RESEARCH PAPER

Synthesis and Characterization of a New Series of Arylidene Compounds from 2-Iminothiazolidine-4-one derivatives

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ABSTRACT:

The present work describes the synthesis and characterization of a new series of arylidene compounds from 2-iminothiazolidine-4-one which includes the preparation of 2-chloro-N-(4-(6-methyl benzoyl[2] thiazol-2-yl) phenyl) acetamide which was prepared through the reaction of 4-(6-methylbenzothiazole-2-yl) benzyl amine with chloroacetyl chloride in dry benzene to afford 2-chloro-N-(4-(6-methyl benzoyl[2] thiazol-2-yl)phenyl) acetamide. The later compound easily undergo cyclization reaction by potassium thiocyanate in dry acetone and results the formation of 2-imino-3-(4-(6-methylbenzo[2] thiazol-2-yl) phenyl) thiazolidin-4-one. After cyclization let react with different aromatic aldehydes to produce 5-benzylidene-2-imino-3-(4)-6-methyl benzoyl[2] thiazol-2-yl) phenyl) thiazolidin-4-one. The FT-IR, 1H-NMR and 13C-NMR, 13C-DEPT-135, UV-Visible) spectra of the prepared compounds were confirmed the proposed structure, ultimately antimicrobial activity of the newly obtained compounds were tested against (Staphylococcus aureus) (+ve), (Pseudomonas aeruginosa) (-ve) and the results showed that most of the prepared compounds are sensitive against both types of test organisms in different activities.

KEY WORDS: iminothiazolidin-4-one, arylidene, antimicrobial.
DOI: http://dx.doi.org/10.21271/ZJPAS.31.s4.16
ZJPAS (2019), 31(s4):97-108.

1. INTRODUCTION:

Heterocyclic compounds, or heterocycles, are cyclic compounds in which one or more of the atoms of the ring are hetero atoms. A heteroatom is an atom other than carbon. The name comes from the Greek word heteros, which means “different.” A variety of atoms, such as N, O, S, Se, P, Si, B and As, can be incorporated in to ring structures. By far the most numerous and most important heterocyclic systems are those of five and six members (Vijay & Lakshika, 2011). Heterocycles bearing nitrogen, sulphur such as thiazol moieties constitute the core structure of a number of biologically interesting compounds (Reddy et al., 2011).

One of the main objectives of organic and medicinal chemistry is the design, synthesis and production of molecules having values as human therapeutic agents and the treatment of infectious diseases still remains an important and challenging problem because of a combination of factors, including emerging infectious diseases and the increasing number of multi-drug resistant microbial pathogens (Behbehani et al., 2012). Thiazole derivatives are important classes of heterocyclic and especially their aromatics that have five member molecular ring structures C5H3NS. 4-Thiazolidinones are derivatives of thiazolidine which belongs to an important group of heterocyclic compounds (Kalantari, 2013). A lot of research work on thiazolidinones have been done in the past (Chavan & Pi., 2007) for their pharmaceutical application (Kasmi-Mir et al.,

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Article History:
Published: 01/10/2019
2006). The chemistry of thiazolidin-4-one ring systems is of considerable interest as it is a core structure in various synthetic pharmaceuticals displaying a broad spectrum of biological activities.( Khazaei et al., 2014, Saundane et al., 2013, Reddy et al., 2011). The developing new derivatives as dual antimicrobial / anti-inflammatory agents. (Apostolidis et al., 2013) describe the synthesis of novel 5-arylidene-thiazolidin-4-ones. 4-Thiazolidinone and its arylidene compounds give a good pharmacological properties also known to exhibit antifungal, anticonvulsant, and antibacterial activities (Kiyani and Ghorbani, 2013). Multidrug resistance has become a factor seriously limiting treatment of various diseases, including bacterial, fungal, infections and cancer (Handzlik et al., 2012). It was shown that the presence and the importance (Thirupathi et al., 2012). Thus, the synthesis of 4-arylidene thiazolidinones is recently of very much importance. (Thirupathi et al., 2012).

2. Experimental

Instruments:

1. Melting points were determined by a DMP 100 uncorrected melting point apparatus.
2. IR –Spectra were recorded on a SHIMADZU, FT-IR spectroscopy Mod IR Affinity-1 CE, in which solid materials were taken as a KBr disc special for spectroscopy.
3. The 1H-NMR, 13C-NMR and 13C –DEPT -135 spectra were taken on a Bruker 400 MHz ultra shield with TMS as internal reference, in Jordan University of Science and Technology.
4. UV-Visible spectra were recorded on SHIMADZU -1800 spectrophotometer (DMSO).

2.1 Synthesis of 2-chloro-N-(4-(6-methylbenzo[d]thiazol-2-yl) phenyl) acetyl amide (1) (Liu et al., 2000)

A solution of 4-(6-methyl-2-benzothiazole-2-yl) benzyl amine (0.01) mole in dry benzene (30 ml) was cooled to 0-5 °C. Chloroacetyl chloride (10 ml, 0.04 mol) dissolved in dry benzene (20 ml) was slowly added to the solution with vigorous stirring. When the addition was completed, the reaction mixture was refluxed for (6 hrs). Benzene was removed in vacuum. The residue was washed with 5% diluted sodium bicarbonate, and subsequently with water. The product was dried and crystallized from abs. methanol to obtain yellow crystals of 2-chloroacetamido, yield 2.9 gm (91 %), m. p 220-222 0 C, λ max 337.4 nm. IR (cm−1) 3332 (NH) str., 3020.53 aromatic CH str., 2978.74 (CH) str. aliphatic, 1680 (C=O) str., 1597 (C=C) str.

2.2 Synthesis of 2-imino-3-(4-(6-methylbenzo[d]thiazol-2-yl) phenyl) thiazolidin-4-one) (2) (Liu et al., 2000)

A mixture of 2-chloro-N-(4-(6-methylbenzo[d]thiazol-2-yl) phenyl) acetamide (0.01) mole, KSCN (0.01) mole and dry acetone (33 ml) was refluxed for 6 hrs. Excess acetone was removed in vacuo and the residue was dried. The 2-iminothiazolidinone was obtained by crystallization from methanol: yield 1.3 gm (% 76), m.p. 210-212 0 C, λ max 337.2 nm. IR (cm−1) (NH) 3336, (CH) aliphatic str. 2990, (C=O) 1778 str., 1593 (C=C) str.

2.3 General procedure for the synthesis of 5-benzylidene-2-imino-3-(4(6 methylbenzo[d] thiazol-2-yl) phenyl) thiazolidin-4-one(3a-l) (Lobo et al., 2014):

2-Imino -3-(4-phenylthiazole-2-yl)-thiazolidin-4-ones (0.01) mole and different aromatic aldehyde (0.02) mole are added to a solution of anhydrous NaOAc (0.8 gm) and glacial acetic acid (10 ml). The reaction mixture was refluxed for 3 hrs then cooled to room temp. and poured into ice cold water. The separated solid product was filtered, washed with water, dried and recrystallized from absolute methanol. The yields and melting points of synthesized 5-arylidens are shown in Table (1).

Table (1): Some physical properties of synthesized 5-benzylidene-2-imino-3-(4 (6-methyl benzo [d]thiazol-2-yl) phenyl) thiazolidin-4-one (3a-l):

![Chemical Structure](image-url)
Results and Discussions

3.1 Spectroscopic study of 2-chloro-N-(4-(5-methylbenzo[d]thiazol-2-yl) phenyl) acetamide

(1) (Liu *et al.*, 2000):

The most frequently used method for the preparation of amides is the reaction of amine and acyl chloride under reflux condition in dry benzene, (Liu *et al.*, 2000)

![Reaction diagram](image)

In the IR spectrum of compound (1), Figure (1), (Vinay *et al.*, 2011; Theodorou *et al.*, 2009), the appearance of a band at 3332 cm⁻¹ for (N-H)str. of secondary amide group, the most important feature of this spectrum is (C=O)str. of the amide assigned at 1680 cm⁻¹ Katke *et al.*; 2011), the absorption band of aromatic group for C=C is assigned at 1525 cm⁻¹ while the band at 1604 cm⁻¹ is attributed to the (C=N) str. of thiazole ring and the two strong absorption bands corresponding to −(COCH₂) group occurs at (1251 asym. and 1182 sym.) cm⁻¹.

Also information of compound (1), (Gadre *et al.*, 2007) was evidenced from ¹H-NMR spectrum Figure (2), by the appearance of singlet signal at δ 2.43 ppm fitted to the three protons of (−CH₃) group, another singlet at δ 4.49 ppm related to the protons of (−CH₂Cl) group (Nadr, 2015; Hajipoor and Ghasemi, 2001.), four doublets at δ (7.04 -

| Comp No.1 | X       | M.F                                      | Yield% | M wt. (g/ mole) | M.P °C | λₓ max nm |
|----------|---------|------------------------------------------|--------|-----------------|--------|-----------|
| a        | 4-Br    | C₂₅H₁₉N₅S₂OBr                           | 69%    | 506.44          | 270-272| 337.1     |
| b        | 4-OH    | C₂₅H₁₈N₅S₂O₂                            | 80%    | 443.54          | 240-242| 337.2     |
| c        | 4-OCH₃  | C₂₅H₁₉N₅S₂O₂                            | 76%    | 457.57          | 220-222| 337.3     |
| d        | 2-F     | C₂₅H₁₈N₅S₂OF                            | 68%    | 445.53          | 235-237| 337.2     |
| e        | 3-Cl    | C₂₅H₁₉N₅S₂OCl                           | 76%    | 461.99          | 200-202| 337.2     |
| f        | 2-Cl    | C₂₅H₁₉N₅S₂OCl                           | 76%    | 461.99          | 172-174| 337.4     |
| g        | 4-F     | C₂₅H₁₉N₅S₂OF                            | 74%    | 445.53          | 210-212| 337.4     |
| h        | 3-Nitro | C₂₅H₁₈N₅S₂O₃                            | 69%    | 472.54          | 266-268| 337.2     |
| i        | 4-Nitro | C₂₅H₁₈N₅S₂O₃                            | 75%    | 472.54          | 172-174| 337.4     |
| j        | 4-N(CH₃)₂| C₂₅H₂₂N₄S₂O                            | 76%    | 470.61          | 175-177| 337.2     |
| k        | 4-CH₃   | C₂₅H₁₇N₃S₂O                            | 80%    | 445.57          | 260-262| 337.2     |
| l        | H       | C₂₅H₁₇N₃S₂O                            | 77%    | 427.54          | 239-241| 337.2     |
8.07) ppm related to (Ar-H) of two phenyl groups, and the other singlet signal appear at $\delta$ (10.97) ppm (Vinayak et al., 2014,) which is more deshielded related to the (-NH) of amide group.

$^{13}$C-NMR spectrum assignments of compound (1) Figure (3), (Hamad 2010) showed different chemical shifts: (-CH$_3$) at $\delta$ 21.28 ppm, (-CH$_2$-Cl) at $\delta$ 43.83 ppm, also at $\delta$ (140.7, 149.4 ) ppm for C$_5$, C$_4$ in thiazole ring and at $\delta$ (123.5 122.0, 127.6, 131.1, 137.2, 138.5) ppm for C$_6$, C$_3$, C$_2$, C$_8$, C$_1$, C$_11$ while the chemical shifts of C$_{10,10}$, C$_{9,9}$ at 123.1, 128.7, $\delta$ C$_{12}$(C=O) of amide group appear at 165.31 ppm and for $\delta$ C$_7$ at $\delta$ 165.96 ppm.

The $^{13}$C- DEPT -135 of compound (1), Figure (4) showed up warded signal at $\delta$ 21.28 ppm for (CH$_3$) group and demonstrated downward signal at $\delta$ -43.83 ppm for di protonated carbon atom of (-CH$_2$) group, and illustrated five different upward signals at $\delta$ (123.5, 122.0, 123.1, 127.6, 128.7) ppm for C$_6$, C$_3$, C$_{10,10}$, C$_2$, C$_{9,9}$ according to the mono protonated (CH) carbon atoms signal for aromatic rings.
3.2 Spectroscopic study of 2-imino-3-(4-(5-methylbenzo[d]thiazol-2-yl) phenyl) thiazolidin-4-one (2), (Liu et al., 2000).

Since the spectroscopic substitution reaction of alkyl halides with potassium thiocyanate was successful especially in polar aprotic solvent, we decided to follow some astrology for carrying out reaction between the compounds (amide) with potassium thiocyanate in dry acetone under reflux condition. In this reaction the situate generated substitution product readily undergoes cyclization reaction to yield 2-imino-3-(4-(5-methylbenzo[d]thiazol-2-yl) phenyl) thiazolidin-4-one(2).

IR spectrum of compound (2), Figure (4), (Dalloul & Al-Shorafa 2009; Solanke & Patel; 2012) showed (NH)str. absorption band at 3232 cm$^{-1}$, exhibit a strong band at 1716 cm$^{-1}$ which belonged to carbonyl groups (Dhar, Bhaumik & Reddy, 2013), that is considered as evidence for the formation of the ring desired product and strong band at 1552 cm$^{-1}$ belongs to imino (C=NH), C=C 1637 cm$^{-1}$.

Fig (3): $^{13}$C-NMR spectrum of compound 1

Fig (4): IR spectrum of compound (2)
The Figure (5) shows the $^1$H-NMR spectrum for 2-iminothiazolidin-4-ones (2), (Patel et al. 2006; Dhar, Bhaumik and Reddy, 2013), the $^1$H-NMR spectrum data of demonstrated a single signal at $\delta$ 2.5 ppm fitted to the three protons of CH$_3$ group, and another singlet at $\delta$ 4.36 ppm is related to the (CH$_2$ cyclic) of thiazole ring, also signals at $\delta$ (7.13- 8.87) ppm are related to the (Ar-H) of phenyl groups, and the other singlet signal appears at 10.73 ppm which is more deshielded related to the (-NH) of imino group.

It seen from $^{13}$C-NMR of 2-iminothiazolidinones (2), Figure (6), (Hussein and Azeez 2013), that the (CH$_3$) group appears at $\delta$ 21.12 ppm, (-CH$_2$ cyclic) of thiazolidinone ring at $\delta$ 38.8 ppm and different types of carbon in different chemical shifts as $\delta$ at (132.8, 133.2, 137.2, 150.2, 150.4) ppm for (C$_5$,C$_1$,C$_{11}$,C$_4$,C$_8$) while C$_7$ (C=N) at $\delta$ 166.1 ppm, C$_{12}$ (C=O) group at $\delta$ 171.58 ppm and $\delta$ 165.3 for C$_{14}$ (C=NH).

The DEPT-135 spectrum of compound (2), Figure (6), (Hussein and Azeez 2013) showed up warded signal at $\delta$ 21.12 ppm for CH$_3$ group and demonstrated downward signal at $\delta$ -38.8 ppm for di protonated carbon atom of (-CH$_2$ cyclic) group, and illustrated five different upward signals at $\delta$ (122.9, 123.5, 122.5, 125.9, 126.8) ppm according to the mono protonated (CH) carbon atoms signals were upward signal for aromatic ring for (C$_6$,C$_3$,C$_{10}$,C$_{10}$,C$_2$,C$_9$) respectively.
3.3 Spectroscopic study of 5-(4-substitutedbenzylidene-2-imino-3-(4)-5-methylbenzo[d]thiazol-2-yl) phenyl thiazolidin-4-one (3a – l),(Lobo et al, 2000).

2-Imino-3-(4-(5-methylbenzo[d]thiazol-2-yl) phenyl) thiazolidin-4-one with different aromatic aldehyde are added to a solution of anhydrous NaOAc in glacial acetic acid. The reaction mixture was refluxed for 3hr.

In the IR spectrum of compound 5-(4-bromobenzylidene)-2-imino-3-(4-(6-methylbenzo[d]thiazol-2-yl)phenyl) thiazolidin-4-one (3a), Figure (7), the shifting absorption band (NH) str.to 3296 cm\(^{-1}\), absorption band of carbonyl to 1699 cm\(^{-1}\) (Waghmare et al, 2015), (C=C) str. at 1558 cm\(^{-1}\) and olefinic (C=CH) str. at 1627 cm\(^{-1}\) were considered a good evidence to produce benzaldehyde derivatives and two bands at (2970 & 2870) cm\(^{-1}\) equivalent to the (C-H) str. of methyl group.

Table -3

From the \(^1\)H-NMR spectrum data of 5-(4-nitrobenzylidene)-2-imino-3-(4-(6-methylbenzo[d]thiazol-2-yl) phenyl) thiazolidin-4-one (3i), Figure (8), (Kaveh et al, 2011; Gardre et al, 2007) the CH\(_3\) group appears at \(\delta\) (2.30) ppm (Solankee, Patel, and Patel; 2012), (C=CH) group appears at \(\delta\) 7.33 ppm (Kumar et al, 2013, Waghmare et al, 2015), \(\delta\) 7.5-8.01 (Shirvastava, Seelam and Rai; 2012) ppm for aromatic and \(\delta\) 10.66 ppm due to NH group. Table -4 shows the explanation of the \(^1\)H-NMR data of benzylidene (3 e, i, j, k and l).

Fig (7) : IR spectrum of compound (3 a)

Fig (8) : \(^1\)H-NMR spectrum of compound 3 i
$^{13}$C-NMR spectrum data of 5-(4-nitrobenzylidene)-2-imino-3-(4-(6-methylbenzo[d]thiazol-2-yl)phenyl) thiazolidin-4-one(3 i), Figure (9), the CH$_3$ group appears at δ 21.2 ppm, δ (114.6-152.5) for Ar-carbons, δ 151.4 ppm for (C=NH)C$_{14}$, δ 167.5 ppm for (C=N)C$_7$, δ 148.8 ppm for C$_{19}$ and 169.0 ppm for δ C$_{12}$ (C=O). Table 5.

![Fig (9): $^{13}$C-NMR spectrum of compound 3 i](image)

The $^{13}$C-DEPT-135 spectrum of compound 5-(4-nitrobenzylidene)-2-imino-3-(4-(5-methylbenzo[d]thiazol-2-yl)phenyl) thiazolidin-4-one(3 i) , Figure (9), δ for CH$_3$ appears at 21.2 ppm and illustrated eight different upward signals at δ (114.2-147.0) ppm according to the mono protonated (CH) carbon atoms in benzene rings. Table-6

![Fig (9): $^{13}$C-DEPT-135 spectrum of compound 3 i](image)
### Table 3: Assignments of characteristic frequencies (cm\(^{-1}\)) of IR spectra of the new 5-benzilidene derivatives (3 a-l):

| Comp. No. | N-H str. | C-H str. | C-H str. | C=O Str. | C=C str. | C=NH str. |
|-----------|----------|----------|----------|----------|----------|----------|
|           | N-H str. | Aromatic | CH\(_2\),CH\(_3\) | Olefinic | phenyl | Imine |
| 3 a       | 3296     | 3047     | 2918,2989 | 1670     | 1627     | 1521     | 1558   |
| 3 b       | 3246     | 3049     | 2914,2987 | 1670     | 1629     | 1560     | 1597   |
| 3 c       | 3248     | 3050     | 2920,2852 | 1670     | 1629     | 1560     | 1590   |
| 3 d       | 3263     | 3049     | 2989,2850 | 1674     | 1633     | 1521     | 1558   |
| 3 e       | 3253     | 3049     | 2918,2854 | 1668     | 1629     | 1510     | 1558   |
| 3 f       | 3464     | 3047     | 2920,2850 | 1693     | 1633     | 1521     | 1554   |
| 3 g       | 3479     | 3045     | 2920,2852 | 1700     | 1631     | 1508     | 1598   |
| 3 h       | 3621     | 3043     | 2920,2916 | 1676     | 1633     | 1525     | 1597   |
| 3 i       | 3468     | 3041     | 2999,2850 | 1674     | 1606     | 1521     | 1552   |
| 3 j       | 3257     | 3045     | 2922,2856 | 1670     | 1629     | 1523     | 1597   |
| 3 k       | 3253     | 3045     | 2974,2850 | 1668     | 1629     | 1560     | 1550   |
| 3 l       | 3253     | 3047     | 2918,2800 | 1670     | 1631     | 1521     | 1558   |

### Table 4: The \(^1\)H-NMR data for some of the synthesized substituted benzylidene (3 e, g, i and k): Solvent DMSO:

| Product No. | \(\delta\) ppm | Multiplicity | Intensity | Assignment |
|-------------|-----------------|--------------|-----------|------------|
| 3 e         | 2.37            | s            | 3H        | -CH\(_3\)  |
|             | 7.12            | s            | 1H        | C=CH       |
|             | 7.4-8.36        | m            | 11H       | Ar-H       |
|             | 10.41           | s            | 1H        | NH         |
| 3 g         | 2.35            | s            | 3H        | -CH\(_3\)  |
|             | 7.33            | m            | 1H        | C=CH       |
|             | 7.4-8.7         | m            | 11H       | Ar-H       |
|             | 10.65           | s            | 1H        | NH         |
| 3 i         | 2.30            | s            | 3H        | -CH\(_3\)  |
|             | 7.33            | m            | 1H        | C=CH       |
|             | 7.5-8.01        | m            | 11H       | Ar-H       |
|             | 10.66           | s            | 1H        | NH         |
| 3 j         | 2.35            | s            | 3H        | CH\(_3\)   |
|             | 2.85            | s            | 6H        | N(CH\(_3\))\(_2\)   |
|             | 7.3             | s            | 1H        | C=CH       |
|             | 7.8-8.18        | m            | 11H       | Ar-H       |
|             | 10.43           | s            | 1H        | NH         |
| 3 k         | 2.35            | s            | 3H        | CH\(_3\)   |
|             | 2.5             | s            | 3H        | CH\(_3\)   |
|             | 7.18            | s            | 1H        | C=CH       |
|             | 7.3-8.2         | m            | 11H       | Ar-H       |
|             | 10.51           | s            | 1H        | NH         |
Table (5): The $^{13}$C-NMR data for some of the synthesized substituted benzylidene (3 e, g, i, j, and k): solvent DMSO

| Assign | $\delta$/ ppm | $\delta$/ ppm | $\delta$/ ppm | $\delta$/ ppm | $\delta$/ ppm |
|--------|---------------|---------------|---------------|---------------|---------------|
| CH$_3$ | 20.78         | 20.63         | 21.2          | 21.28         | 23.9          |
| CH$_2$ |               |               |               |               | 24.3          |
| N(CH$_3$)$_2$ |     | 40.3         |               |               |               |
| C$_6$  | 120.5         | 121.5         | 121.7         | 121.0         | 120.9         |
| C$_7$  | 121.0         | 121.7         | 122.1         | 122.0         | 121.5         |
| C$_{10,10}$ | 124.1     | 123.0         | 122.7         | 122.1         | 124.3         |
| C$_{11}$ | 124.5         |               |               |               |               |
| C$_{17}$ | 126.5         | 128.0         | 127.3         | 126.3         | 126.5         |
| C$_8$  | 126.6         | 124.0         | 125.0         | 126.0         | 127.0         |
| C$_9$  | 127.71        | 127.0         | 127.9         | 128.0         | 128.4         |
| C$_{18}$ | 128.1         | 115.4         | 114.6         | 114.2         | 129.0         |
| C$_{19}$ | 129.14        | 129.5         | 129.8         | 130.1         | 131.5         |
| C$_{20}$ | 130.1         | 162.1         | 148.8         | 149.2         | 137.6         |
| C$_{11}$ | 132.8         | 133.0         | 131.2         | 133.8         | 132.5         |
| C$_{12}$ | 134.2         | 135.5         | 133.0         | 135.2         | 134.9         |
| C$_{20}$ | 135.0         |               |               |               |               |
|        | 135.7         | 136.0         | 135.5         | 138.1         | 136.8         |
| C$_{16}$ | 136.6         | 130.8         | 123.5         | 124.7         | 137.1         |
| C$_{13}$ | 142.16        | 148.0         | 147.0         | 142.5         | 145.0         |
| C$_{14}$ | 153.8         | 153.5         | 151.4         | 154.5         | 152.6         |
| C$_{1}$  | 155.0         | 151.4         | 152.5         | 153.4         | 154.6         |
| C$_{19}$ | 165.3         | 165.1         | 167.5         | 167.1         | 166.5         |
| C$_{12}$ | 167.9         | 166.7         | 168.9         | 168.9         | 166.9         |

Table (6): The $^{13}$C-DEPT-135 data for some of the synthesized substituted benzylidene (3 e, g, i, j, k): Solvent DMSO.

| Assign | $\delta$/ ppm | $\delta$/ ppm | $\delta$/ ppm | $\delta$/ ppm | $\delta$/ ppm |
|--------|---------------|---------------|---------------|---------------|---------------|
| CH$_3$ | 20.78         | 20.63         | 21.2          | 21.28         | 23.9          |
| CH$_2$ |               |               |               |               | 24.3          |
| N(CH$_3$)$_2$ |     | 40.3         |               |               |               |
| C$_6$  | 120.5         | 121.5         | 121.7         | 121.0         | 120.9         |
| C$_7$  | 121.0         | 121.7         | 122.1         | 122.0         | 121.5         |
| C$_{10,10}$ | 124.1     | 123.0         | 122.7         | 122.1         | 124.3         |
| C$_{11}$ | 124.5         |               |               |               |               |
| C$_{17}$ | 126.5         | 128.0         | 127.3         | 126.3         | 126.5         |
| C$_8$  | 126.6         | 124.0         | 125.0         | 126.0         | 127.0         |
| C$_9$  | 127.71        | 127.0         | 127.9         | 128.0         | 128.4         |
| C$_{18}$ | 128.1         | 115.4         | 114.6         | 114.2         | 129.0         |
| C$_{19}$ | 129.14        | 129.5         | 129.8         | 130.1         | 131.5         |
| C$_{20}$ | 130.1         | 162.1         | 148.8         | 149.2         | 137.6         |
| C$_{11}$ | 132.8         | 133.0         | 131.2         | 133.8         | 132.5         |
| C$_{12}$ | 134.2         | 135.5         | 133.0         | 135.2         | 134.9         |
| C$_{20}$ | 136.0         |               |               |               |               |
|        | 135.7         | 136.0         | 135.5         | 138.1         | 136.8         |
| C$_{16}$ | 138.6         | 130.8         | 123.5         | 124.7         | 137.1         |
| C$_{13}$ | 142.16        | 148.0         | 147.0         | 142.5         | 145.0         |
| C$_{14}$ | 153.8         | 153.5         | 151.4         | 154.5         | 152.6         |
| C$_{1}$  | 155.0         | 151.4         | 152.5         | 153.4         | 154.6         |
| C$_{19}$ | 165.3         | 165.1         | 167.5         | 167.1         | 166.5         |
| C$_{12}$ | 167.9         | 166.7         | 168.9         | 168.9         | 166.9         |
4.4 Screening of the synthesized 5-benzylidene compounds for their antibacterial activity against two types of bacteria. The biological activities of some chemical compounds against S. aureus and P. aeruginosa determined according to Clinical and Laboratory Standards Instituted (CLSI). Some of the synthesized compounds were screened for their antibacterial activity against two types of bacteria Staphylococcus aureus G (+ve) and Pseudomonas aeruginosa G (-ve) During this study, it was cleared that the prepared compounds possess anti-bacterial activity and their results were mentioned in (mm). According to the obtained results, small inhibition zone of (3 c, 3 e) against (Staphylococcus aureus) were observed. This means that this bacteria was more resistance against above compounds but (Pseudomonas aeruginosa) type of bacteria was sensitive against target products, because most of the measured inhibition zone produced by G (-ve) type of bacteria was greater than the inhibition zone of G (+ve) type of bacteria. The results are summarized in the Table -7.

Table -7: Anti-bacterial activity of some synthesized arylidenes (1,2,3 a-l) with inhibition zone diameters in (mm) scale, against (Staphylococcus aureus) and (Pseudomonas aeruginosa):

| Product No. | Inhibition zone |
|-------------|-----------------|
| Compounds   | S. aureus G(+ve) (mm) | P. aeruginosa G (-ve) (mm) |
| 1           | 19              | 30               |
| 2           | 20              | 40               |
| 3 a         | 22              | 25               |
| 3 b         | 15              | 29               |
| 3 c         | 10              | 32               |
| 3 d         | 20              | 36               |
| 3 e         | 10              | 35               |
| 3 f         | 20              | 34               |
| 3 g         | 15              | 26               |
| 3 i         | 18              | 30               |
| 3 j         | 17              | 33               |
| 3 k         | 13              | 28               |
| 3 l         | 18              | 31               |
| KBr         | 0               | 0                |
According to the reported procedure (el-masry et al.;2000 ) highly active inhibition zone > 34 mm
active inhibition zone 25-35mm ; moderately

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