

## Synthesis and Identification some of heterocyclic compounds from imidazole derivatives

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### Abstract

This research involved heterocyclic compounds such as ( $\beta$ -Lactam derivatives, Thiazolidine-4-one derivatives, imidazolidin-4-one derivatives) were prepared by reaction between 4-(1H-benzo[d]imidazol-2-yl)aniline (1) with *p*-amino acetophenone to get N-(1-(4-aminophenyl)ethylidene)-4-(1H-benzo[d]imidazol-2-yl)aniline (2) which reacts with substituted aromatic aldehyde to get 4-(1-(4-(1H-benzo[d]imidazol-2-yl)phenyl)imino)ethyl-N-(derivative benzylidene)aniline. The cyclization of (3-6) with chloroacetylchloride, thioglycollic acid and  $\alpha$ -amino acid such as glycine and aniline give the corresponding  $\beta$ -lactam (7-10), thiazolidine-4-one (11-14) and imidazolidine-4-one (15-22) derivatives.

All these compounds were characterized by means of FT-IR,  $^1\text{H-NMR}$ , and followed by reaction with  $R_f$ -TLC and melting point measurement.

**Key words:-** heterocyclic, benzoimidazole,  $\beta$ -Lactam, Thiazolidin, Imidazolidin

### الخلاصة

تضمن البحث تحضير مركبات حلقيه غير متجانسة مثل (مشتقات البيتا لاكتام، مشتقات الثايوزولدين-4-اون، مشتقات الاميدازولدين-4-اون) التي تم تحضيرها من تفاعل 4-(1-هيدروجين-بنزو (د) اميدازول-2-ايل) انلين (1) مع بارا-امينو اسيتوفينون لتحصل على نتروجين - (1) - (4-امينوفيل ( اثيل داين) -4) - (1-هيدروجين-بنزو (د)-اميدازول -2-ايل) انلين (2) الذي يتفاعل مع الديهايدات اروماتيه معوضة لتحصل على 4 - (1) - (4) - (1-هيدروجين - بنزو (د) اميدازول -2-ايل ( فيل امينو ) اثيل ) - نتروجين - ( مشتق البنزولدين ) انلين . التعلق مع كلورو استايل كلورايد و حامض الثايوكلايكول والاحماض الامينيه ( الكلايسين و الانين ) يعطي بالمقابل البيتا لاكتام (7-10) والثايوزولدين -4-اون (11-14) والاميدازولدين (15-22) كمشتقات .

كل هذه المركبات تم تشخيصها بواسطة مطيافيه الاشعه تحت الحمراء وبعضها بواسطة مطيافية الرنين النووي المغناطيسي و متابعة التفاعل بكموتوغرافيا الطبقة الرقيقه وقياس درجة الانصهار .

الكلمات المفتاحية :- المركبات الحلقيه غير المتجانسة، البنزو اميدازول، بيتا لاكتام، ثايوزولدين، اميدازولدين

## Introduction

Benzimidazole derivatives play important role in medical field with many pharmacological activities such as antimicrobial, antiviral, antidiabetic and anticancer activity. It is an important pharmacophore in drug discovery due to being a good bioisostere of naturally occurring nucleotides<sup>(1-4)</sup>

All  $\beta$ -lactam compounds contain a four-member ring. While  $\beta$ -lactam compounds were discovered in filamentous fungi, actinomycetes and gram-negative bacteria are also known to produce different types of  $\beta$ -lactams<sup>(5-7)</sup>

Imidazolidin-4-ones represent an interesting class of compounds with respect to biological activity. Through manipulation of the substituents around the imidazolidin-4-one core, molecules with a variety of biological properties have been discovered. Examples include compounds that exhibit antibacterial activity. Imidazolidin-4-one have also been reported to inhibit binding of vascular cell adhesion molecule 1 (VCAM 1) to very late antigen 4 (VLA-4), which are useful in treating inflammation associated with chronic inflammatory diseases such as rheumatoid arthritis, multiple sclerosis, asthma, and inflammatory bowel disease<sup>(8,9)</sup>

The versatile uses of thiazolidinones as anaesthetics 1, anti-convulsants 2, amoebicides 3, hypotensive 4 and tuberculostatic agents 5 have stimulated a considerable interest to explore the possible synthesis of new potential compounds in which the thiazolidinone ring is fused with another biologically active nucleus. With a view

in achieving such a system, thiazolidine was fused with benzimidazole<sup>(10-16)</sup>

## Experimental Apparatus

(FTIR) Spectra (4000-400 cm<sup>-1</sup>) in KBr disk were recorded on a SHIMADZU FTIR-8400S fourier transform. melting point were measured using Stuart, UK. <sup>1</sup>H NMR were recorded on fourier transformation bruker spectrometer, operating at (400 MHz) with (DMSO-d<sub>6</sub>) measurements were made at Department of chemistry, kashan university, Iran.

### Synthesis of 4-(1H-benzo[d]imidazol-2-yl)aniline (1)

Equimolar quantities (0.01 mol) of *o*-benzen diamine, *p*-amino benzoic acid (0.01 mol) in 4N HCl (20 mL) was refluxed for 30 min. The mixture is cooled and filtered off. The residue is the 4-(1H-benzo[d]imidazol-2-yl)benzenamine. The product is recrystallized from absolute alcohol.<sup>(17)</sup>

### synthesis N-(4-aminophenyl) ethylidene)-4-(1H-benzo[d]imidazol-2-yl) aniline (2)

A mixture of equimolar quantities (0.01 mol) of *p*-aminoacetophenone and 4-(1H-benzo[d]imidazol-2-yl)benzenamine was refluxed for 2 h in 20 mL of ethanol. The reaction mixture was cooled and kept for 24 h. The crystals found was filtered, dried and recrystallized from ethanol to give compound (2).

### General method of synthesis of compounds have tow group schiff bases (3-6)

A mixture of equimolar quantities (0.01 mol) of aromatic benzaldehyde and compound (2) was refluxed for 20 min in 30 mL of ethanol. The reaction mixture was cooled and kept for (24 h). The

crystals found was filtered , dried and recrystallized from ethanol to give compounds (3-6) .

**General method of synthesis of azetidiones (7-10)**

A mixture of schiff bases(3-6) (0.001mol) and triethylamine (0.006mol) was dissolved in 1,4 – Dioxan ( 25mL ) , to this well stirred cooled solution of chloro acetyl chloride (0.0024mol)was added drop wise at10°C.The reaction mixture was stirred for 6 hs. Half of the solvent separated and yield 1-(4-(1H-benzo[d]imidazol-2-yl)phenyl)-3-chloro-4-(4-(3-chloro-2-(derivatives) phenyl) -4-oxoazetid-1-yl)phenyl) -4-methylazetid-2- one recrystallized from chloroform.

**General method of synthesis of thiazolidinones (11-14)**

A mixture of schiff bases (3-6) (0.001mol)and thioglycollic acid (0.002mol)dissolved in 1,4 dioxane(20mL),anhydrous zinc chloride(0.7mg)was added and refluxed for 8 h. The reaction was then cooled and the resulting solid was washed with sodium bicarbonate solution and final compound 3- ( 4-(1H-benzo[d] imidazol-2 -yl) phenyl) -2- (4 (2- (substituted)

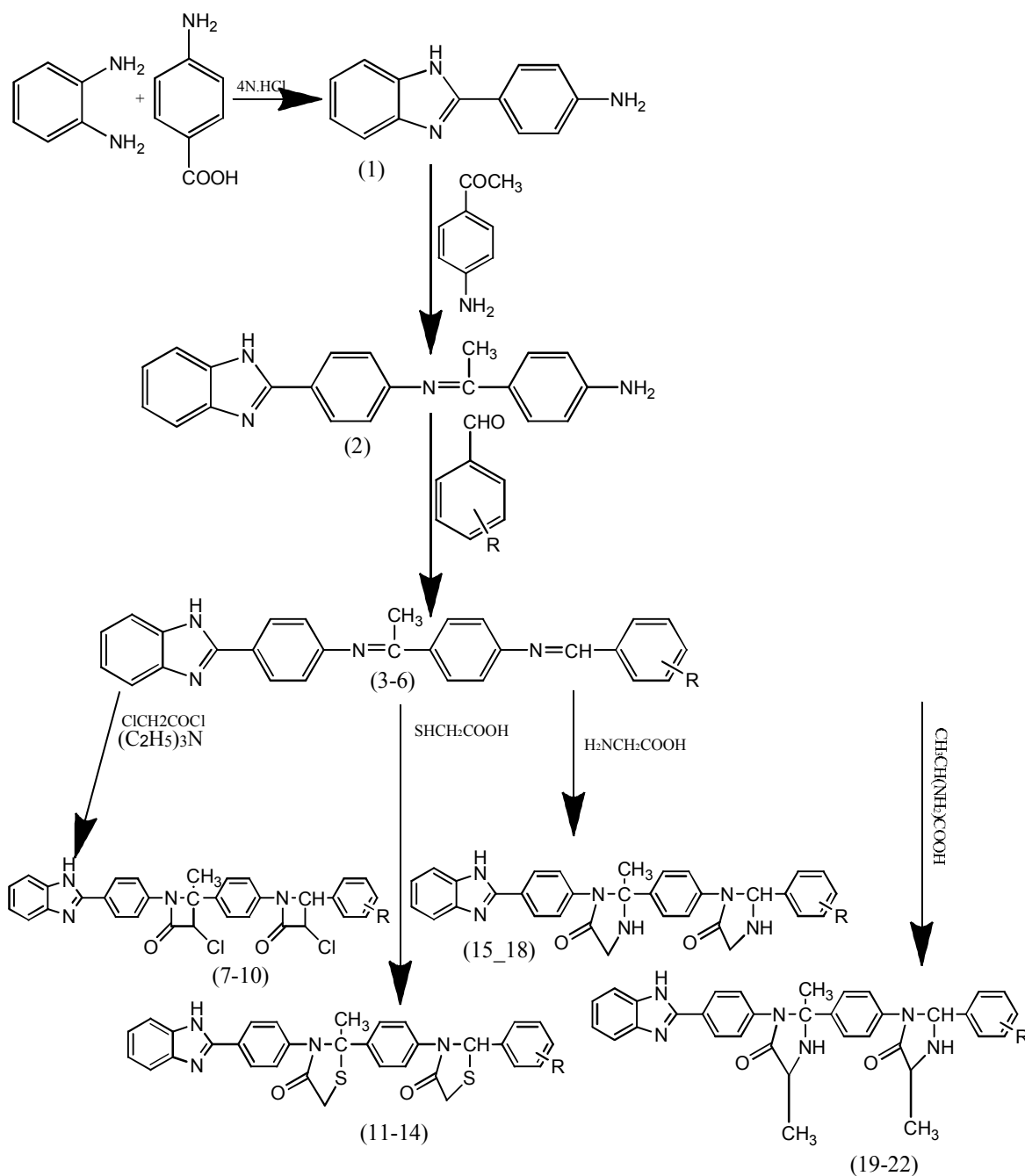
phenyl) - 4 -oxothiazolidin-3-yl) phenyl) - 2 – methylthiazolidin -4- one recrystallized from absolute ethanol.

**General method of synthesis of imidazolidin-4-one derivative (15-18)**

A mixture of schiff bases(3-6) (0.001mol ) dissolved in THF ( 15mL) and glycine (0.002mol)was dissolved in THF (15mL)and refluxed for 24 hs.The reaction was then cooled and the resulting final compound 3-(4-(1H-benzo [d] imidazol-2-yl)phenyl)-2-(4-(2-(substituted)phenyl) -5-oxoimidazolidin-1-yl) phenyl) -2-methylimidazolidin-4-one recrystallized from absolute ethanol.

**General method of synthesis of 5-methyl imidazolidin-4-one derivative (18-22)<sup>(17)</sup>**

A mixture of schiff bases (3-6) (0.001mol) and alanine (0.002mol)was dissolved in THF (15mL)and refluxed for 24 hs.The reaction was then cooled and the resulting final compound3-(4-(1H-benzo [d] imidazol -2-yl )phenyl )-2-( 4-(2- ( substituted ) phenyl) -4-methyl -5-oxoimidazolidin -1-yl) phenyl) -2,5-dimethyl imidazolidin -4 - one recrystallized from absolute ethanol.



R:- P-N(CH<sub>3</sub>)<sub>2</sub> ; P-Cl ; p-OH,m-OCH<sub>3</sub> ; H  
 3,7,11,19      4,8,12,20      5,9,13,21      6,10,14,22

**Schem1**

solid yield 92.28% , Rf =0.62 ,  
M.P( 240)<sup>o</sup>C.

### Results and Discussion

#### 4-(1H-benzo[d]imidazol-2-yl)aniline (1)

The compound(1) was obtained as paly yellow solid yield 76.98% , M.P( 209-211)<sup>o</sup>C

The infrared spectrum data of compound (1) showed band at (3047) cm<sup>-1</sup> for (Ar-H), (3394-3448) cm<sup>-1</sup> (N-H), (1319) cm<sup>-1</sup> (C-N),(1704) cm<sup>-1</sup> (C=N) .

#### Schiff base N-(1-(4-aminophenyl)ethylidene)-4-(1H-benzo[d]imidazol-2-yl) aniline (2)

This compound was obtained as purple solid yield 94.1%,R<sub>f</sub>=064, M.P (220)<sup>o</sup>C.

The infrared spectrum data of compound (2) show absorption at (3047) cm<sup>-1</sup> for (Ar-H),( 3332-3394) cm<sup>-1</sup> (N-H), (1319 )cm<sup>-1</sup> (C-N),(1612) cm<sup>-1</sup> (C=N),and show new band at (2993) for (C-H)CH<sub>3</sub><sup>(17)</sup>

The<sup>1</sup>H-NMR(CDCl<sub>3</sub>) spectrum data of compound (2) show δ:6.8-7.79(m,12H,Ar-H) , 4.5(s,2H,NH ,NH<sub>2</sub>), 2.8(m,6H,CH<sub>3</sub>).

**Synthesis compound (3-6)** have two group of schiff base by react between (2) and sub-aromatic aldehyde .

**compound (3)** 4-(((4-(1-(4-(1H-benzo[d]imidazol-2-yl)phenyl) imino) ethyl) phenyl) imino)methyl)-N,N-dimethylaniline was obtained as orang

**compound (4)** 4-(1-(((4-(1H-benzo[d]imidazol-2-yl)phenyl)imino)ethyl)-N-(4-chloro benzylidene)aniline was obtained as brown solid yield 20.79%,R<sub>f</sub>=0.375 ,M.P ( 140d.)<sup>o</sup>C.

**compound (5)** 4-(((4-(1-(((4-(1H-benzo[d]imidazol-2-yl)phenyl)imino) ethyl) phenyl) imino) methyl)-2-methoxyphenol was obtained as orang solid yield 46.1% , R<sub>f</sub> =0.2 , M.P( 163d.)<sup>o</sup>C.

The<sup>1</sup>H-NMR(CDCl<sub>3</sub>) spectrum data of compound (5) show δ:7-8(m,15H,Ar-H) , 9.5 (s,1H,NH) , 3.6(m,3H,OCH<sub>3</sub>) , 2.1(S,3H,CH<sub>3</sub>) ,8.4(s,1H,CH).

**compound (6)** 4-(1-(((4-(1H-benzo[d]imidazol-2-yl) phenyl) imino) ethyl) -N-benzylidene aniline was obtained as goldenrod solid yield 46.1% , R<sub>f</sub>=0.2 , M.P ( 163d.)<sup>o</sup>C.

The infrared spectrum data of compound (3-6) show absorption at (3047-3209) cm<sup>-1</sup> for (Ar-H),( 3317-3363) cm<sup>-1</sup> (N-H), (1426-1450 )cm<sup>-1</sup> (C-N),(1650)cm<sup>-1</sup> (C=N),and show band at (2839-2962) for (C-H)CH<sub>3</sub>,compound(4)showband at(771) cm<sup>-1</sup> for (C-Cl) , compound(5)showband at(1218) cm<sup>-1</sup> for (C-O ) C-OH ,(1026) cm<sup>-1</sup> (C-O) Ph-O-CH<sub>3</sub>fig(3 ,4,5,6)<sup>(18)</sup>

**Table (1) infrared spectrum data for imidazolidn-4-one derivatives compounds (1,2,3,4,5,6)**

Comp.	$\nu_{\text{Ar-H arom.}}$	$\nu_{\text{N-H}}$	$\nu_{\text{C-N}}$	$\nu_{\text{C=N}}$	$\nu_{\text{C-H aleph.}}$	$\nu_{\text{C=O}}$	$\nu_{\text{C-Cl}}$	$\nu_{\text{OH}}$	$\nu_{\text{ArOCH}_3 \text{ CO}}$
1	3047	3394	1319	1704					
2	3047	3394	1427	1704	2993				
3	3055	3363	1411	1681	2962	1712			
4	3024	3355	1411	1681	2962	1650	771		
5	3078	3309	1411	1681	2962	1697		3349	1257
6	3085	3363	1411	1681	2962	1681			

**Synthesise of compounds(7,8,9,10)** by react between schiff base (3-6) with chloro acetyl chloride .

**compound (7)** 1-(4-(1H-benzo[d]imidazol-2-yl)phenyl)-3-chloro-4-(4-(3-chloro-2-(4-(dimethylamino) phenyl) -4-oxoazetidin-1-yl ) phenyl)-4 -methyl azetidin -2- one was obtained by react between schiff base (3) with chloro acetyl chloride to get (7) as white solid, yield 41.8% ,Rf =0.45 , M.P(255)<sup>o</sup>C.

**compound (8)** 1-( 4-(1H-benzo [d]imidazol-2-yl )phenyl)-3-chloro-4-(4-(3-chloro-2-(4-chlorophenyl)- oxoazetidin-1-yl) phenyl) -4-methylazetidin-2-one was obtained by react between schiff base (4) with chloro acetyl chloride to get (8) as black solid yield 64.1% , Rf =0.65 , M.P( 155d.)<sup>o</sup>C.

**compound (9)** 1-(4-(1H- benzo[d]imidazol-2-yl)phenyl )-3-chloro-4-(4-(3-chloro -2-(4 – hydroxy -3-methoxyphenyl)

-4-oxoazetidin-1-yl) phenyl) -4-methyl azetidin -2-one was obtained by react between schiff base (5) with chloro acetyl chloride to get (9) as purple solid yield 50.8% , Rf =0.7 , M.P(188d.)<sup>o</sup>C.

**compound (10)** 1-(4-(1H-benzo[d]imidazol-2-yl)phenyl)-3-chloro-4-(4-(3-chloro -2-oxo-4 -phenylazetidin-1-yl) phenyl) -4-methylazetidin-2-one was obtained by react between schiff base (6) with chloro acetyl chloride to get (10) as purple solid yield 64.1% , Rf =0.72 , M.P( 148d.)<sup>o</sup>C.

The infrared spectrum data of compound (7,8,9,10) show absorption at (2909-2977) $\text{cm}^{-1}$  for(Ar-H),(32243440) $\text{cm}^{-1}$  (N-H),(1396-1411) $\text{cm}^{-1}$  (C-N),(1696) $\text{cm}^{-1}$  (C=N),and show band at (2947-2970)  $\text{cm}^{-1}$  for (C-H)CH<sub>3</sub>, and (1696-1681)  $\text{cm}^{-1}$  for(C=O)(  $\beta$ - lactam ) compound (11)show band at (771)for(C-Cl) compound(15)showband at(3346)  $\text{cm}^{-1}$  for OH ,(1065)  $\text{cm}^{-1}$  (C-O) Ph-O-CH<sub>3</sub><sup>(19)</sup>

**Table (2) infrared spectrum data for  $\beta$ -lactam derivatives compounds (7,8,9,10)  $\text{cm}^{-1}$** 

Comp	$\nu_{\text{Ar-H aromatic}}$	$\nu_{\text{N-H}}$	$\nu_{\text{C-N}}$	$\nu_{\text{C=N}}$	$\nu_{\text{C-H aleph}}$	$\nu_{\text{C=O}\beta}$ Lactam	$\nu_{\text{C-Cl}}$	$\nu_{\text{OH}}$	$\nu_{\text{ArOCH}_3}$
7	3008	3440	1396	1696	2947	1681			
8	3008	3355	1411	1598	2947	1697	771		
9	3055	3224	1396	1596	2947	1650		3346	1265
10	3008	3363	1396	1596	2970	1697			

**Synthesise of compounds ( 11,12,13,14 )**

by react between schiff base ( 3-6 ) with thioglycollic acid .

**compound (11)** 3-(4-(1H-benzo[d]imidazol-2-yl)phenyl)-2-(4-(2-(4-(dimethyl amino) phenyl)-4-oxothiazolidin-3-yl)phenyl)-2-methylthiazolidin-4-one obtained by react between schiff base (3) with thioglycollic acid to get (11) as brown seram , Rf =0.21 .

**compound (12)** 3-(4-(1H-benzo[d]imidazol-2-yl)phenyl)-2-(4-(2-(4-chloro phenyl)-4-oxothiazolidin-3-yl)phenyl)-2-methylthiazolidin-4-one obtained by react between schiff base (4) with thioglycollic acid to get (12) as brown seram , Rf=0.52 .

**compound (13)** 3-(4-(1H-benzo[d]imidazol-2-yl)phenyl)-2-(4-(2-(4-hydroxy -3- methoxyphenyl)-4-oxothiazolidin-3-yl) phenyl)-2-methylthiazolidin-4-one obtained by react between schiff base (5) with thioglycollic acid to get (13) as brown seram ,Rf =0.71 .

**compound (14)** 3-(4-(1H-benzo[d]imidazol-2-yl)phenyl)-2-methyl-2-(4- (4- oxo -2- phenylthiazolidin-3-yl)phenyl)thiazolidin-4-one obtained by react between schiff base (6) with thioglycollic acid to get (14) as brown seram , Rf=0.499 .

**Synthesis compound**

**(15,16,17,18,19,20,21,22 )** obtained by react schiff base (3-6) with  $\alpha$ -amino acid

**compound (15)** 3-(4-(1H-benzo[d]imidazol-2-yl)phenyl)-2-(4-(2-(4-(dimethyl lamino) phenyl)-5-oxoimidazolidin-1-yl)phenyl)-2-methylimidazolidin-4-one was obtained by react between schiff base (3) with glycine to get (15) as brown solid, yield 71..43% , Rf=0.45 , M.P( 170d.) $^{\circ}\text{C}$ .

**compound (16)** 3- ( 4-( 1H-benzo [d]imidazol-2-yl ) phenyl ) -2-(4-( 2-(4-chlorophenyl) -5-oxoimidazolidin-1-yl) phenyl)-2-methylimidazolidin-4-one was obtained by react between schiff base ( 4 ) with glycine to get ( 16 ) as black solid, yield 58.61% , Rf =0.58 , M.P( 147d.) $^{\circ}\text{C}$

**compound (17)** 3-(4-(1H-benzo[d]imidazol-2-yl)phenyl)-2-(4-(2-(4-hydroxy -3- methoxy phenyl)-5-oxoimidazolidin-1-yl) phenyl)-2-methylimidazolidin-4-one was obtained by react between schiff base (5) with glycine to get (17) as purple solid, yield 90.46% , Rf=0.61 , M.P( 168d.) $^{\circ}\text{C}$  .

**compound (18)** 3-(4-(1H-benzo [d]imidazol-2-yl) phenyl) -2-methyl-2-(4-(5-oxo-2-phenyl imidazolidin-1-yl) phenyl)imidazolidin -4-one was obtained

by react between schiff base (6) with glycine to get (18) as brownrod solid, yield 90.1% , Rf=0.69 , M.P( 173)<sup>o</sup>C .

The <sup>1</sup>H-NMR(CDCl<sub>3</sub>) spectrum data of compound (18) show δ:6.87-8.3( m , 17H , Ar-H ) , 5 ( s , 1H , NH ) , 3.54-3.44 ( m , 2H,CH ) , 2.3 (m,3H,NH) ,1.5(s,3H,CH<sub>3</sub>), 6.1(m,1H,CH).

**compound (19)** 3-(4-( 1H-benzo [ d ] imidazol-2-yl) phenyl) -2-(4-(2-(4-(dimethyl amino ) phenyl) -4-methyl-5-oxoimidazolidin-1-yl) phenyl)-2,5-dimethyl imidazolidin -4-one was obtained by react between schiff base (3) with alanine to get (19) as brown solid, yield 96.23% , Rf=0.53 , M.P( 149d.)<sup>o</sup>C. The <sup>1</sup>H-NMR ( CDCl<sub>3</sub>) spectrum data of compound ( 19 ) show δ : 6.3-8.2 (m,17H, Ar-H), 1.2 (s,6H,CH<sub>3</sub>), 4.5 (s,1H,NH),3.7(m,2H,CH),1.69(s,3H,CH<sub>3</sub>) ,3.2(m,6H,CH<sub>3</sub>).

**compound (20)** 3-(4-(1H-benzo[d]imidazol-2-yl)phenyl ) -2-(4- (2-(4-chloro phenyl) -4- methyl -5-oxoimidazolidin-1-yl) phenyl)-2,5-dimethyl imidazolidin-4-one was obtained by react between schiff base (4) with alanine to get (20) as brown solid, yield 89.49% , Rf=0.64 , M.P( 179)<sup>o</sup>C.

**compound (21)** 3-(4-(1H-benzo[d]imidazol-2-yl)phenyl)-2- (4-(2-(4-hydroxy-3-methoxy phenyl) -4-

methyl-5-oxoimidazolidin-1-yl )phenyl) -2,5- dimethy limidazolidin -4- one was obtained by react between schiff base (5) with alanine to get (21) as purple solid, yield 97.8% , Rf =0.71 , M.P( 185)<sup>o</sup>C.

**compound (22)** 3-(4-(1H-benzo[d]imidazol-2-yl)phenyl)-2,5-dimethyl-2- (4-(4-methyl -5-oxo-2-phenylimidazolidin -1-yl) phenyl) imidazolidin-4-one was obtained by react between schiff base (6) with alanine to get (22) as brown solid, yield 84.345% , Rf=0.62 , M.P( 155)<sup>o</sup>C.

The <sup>1</sup>H-NMR ( CDCl<sub>3</sub>) spectrum data of compound ( 22 ) show δ : 7.2-8.3 ( m , 17H , Ar-H ) , 5.1 ( s , 1H , NH ) , 3.7 ( m , 2H , CH ) , 1.28 (m,6H ,CH<sub>3</sub>) , 2(s,2H,NH), 6.4(m,1H,CH).

The infrared spectrum data of compound (15,16,17,81,19,20,21,22) show absorption at (3024-3085)cm<sup>-1</sup> for (Ar-H),(3309-3456) cm<sup>-1</sup> (N-H), (1396-1411)cm<sup>-1</sup> (C-N), (1504-1598)cm<sup>-1</sup>(C=N),and show band at(2838-2985)cm<sup>-1</sup>for (C-H)CH<sub>3</sub>, and(1681-1712) cm<sup>-1</sup> for(C=O) ,compound (13)and (14) show band at (825)for (C-Cl), compound(17)showband at(3749) cm<sup>-1</sup> for OH ,(1257) cm<sup>-1</sup> (C-O) Ph-O-CH<sub>3</sub>, but compound (18) show band at (3347) cm<sup>-1</sup> for OH ,(1265) cm<sup>-1</sup> (C-O) Ph-O-CH<sub>3</sub> <sup>(20)</sup>



**Table (3) infrared spectrum data for imidazolidn-4-one derivatives compounds (15,16,17,18,19,20,21,22) cm<sup>-1</sup>**

Comp.	$\nu_{\text{Ar-H}}$	$\nu_{\text{N-H}}$	$\nu_{\text{C-N}}$	$\nu_{\text{C=N}}$	$\nu_{\text{C-H}}$ aleph.	$\nu_{\text{C=O}}$	$\nu_{\text{C-Cl}}$	$\nu_{\text{OH}}$	$\nu_{\text{ArOCH}_3}$ CO
15	3055	3456	1396	1596	2838	1697			
16	3055	3384	1404	1504	2838	1697	825		
17	3055	3350	1411	1589	2838	1712		3349	1257
18	3024	3363	1411	1596	2838	1650			
19	3078	3309	1411	1596	2931	1697			
20	3085	3355	1411	1598	2985	1681	825		
21	3070	3309	1411	1596	2949	1681		3346	1265
22	3070	3363	1411	1596	2931	1681			

**Table(4):- Analytical and physical data of compounds .**

No.	Molecular formula	Color	M.P°C	Yield%	R <sub>f</sub>
1	C <sub>13</sub> H <sub>11</sub> N <sub>3</sub> (209.247)	silver	211	76.92	0.34
2	C <sub>21</sub> H <sub>18</sub> N <sub>4</sub> (326.394)	purple	220.	941	0.64
3	C <sub>30</sub> H <sub>27</sub> N <sub>5</sub> (457.569)	orang	240	92.28	0.62
4	C <sub>28</sub> H <sub>21</sub> N <sub>4</sub> Cl (448.946)	Brown	140 d.	20.79	0.375
5	C <sub>29</sub> H <sub>24</sub> N <sub>4</sub> O <sub>2</sub> (469.190)	orang	163d.	46.1	0.2
6	C <sub>28</sub> H <sub>22</sub> N <sub>4</sub> (414.501)	Goldenrod	153d.	27.96	0.43
7	C <sub>34</sub> H <sub>29</sub> N <sub>5</sub> O <sub>2</sub> Cl <sub>2</sub> (610.532)	white	255	41.8	0.45
8	C <sub>32</sub> H <sub>23</sub> N <sub>4</sub> O <sub>2</sub> Cl <sub>3</sub> (601.910)	black	155	64.1	0.65
9	C <sub>33</sub> H <sub>26</sub> N <sub>4</sub> O <sub>4</sub> Cl <sub>2</sub> (591.102)	purple	180d	50.8	0.7
10	C <sub>32</sub> H <sub>24</sub> N <sub>4</sub> O <sub>2</sub> Cl <sub>2</sub> (567.469)	purple	148	40.56	0.72
11	C <sub>34</sub> H <sub>31</sub> N <sub>5</sub> O <sub>2</sub> S <sub>2</sub> (605.722)	Brown	liquid	88	0.21
12	C <sub>32</sub> H <sub>25</sub> N <sub>4</sub> O <sub>2</sub> S <sub>2</sub> Cl (605.722)	Brown	liquid	92	0.52
13	C <sub>33</sub> H <sub>28</sub> N <sub>4</sub> O <sub>4</sub> S <sub>2</sub> (608.730)	Brown	liquid	77.7	0.71

14	C <sub>33</sub> H <sub>26</sub> N <sub>4</sub> O <sub>2</sub> S <sub>2</sub> (562.704)	Brown	liquid	93	0.499
15	C <sub>34</sub> H <sub>33</sub> N <sub>7</sub> O <sub>2</sub> (571.672)	Brown	170 d.	76.45	0.45
16	C <sub>32</sub> H <sub>27</sub> N <sub>6</sub> O <sub>2</sub> Cl (563.049)	black	147	58.614	058
17	C <sub>33</sub> H <sub>30</sub> N <sub>6</sub> O <sub>4</sub> (574.629)	purple	168	90.46	0.61
18	C <sub>32</sub> H <sub>28</sub> N <sub>6</sub> O <sub>2</sub> (528.604)	brownrod	173	90.1	0.69
19	C <sub>36</sub> H <sub>37</sub> N <sub>7</sub> O <sub>2</sub> (571.672)	Brown	149d.	96.23	0.53
20	C <sub>34</sub> H <sub>31</sub> N <sub>6</sub> O <sub>2</sub> Cl (591.102)	Brown	179	89.49	0.64
21	C <sub>35</sub> H <sub>34</sub> N <sub>6</sub> O <sub>4</sub> (574.629)	purple	185	97.8	0.71
22	C <sub>34</sub> H <sub>32</sub> N <sub>6</sub> O <sub>2</sub> (556.657)	brownrod	155	84.345	0.62

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