17)

Formed as yellow crystals from Dioxan; yield (75%); m.p.272-274°C; IR (KBr)  $\nu$   $\text{cm}^{-1}$  = 3447 (NH), 3059 (CH-arom), 2955 (CH-aliph), 1776,1692 (2C=O)  $\text{cm}^{-1}$ ;  $^1\text{H-NMR}$  (DMSO- $d_6$ )  $\delta$  = 2.89 (s, 1H, CH-pyrimidine), 6.11 (s, 1H, CH=N), 6.61-7.95 (s, 11H, aromatic H and NH), 10.851-10.858 (hump, 2H, 2NH) ; MS =  $m/z$  (%) 333 ( $\text{M}^+$ ).

#### Second step

A mixture of compounds 17 (0.5g) in ammonium acetate was fused for 30 minutes. The reaction mixture was allowed to cool and poured into crushed ice. The

separated solid was filtered off, washed with water and crystallized from DMF to give (18).

#### Preparation of 7-imino-1,5-diphenyl-7,8-dihydropyridazino[3,4-d]pyrimidin-4(1H)-one(18)

Formed as white crystals from DMF; yield (74%); m.p.>300 °C; IR (KBr)  $\nu$   $\text{cm}^{-1}$  = 3346 (NH), 3078 (CH-arom), 1655 (C=O)  $\text{cm}^{-1}$ ;  $^1\text{H-NMR}$  (DMSO- $d_6$ )  $\delta$  = 6.10(s, 1H, CH-pyridazine), 6.61-7.95 (m, 11H, aromatic H and NH), 10.82(s, 1H, NH); MS =  $m/z$  (%) 315 ( $\text{M}^+$ ).

#### Preparation of 6-amino-2-imino-4-phenyl-1,2-dihydrothieno[3,2-d]pyrimidine-7-carbonitrile(21)

A mixture of compound 4 (0.01 mol), malononitrile and sulfur (0.01 mol) in DMF (30 ml) containing catalytic amount of piperidine was heated under reflux for 12 hr. The reaction mixture was allowed to cool and poured into crushed ice then acidified with HCl. The separated solid was filtered, washed with water and crystallized from ethanol to give (21;84%) as pale yellow crystals, m.p.200-202 °C; IR (KBr)  $\nu$   $\text{cm}^{-1}$  = 3330, 3200 (NH<sub>2</sub>/NH), 2212 (CN)  $\text{cm}^{-1}$ ;  $^1\text{H-NMR}$  (DMSO- $d_6$ )  $\delta$  = 6.13 (s, 2H, NH<sub>2</sub>), 6.47-7.99 (m, 5H, aromatic H), 11.65 (s, 1H, NH), 11.98 (s, 1H, NH); MS =  $m/z$  (%) 267 ( $\text{M}^+$ ).

#### Preparation of ethyl N-7-cyano-2-imino-4- phenyl-1, 2-dihydrothieno [3,2-d]pyrimidin -6-ylformimidate(22)

Compound 21 (0.01 mol) and triethylorthoformate (5ml) in acetic anhydride (10ml) was heated under reflux for 12 hr. The reaction mixture was allowed to cool and poured into crushed ice. The separated solid was filtered, washed with water and crystallized from Dioxan to give (22;85%) as brown crystals, m.p.270-272°C;IR (KBr)  $\nu$   $\text{cm}^{-1}$  = 3341, 3211 (2NH), 2936-2860 (CH-aliph), 2216 (CN)  $\text{cm}^{-1}$ ;  $^1\text{H-NMR}$  (DMSO- $d_6$ )  $\delta$  = 1.29 (t, 3H, CH<sub>3</sub>),

4.28 (q, 2H, CH<sub>2</sub>), 6.10 (s, 1H, =CH), 6.60-8.24 (m, 6H, aromatic H and NH), 10.81 (s, 1H, NH); MS= *m/z* (%) 323 (M<sup>+</sup>).

### Preparation of dihydrothieno[3,2-d]pyrimidin-6-ylformimidate(23)

A mixture of 22 (0.5gm) and Hydrazine hydrate (3ml) was heated under reflux for 12 hr. The reaction mixture was allowed to cool and poured into crushed ice then acidified with HCl. The separated solid was filtered, washed with water and crystallized from DMF to give (23;73%) as brown crystals, m.p>300°C; IR (KBr)  $\nu$  cm<sup>-1</sup>= 3452, 3244, 3139 (NH<sub>2</sub>, NH), 3050 (CH-arom) cm<sup>-1</sup>; <sup>1</sup>H-NMR (DMSO-d<sub>6</sub>)  $\delta$ =6.08 (s, 2H, NH<sub>2</sub>), 6.55-8.01 (m, 6H, aromatic H), 13.97 (hump, 1H, NH), 14.16 (hump, 1H, NH), 14.23 (hump, 1H, NH); MS= *m/z* (%) 309 (M<sup>+</sup>).

### Conclusions

The newly synthesized compounds and their derivatives have been screened for antibacterial activity against bacterial species (*Escherichia coli*, *Bacillus megaterium* & *Bacillus subtilis*) and fungal species (*Fusarium proliferatum*, *Trichoderma harzianum* & *Aspergillus niger*). Generally, the biological activity of most compounds were observed for most tested bacteria and fungi, therefore they could be used as wide spectrum antimicrobial agents, it can be considered as promising broad spectrum antibiotics.

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## المخلص العربي

استخدام المركبات ثنائية الكيتون في تحضير مركبات غير متجانسة الحلقة: تحضير مشتقات جديدة من البيريبيدين والبيريبيدين متعددة الحلقات والتي لها نشاط حيوي

هند سعدالدين عبدالراضي، محمد أحمد محمود عبدالرحيم، إبراهيم سعد عبدالحافظ

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ذكرنا أن الامينوبيريبيدين ٤ تم تحضيره خلال تفاعل الجوانيديين هيدروكلوريد والإيثيل بنزويل اسيتات (شكل ١). مجموعة الميثيلين النشطة في المركب ٤ استخدمت في تحضير مشتقات الامينوبيريبيدين خلال تفاعله مع بعض الكواشف الالكتروفيلية. وبناء على ذلك، تم تحضير المركب ٥ عند تفاعل ٤ مع ثنائي ميثيل فورماميد ثنائي ميثيل اسيتال-DMF DMA وعند تفاعله مع الهيدرازين هيدرات والفينيل هيدرازين يعطي المركب ٨ تم اثبات تركيب المركبات ٤ و ٥ و ٨ من خلال التحليل الطيفية الدقيقة شكل (١). يتم الحصول على مركب 10 بمعاملة مركب 4 مع كلورواسيتيل كلوريد في وجود الطولوين، وتركيب المركب الجديد تم اثباته م خلال التحليل الطيفية الدقيقة. مركب 10 يتحول بعد غليانه مع الطولوين ليعطي مركب 11. ومطياف الكتلة لمركب 11 يتفق مع التركيب المقترح. (شكل ٢). المركب ١٢ يتم الحصول عليه من خلال تفاعل ٤ مع الاسيتيل كلوريد في انهيدريد الاسيتيك واسيتات الصوديوم ويتكاثف المركب ١٢ مع الالدهيد الاروماتيه في وجود هيدروكسيد الصوديوم ليعطي المركب 14a-c الذي يتفاعل مع الايثيل ثيانو اسيتات ليعطي كربونيتريل هيدروبيريبيدين 15a-c. أيضا يتكاثف المركب ١٢ مع املاح الديازونيوم الاروماتية لينتج مشتقات هيدرازون 16a-c بغليانه مع اسيتات الامونيوم ينتج المركب 17b-c شكل (٢)، ويتفاعل مركب ٤ مع المالونونيتريل والكبريت في الدايبوكسان لينتج مركب ٢١، ويتسخن مركب ٢١ مع ترائ اورتوفورمات في وجود انهيدريد حمض الاسيتك لينتج مشتقات امسنو ايتوكسى ميثيلين ٢٢، وعند معاملة مركب ٢٢ مع الهيدرازين هيدريت يتم الحصول على المركب ٢٣ تم اثبات تركيب المركبات ٢١ و ٢٢ و ٢٣ من خلال التحليل الطيفية الدقيقة (شكل ٣).

الكلمات الإسترشادية: ايمينوبيريبيدين، بيرازولوبيريبيدين، داي هيدروبيريبيدين، داي هيدروبيريبيدين كربونيتريل.

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