Iranian Journal of Organic Chemistry Vol. 8, No. 3 (2016) 1851-1858

Synthesis of some 3-indolyl heterocycles and evaluation of its antimicrobial activity

Wesam S. Shehab*, Mohamed H. Sherif and Mohamed G. Assy

Department of Chemistry, Faculty of Science, Zagazig University, Zagazig, 44511, Egypt

Received: May 2016; Revised: May 2016; Accepted: July 2016

Abstract: In this present study, Chalcone **1** has been synthesized by the reaction of 3-acetylindole with pyrrole-2-carboxaldehyde using Clasien- Schmidt condensation. Chalcone **1** has been used as starting intermediates for synthesis of pyrazolo derivatives **2**, **3** and allowed to react with urea, thiourea and guanidine which gave the pyrimidine derivatives **4-6**. Base catalyzed reaction of **1** with ethyl acetoacetate gave cyclohexanone derivatives **7**, respectively. Reaction of the latter compounds with hydrazine hydrate afforded indazole derivatives **8**. Compound 4 condensed with benzaldehyde affording the corresponding Schiff's bases **9**. A β- lactam derivative **10** is formed by the addition of chloroacetyl chloride to Schiff's bases **9**. On the other hand, condensation with thioglycolic acid formed the isolated 3-(4-(1H-indol-3-yl)-6-(1H-pyrrol-2-yl) pyrimidin-2-yl)-2-phenylthiazolidin-4-one **11**. Structure elucidation of the products has been accomplished on the basis of elemental analysis, IR, ^{1}H-NMR and ^{13}C-NMR spectral data. Some compounds were tested for antibacterial and antifungal activity indicated that some of compounds are exhibiting good activity.

Keywords: 3-Acetylindole, Schiff's bases, Pyrimidines, Antimicrobial activity.

Introduction

Indole which is the potent basic pharmacodynamic nucleus has been reported to possess a wide variety of biological properties anti-inflammatory, anti-cancer and antimicrobial activities [1-5]. Additionally, Chalcones act as an intermediate for the synthesis of biologically active heterocyclic compounds viz, pyrimidine , cyclohexanone, pyrazole and isoxazole derivatives [6, 7]. The presence of a reactive, unsaturated keto function in chalcones is found to be responsible for their antimicrobial activity, which may be depending on the type and position of substituent on the rings [8]. The pyrrole moiety is an important part of many natural products [9]. They are the structural units in many pharmacologically active compounds, such as porphyrins (e.g. heme and chlorophylls) [10] and some pyrrole-based alkaloids (e.g. hygrine, nicotine, tropine, and cocaine) [11].

*Corresponding author. Tel: +20-10-2359-9259, Fax: +20-55-228-5374, E-mail: wesamshehab2015@gmail.com

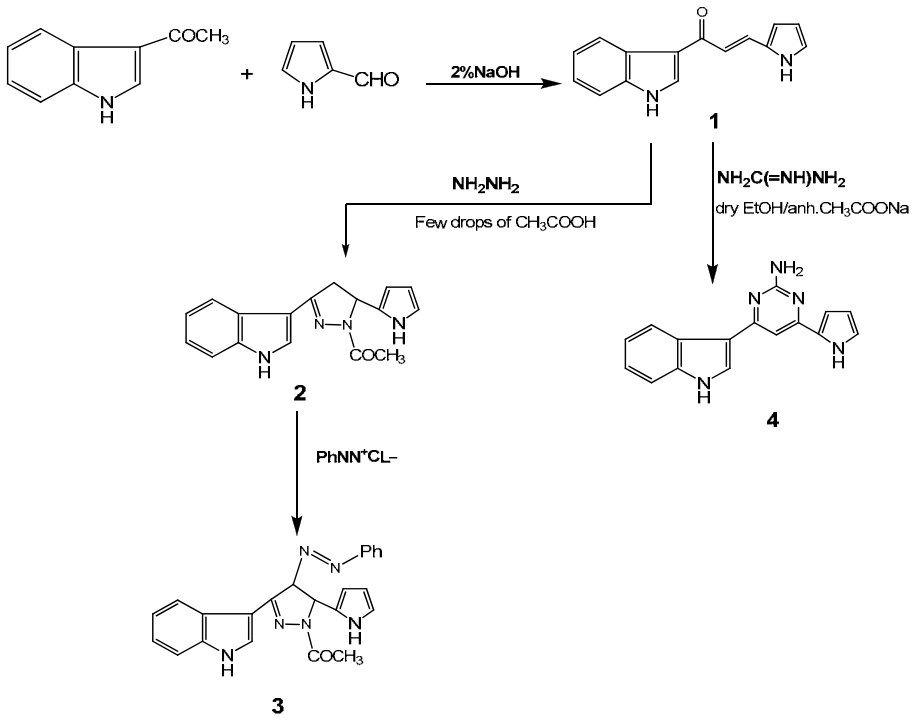
The incidence of bacterial infections has increased dramatically in recent years [12] the widespread use of antibacterial and antifungal drugs and their resistance against bacterial and fungal infections has led to serious health hazards. The resistance of wide spectrum antibacterial agents has prompted discovery and modification towards new antifungal and antibacterial drugs [13, 14].

Prompted by the observed biological activities of the above mentioned derivatives and in continuation of our studies on novel biologically active molecules [15]. We have designed and synthesized some of novel 3-indolyl isolated heterocycles derivatives as potential antibacterial agents.

Results and discussion

The novel 3-indolylchalcone derivatives **1** were synthesized by Claisen–Schmidt condensation of 3-acetylindole with pyrrole-2-carboxaldehyde in ethanol in the presence of aqueous potassium hydroxide (2%)

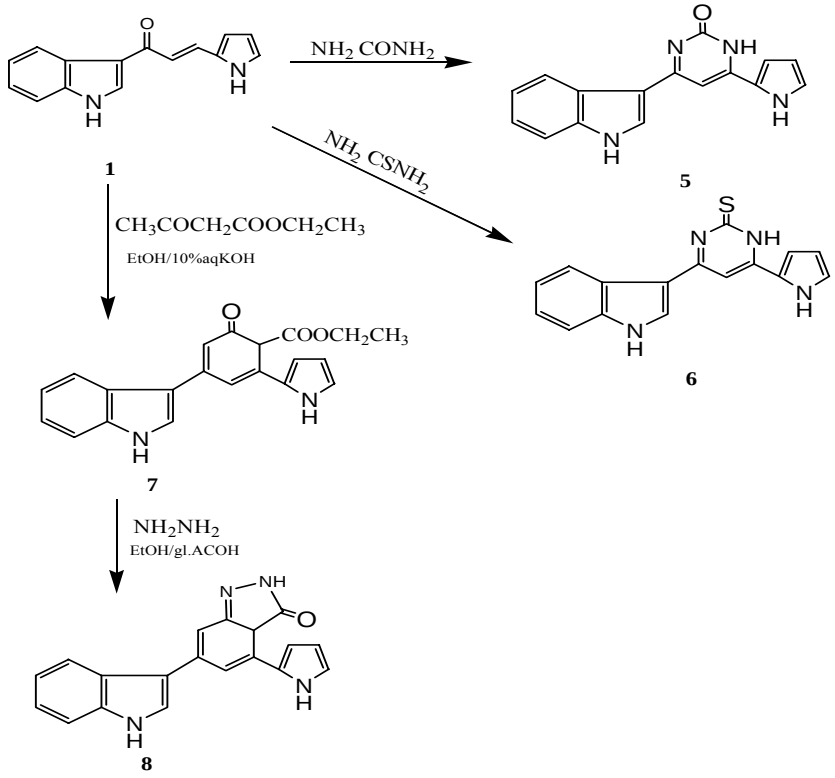
which considered as a good precursor for the synthesis of isolated heterocyclic compounds [16]. Good yields were achieved in the reaction of chalcones with hydrazines hydrate in presence of glacial acetic acid afforded pyrazole derivatives **2**. Direct coupling of 1-(4,5-dihydro-3-(1H-indol-3-yl)-5-(1H-pyrrol-2-yl)pyrazol-1-yl)ethanone **2** with benzene diazonium chlorid gives the corresponding 3-indolylpyrazolo phenyldiazene derivatives **3**. Cyclocondensation of chalcones with guanidine hydrochloride in dry ethanol in the presence of anhydrous sodium acetate yielded 4-(1H-indol-3-yl)-6-(1H-pyrrol-2-yl) pyrimidin-2-amine **4**, respectively (Scheme **1**). The structure of compounds were elucidated based on IR, ^{1}H-NMR and ^{13}C-NMR analyses (see experimental section).



Scheme 1: Synthesis of 3-indolylpyrazolo derivatives **3**.

Cyclocondensation of chalcones **1** with urea in dry ethanol in the presence of glacial acetic acid as a catalyst gave 4-(1H-indol-3-yl)-6-(1H-pyrrol-2-yl) pyrimidin-2(1H)-one **5**. Furthermore, reaction with thiourea gave the corresponding 4-(1H-indol-3-yl)-6-(1H-pyrrol-2-yl) pyrimidine- 2(1H)-thione 6, respectively (Scheme **2**). Moreover, it was reported that, reaction of chalcone with ethyl acetoacetate in the presence of aqueous potassium hydroxide (10%) gives rise to cyclohexanone [16]. In the present work and under the above mentioned conditions, chalcones **1** reacted with ethyl acetoacetate and gave the newly compounds namely, ethyl 4- (1H- indol -3- yl) -6 –oxo-2-(1H-pyrrol-2-yl) cyclohexa-2, 4-diencarboxylate **7**.

Reaction of compound **7** with hydrazine hydrate under reflux in absolute ethanol in the presence of glacial acetic acid as a catalyst afforded **8**. The IR spectrum exhibited absorption band at 3218, 1665, 1620 for NH, C=O and C=N groups, successively. The appearance of signals at δ 1.91 and 4.42 ppm of $COOCH_2CH_3$ and 8.01 ppm which can be attributed to the proton of NH group besides the signals 9.69 (s, 1H, NH indole) , 3.87 (s, 1H, CHCO), 5.01 (s, 1H, NH pyrrol), 6.70 (s, 1H, CH=C) and 6.50–7.69 (m, 9H, Ar-H) . The reaction may be proceeded through condensation between C=O of cyclohexanone and NH_2 of hydrazine, followed with cyclization by losing a molecule of ethanol, respectively (Scheme **2**).



Scheme 2: Synthesis of fused 3-indolyl derivatives **8.**

However, condensation of compound **4** with benzaldehyde in ethanol containing piperidine at reflux temperature affording the corresponding Schiff's bases 9. The IR spectrum of **9** showed the absence of the absorption amino group. The ^{1}H NMR spectrum of **9** showed singlet signal at 6.21 due to the N=CH. A *β*-lactam derivative **10** is formed by the addition of chloroacetyl chloride to the Schiff's bases **9** via elimination of two hydrogen chloride molecule. The IR spectrum of **10** showed the presence of absorption bands at 1700 cm^{-1} due to CO amide function. The ^{1}H-NMR spectrum of **10** showed two doublet signals at 3.65 and 4.19 for the protons at C-3 And C-4 of the azetidinone. A similar reactivity of Schiff's bases **4** is shown by the thioglycolic acid ; formation of the isolated 2-phenylthiazolidin-4-one derivative **11** which takes place by the nucleophilic addition of thiol function on the imino carbon of Schiff's bases , which subsequently cyclized via loss of water affording **10** ,**11** respectively (Scheme **3**).

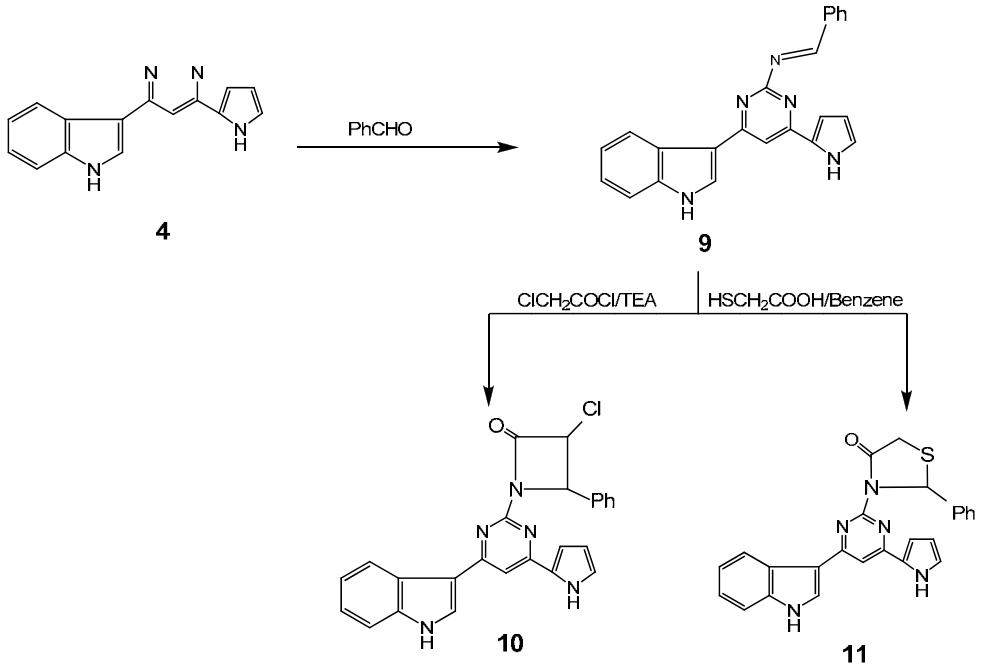
Some of synthesized compounds have been tested for antibacterial and antifungal activities by agar diffusion technique. These compounds showed mild to good antibacterial activity and antifungal activity.

The compound **9** showed potent antibacterial activity and compound **5** showed potent antifungal activity.

The negative control was DMSO showed no antimicrobial activity against the tested microorganisms, and the positive control was Erythromycin for bacteria and Metronidazole for yeast and fungus. All examinations were done in duplicates and the listed data are the average of the obtained results [18]. The observed data on the antimicrobial activity of the compounds and control drugs are given in Table **1**, **2** (see Figure **1**, **2**).

Experimental

All melting points are uncorrected and were determined on Gallen Kamp electric melting point apparatus. IR spectra (KBr discs) were recorded on ATR-Alpha FT-IR Spectrophotometer from 400 to 4000 cm^{-1}. ^{1}H and ^{13}C NMR spectra were recorded on a Bruker AC-600Hz instrument. Chemical shifts are expressed as δ (ppm) relative to TMS as an internal standard, and DMSO-d_6 was used as the solvent. The elemental analyses were carried out at Micro-Analytical Center, Cairo University.



Scheme 3: Synthesis of isolated 3-indolyl pyrimidine derivatives.

Table 1: Antibacterial activity data of some synthesized compounds.

S. No.	Zone of inhibition in mm			
	Bacillus subtilis	Staph. aureus	Escherichia coli	Pseud. aeruginosa
1.	-	-	-	-
2.	14	12	19	19
3.	20	21	19	19
5.	17	18	19	20
6.	28	18	18	18
9.	30	28	28	28
Control	-	-	-	-
Standard	31	32	31	30

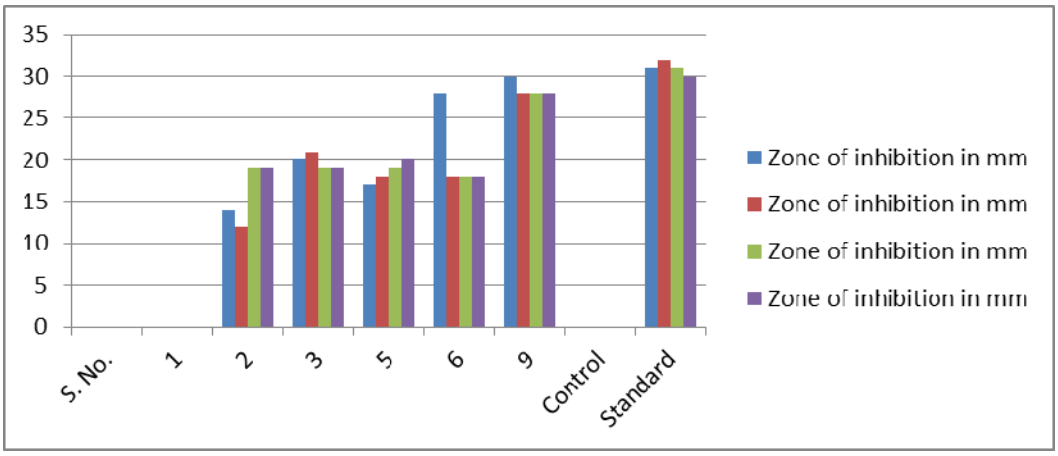


Figure 1: Zone of inhibition (mm) of test samples and standard drug Erythromycin.

Table 2: Antifungal activity data of some synthesized Compounds.

S. No.	Zone of inhibition in mm	
	Candida albicans	Aspergillus niger
1.	13	15
2.	14	16
3.	21	22
5.	22	24
6.	15	16
9.	13	15
Control	-	-
Standard	27	28

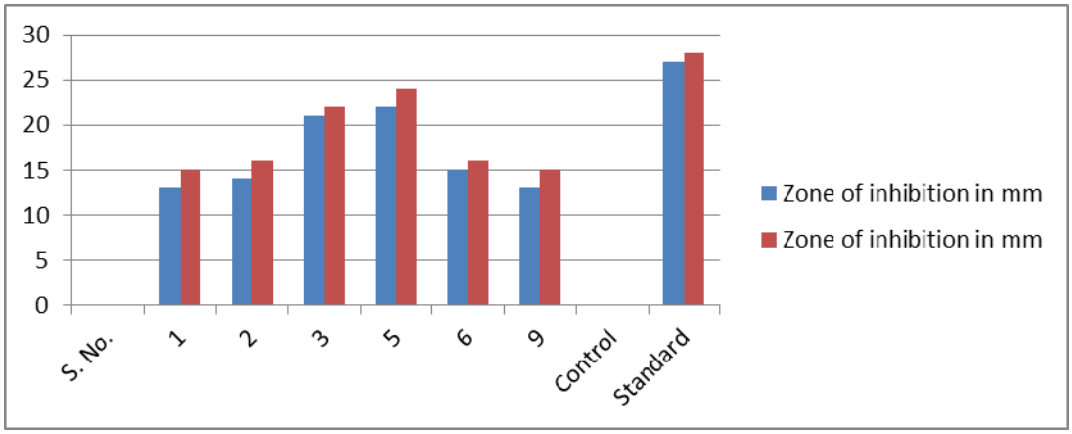


Figure 2: Zone of inhibition (mm) of test samples and standard drug Metronidazole.

(E)-1-(1H-indol-3-yl)-3-(1H-pyrrol-2-yl) prop-2-en-1-one **(1):**

Solution of (0.01 mol) of 3-acetylindole dissolved in 50 ml of dry methanol, (0.01 mol) of 2-pyrrolcarbaldehyde was dissolved in the presence of 2% NaOH solution (5ml). The reaction mixture was refluxed on water bath for 9-10 hrs. The solvent was distilled off and crude product was poured into ice cold water. The compound obtained was washed with water and recrystallized from methanol to give compound **1**. The compound was obtained as light yellow solid with yield of 70% and m.p.190-192°C. IR (KBr, ν, cm^{-1}): 3270cm^{-1} (N-H str), 3012cm^{-1} (Ar-C-H str), 1620 cm^{-1} (C=N str), 1673 (C=O), 1607 (HC = CH), 1584 (C =N); ^{1}H NMR (DMSO-d_6, 600 MHz): δ = 6.27 – 6.76 (m, 3H,pyrrol-H),7.2 (1H, d, *J*=17 Hz, -CO-CH=), 7.54 (1H, d, *J*=17 Hz , =CH-py),7.12-7.89(m,4H,Ar-H) , 8.10 (s,1H , NH pyrrol), 9.91 (s, 1H, NH indole). ^{13}C NMR (DMSO-d_6): δ = 108.6, 110.8, 120.1, 122.3, 126.1, 127.4, 129.5, 135.5 and136.6. Anal. Calcd for $C_{15}H_{12}N_2O$ (236.27): C, 76.25; H, 5.12; N, 11.86; Found C, 76.26; H, 5.10; N, 11.85%.

1-(4, 5-Dihydro-3-(1H-indol-3-yl)-5-(1H-pyrrol-2-yl) pyrazol-1-yl) ethanone **(2):**

To a solution of **1** (0.01 mol) in absolute ethanol, hydrazine hydrate (99%, 0.02 mol) and a few drops of glacial acetic acid were added. The reaction mixture was refluxed for 6-8 hours. The excess of solvent was distilled off and the crude product was poured into ice water. The separated solids were filtered and recrystallized from ethanol. The compound was obtained as yellow solid with yield of 55% and m.p. of 200-202°C. IR (KBr, ν, cm^{-1}): 3200 cm^{-1} (N-H str), 2967 cm^{-1} (aliphatic-C-H str), 1644 cm^{-1} (C=O str), 1505 cm^{-1}(C=N str), 1450 cm^{-1} (C=C str), 1276 cm^{-1} (C-N str). ^{1}H NMR (DMSO-d_6, 600 MHz): δ = 2.65 (s, 3H, CH_3), 3.36 (s, 2H, CH_2) ,5.21 (s,1H, methine – CH), 6.27 – 6.76 (m, 3H,pyrrol-H), 7.12-7.89(m,4H,Ar-H) , 8.10 (s,1H , NH pyrrol), 9.91 (s, 1H, NH indole). ^{13}C NMR (DMSO-d_6): δ = 25.4, 40.7, 108.1, 119.0, 112.6, 120.1, 122.2, 126.1, 130.5, 130.8, 135.5 and168.3. Anal. Calcd for $C_{17}H_{16}N_4O$ (292.34): C, 69.85; H, 5.52; N, 19.17; Found C, 69.83; H, 5.50; N, 19.16 %.

(18E)-1-(4,5-dihydro-3-(1H-indol-3-yl)-5-(1H-pyrrol-2-yl)-1H-pyrazol-4-yl)-2phenyldiazene **(3):**

To a solution of aniline (0.01mol) in glacial acetic acid, conc. hydrochloric acid (3 ml) was added at 0-5°C. A solution of sodium nitrite (1g in 5 ml of water) was then added drop wise to the above solution. The diazonium salt thus prepared was added to a solution of **2** (0.01 mol) in methanol drop wise stirring below 0°C. The reaction mixture was kept at room temperature for 2-3 days and then poured into cold water (200 ml). The separated solids were then washed with water and recrystallized from methanol. The compound was obtained as light brown solid with yield of 41% and m.p. of 234-236°C. IR (KBr, ν, cm^{-1}): 3200 cm^{-1} (N-H str), 3025cm^{-1} (Ar-C-H str), 2905 cm^{-1} (aliphatic- C-H str), 1595 cm-1 (C=N str), 1457 cm^{-1} (C=C str), 1276 cm^{-1} (C-N str). ^{1}H NMR (DMSO-d_6, 600 MHz): δ = 1.95 (s, 3H, CH_3), 2.5 (s,1H,methine *β CH*) ,5.11 (s,1H, methine α CH), 6.10 (s,1H , NH pyrrol) , 6.27–6.76 (m, 3H,pyrrol-H) , 7.01-7.69(m,10H,Ar-H) , 10. 1 (s, 1H, NH indole). Anal . Calcd for $C_{23}H_{20}N_6O$ (396.44): C, 69.68; H, 5.08; N, 21.20; Found C, 69.66; H, 5.05; N, 21.19 %.

4-(1H-indol-3-yl)-6-(1H-pyrrol-2-yl)pyrimidin-2-amine **(4):**

A mixture of chalcones **1** (0.001 mol), guanidine hydrochloride (0.001 mol) and anhydrous sodium acetate (0.01 mol) in dry ethanol (15 ml) in absolute ethanol (10 ml) were refluxed on a water bath for 6 hours. The solvent was completely evaporated and the residue was poured into ice cold water, the precipitated solid was collected by filtration and recrystallized from ethanol to give the desired substituted pyrimidine **4.** The compound was obtained as light yellow solid with yield 65%; mp 238-242 ^{0}C; IR (KBr, ν, cm^{-1}): 3316(NH_2), 1680(C=N), 1570 (C=C), 1340 (C-N); ^{1}H NMR (DMSO-d_6, 600 MHz): δ = 5.23 (s,2H, NH_2), 5.9 (s,1H , NH pyrrol) , 6.27 – 6.76 (m, 3H,pyrrol-H) , 7.01-7.69(m,10H,Ar-H) , 9.82 (s, 1H, NH indole). ^{13}C NMR (DMSO-d_6): δ = 95.0, 108.6, 111.1, 118.3, 119.0, 120.1, 122.2, 128.4, 131.4, 135.5, 163.7 and 167.5.Anal. Calcd for $C_{16}H_{13}N_5$ (275.31): C, 69.80; H, 4.76; N, 25.44; Found C, 69.78; H, 4.75; N, 25.42 %.

4-(1H-indol-3-yl)-6-(1H-pyrrol-2-yl)pyrimidin-2-amine **(5):**

A mixture of chalcones **1** (0.01 mol) and urea (0.01 mol) in dry ethanol (10 mL) containing glacial acetic acid (0.5 mL) was refluxed for 6–8 h. After cooling, the reaction mixture was poured into ice-water (50 mL) and the solid that formed was filtered off, air dried and recrystallized from absolute ethanol to give pale brown solid **5** with yield 62%, m.p. 162–164^{0}C. IR (KBr, ν, cm^{-1}): 3140 (NH), 1640 (C=O), 1620 (C=N), 1575 (C=C), 1340 (C-N); ^{1}H NMR (DMSO-d_6, 600 MHz): δ = 5.1 (s,1H , NH pyrrol) , 7.99 (s, 1H, CH pyrimidine)

, 9.90 (s, 1H, NH), 6.28–7.69 (m, 9H, Ar-H) , 10.02 (s, 1H, NH indole). Anal. Calcd for $C_{16}H_{12}N_4O$ (276.29): C, 69.55; H, 4.38; N, 20.28; O, 5.79; Found C, 69.54; H, 4.35; N, 20.25 %.

4-(1H-indol-3-yl)-6-(1H-pyrrol-2-yl)pyrimidine-2(1H)-thione **(6):**

A mixture of chalcones **1** (0.01 mol) and thiourea (0.01 mol) in dry ethanol (10 mL) containing glacial acetic acid (0.5 mL) was refluxed for 6–8 h. After cooling, the reaction mixture was poured into ice-water (50 mL) and the solid that formed was filtered off, air dried and recrystallized from absolute ethanol to give brown solid **6** yield 55%, m.p.155-157^{0}C. IR (KBr, ν, cm^{-1}): 3300 (NH), 1637 (C=N), 1608 (C=C), 1250 (C=S); ^{1}H NMR (DMSO-d_6, 600 MHz): δ =5.9 (s,1H , NH pyrrol) , 6.28–7.69 (m, 8H, Ar-H) , 8.12 (s , 1H ,, CH -pyrimidine) ,10.02 (s, 1H, NH indole),12.05 (1H, s, NH).Anal. Calcd for $C_{16}H_{12}N_4S$ (292.36): C, 65.73; H, 4.14; N, 19.16; S, 10.97; Found C, 69.74; H, 4.15; N, 19.16; S, 10.95 %.

Ethyl 4-(1H-indol-3-yl)-6-oxo-2-(1H-pyrrol-2-yl) cyclohexa-2, 4-diencarboxylate **(7):**

A mixture of chalcones **1** (0.01 mol) and ethyl acetoacetate (0.01 mol) in absolute ethanol (10 ml) containing aqueous potassium hydroxide solution (1 mL, 10%). The reaction mixture was refluxed for 2 h and then left overnight at room temperature. The solid that formed was filtered off, air dried and recrystallized from absolute ethanol to give pale yellow solid **7** yield 32%, m.p. 167-169 ^{0}C. IR (KBr, ν, cm^{-1}): 1702 and 1688 (C=O), 1567 (C=C), 1637 (C=N), 1608 (C=C); ^{1}H NMR (DMSO-d_6, 600 MHz): δ = 1.91 (t, 3H, CH_3CH_2CO), 3.87(s, 1H, CHCO), 4.42 (q, 2H, CH_2-CO), 5.6 (s,1H , NH pyrrol) , 6.68 (s, 1H, CH=C),7.87 (s, 1H, CH pyrimidine) , 6.28–7.69 (m, 8H, Ar-H) , 9.69 (s, 1H, NH indole). Anal. Calcd for $C_{21}H_{18}N_2O_3$ (346.38): C, 72.82; H, 5.24; N, 8.09; O, 13.86; Found C, 72.81; H, 5.22; N, 8.07 %.

6-(1H-indol-3-yl)-4-(1H-pyrrol-2-yl)-2H-indazol-3(3aH)-one ***(8):***

A mixture of compounds **7** (0.01 mol) and hydrazine hydrate 99% (5 mL, 0.01 mol) in absolute ethanol (15 mL) containing glacial acetic acid (0.5 mL) was refluxed for 2 h. After cooling, the solid that formed was filtered off, air dried and recrystallized from chloroform to give brown solid **8** yield 47%, m.p.224-222^{0}C. IR (KBr, ν, cm^{-1}): 3218 (NH), 1665 (C=O), 1620 (C=N), 1557 (C=C); ^{1}H NMR (DMSO-d_6, 600 MHz): δ = 3.87(s, 1H, CHCO), 5.01 (s, 1H, NH pyrrol), 6.70 (s, 1H, CH=C), 6.50–7.69 (m, 9H, Ar-H), 8.01 (s,1H,NH), 9.69 (s, 1H, NH indole). Anal. Calcd for $C_{19}H_{14}N_4O$ (314.34): C, 72.60; H, 4.49; N, 17.82; O, 5.09; Found C, 72.59; H, 4.47; N, 17.79 %.

(E)-N-benzylidene-4-(1H-indol-3-yl)-6-(1H-pyrrol-2-yl) pyrimidin-2-amine (**9*):***

An equimolar mixture of **4** (0.01 mol) and benzaldehyde (0.01 mol) was dissolved in ethanol (30 ml) with adding piperidine (0.2 ml) and refluxed for 5 hrs. The solid product formed after cooling was collected by filtration and recrystallized from ethanol to give yellow solid **9** yield 77 %, m.p.243-245^{0}C. IR (KBr, ν, cm^{-1}): 3200 (NH), 1620 (C=N), 1557 (C=C); ^{1}H NMR (DMSO-d_6, 600 MHz): δ = 5.12 (s, 1H, NH pyrrol), 6.21 (s, 1H, N=CH), 6.10–7.79 (m, 13H, Ar-H), 10.09 (s, 1H, NH indole). ^{13}C NMR (DMSO-d_6): δ = 104.1, 106.5, 111.1, 118.3, 122.2, 128.4, 129.2, 131.5, 133.7, 162.6, 166.5 and 167.8 .Anal. Calcd for $C_{23}H_{17}N_5$ (363.41): C, 76.01; H, 4.71; N, 19.27; Found C, 76.00; H, 4.70; N, 19.26 %.

1-(4-(1H-indol-3-yl)-6-(1H-pyrrol-2-yl) pyrimidin-2-yl)-3, 4-dimethyl azetidin-2-one **(10*):***

An equimolar mixture of **4** (0.01 mol) and benzaldehyde (0.01 mol) was dissolved in ethanol (30 mL) with adding piperidine (0.2 ml) and refluxed for 5 hrs. The solid product formed after cooling was collected by filtration and recrystallized from ethanol to give yellow solid **9** yield 77 %, m.p.243-245^{0}C. IR (KBr, ν, cm^{-1}): 3200 (NH), 1620 (C=N), 1557 (C=C); ^{1}H NMR (DMSO-d_6, 600 MHz): δ = 5.12 (s, 1H, NH pyrrol), 6.21 (s, 1H, N=CH), 6.10–7.79 (m, 13H, Ar-H), 10.09 (s, 1H, NH indole). ^{13}C NMR (DMSO-d_6): δ = 104.1, 106.5, 111.1, 118.3, 122.2, 128.4, 129.2, 131.5, 133.7, 162.6, 166.5 and 167.8 .Anal. Calcd for

$C_{23}H_{17}N_5$ (363.41): C, 76.01; H, 4.71; N, 19.27; Found C, 76.00; H, 4.70; N, 19.26 %.

3-(4-(1H-indol-3-yl)-6-(1H-pyrrol-2-yl) pyrimidin-2-yl)-2-phenylthiazo lidin-4-one **(11):**

An equimolar mixture of **9** (0.01 mol) and thioglycolic acid (0.01 mol) in dry benzene (20 mL) was refluxed for 10 hrs. The reaction mixture was evaporated to dryness under reduced pressure .The thiazolidinone separated off, washed and recrystallization from ethanol as yellow crystals.yield 56 % %, m.p.278-280^{0}C. IR (KBr, ν, cm^{-1}): 3200 (NH), 1700 (C=0), 1557 (C=C); ^{1}H NMR (DMSO-d_6,

600 MHz): δ = 3.65 (s, 1H, CH thiazolidine), 4.50(s,2H, CH_2 thiazolidine), 5.12 (s, 1H, NH pyrrol), 6.10–7.79 (m, 9H, Ar-H), 10.01 (s, 1H, NH indole). Anal. Calcd for $C_{25}H_{19}N_5OS$ (437.13): C, 68.63; H, 4.38; N, 16.01; O, 3.66; S, 7.33; Found C, 68.62; H, 4.39; N, 16.00; S, 7.32 %.

Biological Assay

The antimicrobial activity of the some newly synthesized compounds was evaluated for their anti-microbial activity using the agar diffusion technique [18-19]. Dimethylesulfoxide was used to dissolve the tested compounds in concentration 5 mg/mL (5000 ppm) The tested compounds were evaluated against, Gram +ve bacteria (Bacillus subtilis ATCC 6633, Staphylococcus aureus ATCC 35556), Gram -ve bacteria (Escherichia coli ATCC 23282 and Pseudomonas aeruginosa ATCC 10145), Yeast (Candida albicans IMRU 3669) and Filamentous Fungus (Aspergillus niger ATCC 16404). The bacteria and yeast were grown on nutrient agar while the fungus was grown on Czapek`s Dox agar medium.

Conclusion

In summary, a new series of 3-indolyl -(1H-pyrrol-2-yl) pyrazol **2**–**3**, 3-indolyl -(1H-pyrrol-2-yl) pyrimidin **4**-**6** and **9**, 3-indolyl -(1H-pyrrol-2-yl) cyclohexadiene **7** , 3-indolyl -(1H-pyrrol-2-yl) indazol **8** and 3-indolyl -(1H-pyrrol-2-yl)azetidin **10**-**11** . The newly synthesized compounds were tested for their in vitro antimicrobial Activity. The compound **9** showed potent antibacterial activity and compound **5** showed potent antifungal activity.

References

[1] Dharmendra, K.; Narendra, K.; Sandeep, K.; Tarun, S.; Singh, C. P. *International Journal of Engineering Science and Technology*.**2012**, *2(7)* , 2553.

[2] George, S.; Waran, M. P.; Chakra borty, A.; Ravi, T. K . *Acta Pharm* . **2008** , *58*, 119.

[3] El-Sawy, ER.; Mandour AH, Mahmoud NA, Mustafa M. *Egypt J Chem* .**2009**, *52*, 541.

[4]Mandour, AH.; El- Sawy, ER.;Ebid MS, El-Sayed ZG . *Egypt J Chem*. **2007**, *50*, 555.

[5] Mandour ,AH.; El-Sawy, ER.;Shaker ,KH.;Mustafa ,MA . *Acta Pharm*. **2010,** 60.

[6] Aitmambetov, A.;Menlimuratova, Z . *Russ J Bioorg Chem*.**2003**, *29*, 175.

[7] Sreevidya, VT.;Narayana, B.;Yathirajan, HS . *Eur J Chem*.**2010**, *8*, 174.

[8] Solankee, A. Patel. *Indian J Chem*.**2004**, *43B*, 1580.

[9] Hanessian ,S.;McNaughton-Smith, G.;Lombart ,HG.;Lubell ,WD.;Kaplancikli, ZA.;Zitouni, GT.; Revial, G.; Guven, K . *Arch pharm Res*.**2004**, *27*, 1081.

[10] Kadish, SJ.;Head ,JW.;Barlow, NG . *Icarus*. **2010**, *21*, 92.

[11] O'Hagan, D. *Indian J Chem*, **2000** , *B 43*, 1580.

[12] Ulusoy,N.; Kiraz, M.;Kucukbasmaci, O. *Monatshefte fur chemie*.**2002**, *133*, 1305.

[13] Al-Saddi, MS.;Faidallah,; HM.; Rostom ,SAF . *Arch Life Sci* .**2008**, *341*, 181.

[14] Wesam ,S.S.;Samar, M.M . *Eur J Chem*.**2015**, *6*, 157.

[15] Eslam, R S.;Adel ,HM.;Salwa ,MH.; Kamel ,HS.;Heba ,MA . *Arabian Journal of Chemistry*.**2013**, *6*, 67.

[16] Sreevidya, V.T.; Narayana, B.;Yathirajan, H.S. Eur. J. Chem.**2010**, 8, 174.

[17] Bauer, AW.;Kirby, W. M.;Shersis, J. C.;Turck, M *.Am J Clin*.**1997**, *45(4)*, 493.

[18] Woods, GL.;Washington, JA. The Clinician and the Microbiology Laboratory. Mandell GL, Bennett JE, Dolin R (eds). **1995**, 4th ed. Churchill Livingstone, New York.

[19] GuiQian, S.;GuoHua, Z.; *Southern Medical Journal*. **2007**, *100*, 360.