Synthetic Approaches and Biological Evaluation of Some New Sulfonate Ester-Containing Imidazolone Derivatives

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Abstract Oxazolone derivative 2 was utilised as a key intermediate for the synthesis of some new imidazolone derivatives. Reaction of 2 with p-aminoacetophenone in the presence of acetic acid containing catalytic amount of freshly fused sodium acetate gives the corresponding imidazolone derivative 3 which on reaction with diethyl oxalate in the presence of granulated sodium metal afforded the corresponding imidazolone derivative 4. Condensation of compound 3 with some aromatic aldehydes afforded the corresponding cinnamoylphenyl derivatives 5a-c, respectively. Besides, compounds 5a-c reacted with hydrazine hydrate in boiling ethanol and yield the corresponding 4-arylidene-1-(5-oxo-2-phenyloxazol-4(5H)-ylidene)methyl)phenyl4-methyl benzenesulfonate which on reaction with thiourea in ethanol afforded the corresponding thienopyrimidine derivative 6a. On the other hand, reaction of oxazolone 2 with both ethyl p-aminobenzoate and anthranilic acid in glacial acetic acid and freshly fused sodium acetate has been also studied. Structures of the newly synthesized compounds were established by elemental analysis and spectral data. Representative compounds of the synthesized products were tested and evaluated as antifungal and antimicrobial agents. Most of compounds exhibited good activities against Bacillus Thuringensis and Klebsiella Pneumonia, while compounds 3, 4, 6a, 6b, 6c, 7a, 8a, 8c, 11, 12 and 16 exhibited good activities against Trichoderma Herzianum and Trichoderma Virdi.

Keywords Oxazolone, Imidazolone, Pyrazole, Pyrimidine, Antibacterial

1. Introduction

Substituted oxazolone and imidazolone derivatives have become of great importance due to their wide range of biological activity. Previous studies have been reported that, they exhibit good anticonvulsant, bactericidal, fungicidal and insecticidal activities. Besides, they were shown a wide range of pharmaceutical properties [1-5]. On the other hand, it has been stated that, compounds containing aromatic sulfonate or sulfonamide moieties possess high acaricidal as well as insecticidal activity [6-7].

2. Results and Discussion

The present investigation aims to synthesize a series of products bearing both aryl sulfonate, oxazolone and imidazolone moieties in the same molecule hoping that these new products might show high biocidal activity. Thus, The required (Z)-4-((5-oxo-2-phenyloxazol-4(5H)-ylidene)methyl)phenyl-4-methyl benzenesulfonate 2, was prepared by means of the reaction of 4-toluene sulfonyl oxy benzaldehyde 1 with hippuric acid and acetic anhydride in the presence of freshly fused sodium acetate according to the method reported in literature [8], (scheme 1).

Scheme 1. Synthesis of oxazolone derivative 2

In the present study, oxazolone 2 reacts with p-aminocetophenone in glacial acetic acid and fused sodium acetate giving (Z)-4-((1-(4-acetylphenyl)-5-oxo-2-phenyl-1H-imidazol-4(5H)-ylidene)methyl)phenyl4-methylbenzenesulfonate 3. Structure of 3 was confirmed by both analytical and spectral data. The IR spectrum exhibited absorption bands at 1715 and 1679 cm⁻¹ characteristic for (–COCH₃) and (CON) groups, respectively. ¹H-NMR spectrum exhibited singlet signal at 6 2.6 characteristic for COCH₃ protons. Moreover, the mass spectrum measurement gave an evi-
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Evidence for the proposed structure, which showed the molecular ion peak at m/e 536 (M+)(Scheme 2).

![Scheme 2. Reaction of oxazolone 2 with p-aminoacetophenone](image)

Treatment of compound 3 with diethyl oxalate in the presence of granulated sodium metal produced the corresponding imidazolone derivative 4. In addition, compound 3 undergoes condensation with some aromatic aldehydes namely, benzaldehyde; p-anisaldehyde and p-tolualdehyde to give the corresponding cinnamoylphenyl derivatives 5a-c, respectively (scheme 2). Chemical structures of compounds 5a-c were established on both elemental and spectral evidences. So, the IR spectrum in general showed stretching frequencies at 1675 and 1645 cm⁻¹ attributable to the CON and C=O (Chalcone) groups. ¹H-NMR spectra of compound 5b showed multiple signals at about δ 8.2-8.3 corresponding to olefinic CH=CH protons and singlet signal at δ 2.1 for the -CH₃ protons. Moreover, structures 5a-c were confirmed by the mass spectral measurements which showed the molecular ion peaks at m/e 624 (M+), m/e 654 (M+) and m/e 638 (M+), respectively.

Besides, compounds 5a-c reacted with hydrazine hydrate in boiling ethanol to give the corresponding 4-arylidene-1-(p-(5-aryl-2-pyrazolin-3-yl)phenyl)-2-phenyl-2-imidazolin-5-ones 6a-c, respectively. Structures 6a-c were established on both elemental and spectral evidences. So, ¹H-NMR spectrum in general showed revealed doublet signals at δ 3.1 corresponding for CH₃ protons of pyrazole. The IR spectra of these compounds showed characteristic absorption bands at 3200-3260 cm⁻¹ attributable to (-NH) group. In addition, structures 6a-c were confirmed by the mass spectrophotometric measurements which showed the molecular ion peaks at m/e 638 (M+), m/e 668 (M+) and m/e 652 (M+), respectively. Moreover, refluxing of compounds 5a-c with both ethylcyanoacetate and/or malononitrile in ethanol and excess of ammonium acetate afforded 7a-c and 8a-c, respectively (scheme 3).

On the other hand, treatment of imidazolone 3 with ethylacetate in the presence of sodium metal gives the corresponding 1,3-diketone derivative 9 which reacted with thiourea in ethanol giving the thioypyrimidine derivative 10. The structure of compound 10 was elucidated on the basis of both analytical and spectral data. The IR spectrum of compound 10 displayed absorption band at 1370 cm⁻¹ due to (C=S) group. In addition, the mass spectrum gives a molecular ion peak at m/e 621 (M+2) (scheme 4).

![Scheme 3. Reaction of imidazolone derivatives 5a-c with hydrazine hydrate, ethylcyanoacetate and malononitrile](image)
Oxazolone 2 reacted with ethyl p-aminobenzoate in glacial acetic acid and freshly fused sodium acetate to give (Z)-ethyl 4-(5-oxo-2-phenyl-4-(4-(tosyloxy)benzylidene)-4,5-dihydro-1H-imidazol-1-yl) benzoate 11. The IR spectrum of 11 showed absorption bands at 1680 and 1725 cm\(^{-1}\) due to (CON) and carbonyl ester groups. \(^1\)H-NMR showed signals at \(\delta\) 4.39-4.42 (q, 2H, \(-CH_2CH_3\)) and \(\delta\) 1.39-1.43 (t, 3H, \(-CH_2CH_3\)). The mass spectrum of compound 11 showed the molecular ion peak at m/e 566 (M\(^+\)).

Treatment of imidazolone 11 with benzylamine in ethanol afforded \((Z)-4-((1-(4-(benzylcarbamoyl)phenyl)-5-oxo-2-phenyl-1H-imidazol-4(5H)-ylidene)methyl)phenyl\)4-methylbenzenesulfonate 12, (scheme 5). The structure of compound 12 was established on both analytical and spectral data. The IR spectrum exhibited bands at 1690 and 3478 cm\(^{-1}\) corresponding to -CON and -NH groups and revealed the absence of a carbonyl of ester group absorption band. \(^1\)H-NMR spectrum revealed singlet signals at \(\delta\) 4.2 and \(\delta\) 11 characteristic for \(-CH_2Ph\).

The mass spectrum revealed molecular ion peak at m/e 626.6 (M\(^+\)) with relative abundance corresponding to the molecular formula C\(_{37}\)H\(_{29}\)N\(_3\)O\(_5\)S.

Furthermore, the reaction of imidazolone 11 with hydrazine hydrate is interesting since refluxing in ethanol gives four products 13-16 which were isolated by using column chromatography (scheme 6). Formation of compound 14 could proceed via the plausible mechanism (scheme 7).

On the other hand, refluxing of oxazolone 2 with anthranilic acid in glacial acetic acid and fused sodium acetate gives the benzoxazinone derivative 17 instead of compound 17’ (scheme 8). The structure of compound 17 was elucidated on the basis of both analytical and spectral data. The IR spectrum showed absorption bands at 3470, 1760 and 1595 cm\(^{-1}\) due to amidic (NH), carbonyl of lactone and (C=C) groups. \(^1\)H-NMR spectrum revealed singlet signals at \(\delta\) 4.9 characteristic for CH=C protons. Moreover, the mass spectrum showed the molecular ion peak at m/e 538 (M\(^+\)). Formation of compound 17 could proceed via the plausible mechanism (scheme 9).
3. Antimicrobial Activity

All the compounds were subjected to biological screening and they showed promising antibacterial and antifungal activity which were comparable to the activity of known standard drugs. The results are summarized in Table 1. The results for antibacterial activities depicted in Table 1 revealed that, most compounds exhibited good activities against *Bacillus Thuringenesis* and compounds 3, 5a, 5c, 6a, 7b, 7c, 8a, 9, 11, 13 and 14 exhibited good activities against *Klebseilla Pneumonia* and compounds 3, 5a, 5c, 6a, 7b, 8a, 10, 13, 14, 15 and 16 exhibited good activities against *Trichoderma Herzianum*. On the other hand, the results for antifungal activities depicted in Table 2 revealed that, compounds 3, 4, 6a, 6b, 6c, 7c, 8a, 8c, 11, 12 and 16 exhibited good activities against the *Trichoderma Herzianum* and *Trichoderma Virdi*. Therefore, the obtained results indicated that, the antimicrobial activity is dependent on the attached groups with oxazolone and imidazolone derivatives. A comparison of antibacterial and antifungal activities of compounds with their structures revealed that, the compounds that bearing aryl sulfonate, oxazolone and imidazolone moieties in the same molecule exhibited significant activity against *Bacillus Thuringenesis*, *Klebseilla Pneumonia*, *Trichoderma Herzianum* and *Trichoderma Virdi*.

### 4. Experimental

All melting points (uncorrected) were determined on Gallenkamp electric melting point apparatus, FTIR spectra (KBr disk) were recorded on a Nicolet Magna. IR model 550 spectrophotometers, 1H-NMR spectra, were determined on Bruker Wpsy 300 MHz spectrometer with TMS as internal standard and the chemical shifts are in ppm. Mass spectra were recorded at 70 ev with a Varian MAT 311. Elemental analyses are satisfactory for all synthesized compounds (2-17), all analyses were carried out in Faculty of Science, Cairo University, Egypt. (Z)-4-(((5–oxo-2-phenoxazol-4(5H)-ylidene)methyl)phenyl-4-methylbenzene sulfonate 2 was prepared previously as shown in literature [8].

**Synthesis of (Z)-4-(((1-(4-acetylphenyl)-5-oxo-2-phenyl-imidazol-4(5H)-ylidene)methyl)phenyl-4-methyl benzencesulfonate (3).**

A mixture of oxazolone 2 (0.01mole) and p-aminoacetophenone (0.01mole) in glacial acetic acid (30 ml) containing freshly fused sodium acetate (0.5gm) was heated under reflux for 8 hours. The reaction mixture was concentrated under reduced pressure and the separated solid product was filtered off, and recrystallized from acetic acid to give 3. Yellow crystals; Yield 45%; m.p. 180-182°C; IR (KBr): ν/cm⁻¹: 1715 (COCH₃), 1679 (CO, amidic), 1645 (C=N), 1360 (SO₂); EIMS (m/z) (%): 536 (M⁺, 21.7), 419 (2.1), 380 (25.4), 278 (9.8), 222 (86), 155 (13), 117 (32), 91 (100), 65 (47.7); ¹H NMR (DMSO) (δ, ppm), 2.4 (s, 3H, CH₃), 2.6 (s, 3H, CH₃), 5.1 (1H, NH), 7.1-8.2 (m, 18H, Ar-H, CH=C); Anal. for C₉₁H₈₂N₂O₂S (536.6): Caled.: C, 69.39; H, 4.51; N, 5.22%; Found: C, 69.33; H, 4.49; N, 5.19%.

### Table 1.
| Comp No. | *Bacteria* | | Comp No. | *Bacteria* |
|----------|------------| |----------|------------|
|          | *Bacillus Thuringenesis* | *I. Z.D. mm* | *Klebsella Pneumonia* | *I. Z.D. mm* | | *Bacillus Thuringenesis* | *I. Z.D. mm* | *Klebsella Pneumonia* | *I. Z.D. mm* |
| 2        | 27         | 33 | 8c       | 28         | | 28         |          |          |
| 3        | 30         | 36 | 9         | 31         | | 31         |          |          |
| 4        | 29         | 30 | 10        | 18         | 38         |          |          |
| 5a       | 29         | 44 | 11        | 30         | 33         |          |          |
| 5b       | 32         | 33 | 12        | 29         | 28         |          |          |
| 5c       | 35         | 45 | 13        | 31         | 36         |          |          |
| 6a       | 39         | 50 | 14        | 41         | 41         |          |          |
| 6b       | 24         | 29 | 15        | 26         | 39         |          |          |
| 6c       | 29         | 34 | 16        | 24         | 44         |          |          |
| 7a       | 19         | 28 | 17        | 31         | 31         |          |          |
| 7b       | 32         | 35 | Flummo    | 24         | 29         |          |          |
| 7c       | 35         | 26 | Ampectillin | 29         | 34         |          |          |
| 8a       | 39         | 45 | Chloramphenicol | 19         | 28         |          |          |
| 8b       | 24         | 29 | -         | -          | -          |          |          |
Synthesis of (Z)-ethyl 2,4-dioxo-4-(4-(5-oxo-2-phenyl-1-(4-(3-arylacyl)-phenyl)-4,5-dihydro-1H-imidazol-1-yl)phenyl)butanoate (4).

A mixture of 3 (0.05 mole), dry diethylxalate (1.15 mole) and granulated sodium metals (0.1 mole) were heated at 150°C for 7 hours. The mixture was triturated with ethanol, acidified with dil. HCl and the separated solid was recrystallized from ethanol to give 4.

Brown powder; Yield 25%; m.p. 250-252°C; IR (KBr): ν/cm⁻¹: 1750 (CO, ester), 1720 (CO, amide), 1670 (CO, chalcone), 1650 (C=N); EIMS (m/z (%)): 636 (M⁺, 27), 375 (54), 272 (45), 261 (31), 233 (21), 118 (100), 70 (68); ¹H NMR (DMSO) (δ, ppm), 2.4 (s, 3H, CH₃), 3.71-3.74 (q, 2H, CH₂), 4.7 (s, 2H, CH₂), 7.1-8.1 (m, 23H, Ar-H, CH=CH); Anal. for C₃₈H₂₈N₂O₅S (624.7): Calcd.: C, 73.06; H, 4.52; N, 4.48 %; Found: C, 72.98; H, 4.49; N, 4.46%.

Synthesis of (Z)-4-((5-oxo-2-phenyl-1-(4-(5-phenyl-4,5-dihydro-1H-imidazol-4(5H)-ylidene)methyl)phenyl)-1H-imidazol-4(5H)-ylidene)methyl)phenyl-4-methylbenzenesulfonate 5a-c.

Yellow sheets; Yield 45%; m.p. 177-179°C; IR (KBr): ν/cm⁻¹: 1675 (CO, amidic), 1645 (CO, chalcone), 1610 (C=N), 1360 (SO₃), 1599 (C=C); EIMS (m/z (%)): 654 (M⁺, 13), 566 (55), 460 (13), 312 (21), 108 (33), 91 (100), 65 (18); ¹H NMR (DMSO) (δ, ppm), 2.4 (s, 3H, CH₃), 4.62, N, 4.27%; Found: C, 71.49; H, 4.62; N, 4.38%; Found: C, 73.28; H, 4.40; N, 4.26%.

4-((1Z)-(5-oxo-2-phenyl-1-(4-(3-(p-tolyl)acryloyl)phenyl)-1H-imidazol-4(5H)-ylidene)methyl)phenyl-4-methylbenzenesulfonate 5a-c.

Yellow sheets; Yield 30%; m.p. 154-156°C; IR (KBr): ν/cm⁻¹: 1675 (CO, amidic), 1645 (CO, chalcone), 1610 (C=N), 1360 (SO₃), 1599 (C=C); EIMS (m/z (%)): 638 (M⁺, 8.3), 480 (61), 348 (100), 220 (31), 160 (54), 90 (30), 70 (61); ¹H NMR (DMSO) (δ, ppm), 2.4 (s, 3H, CH₃), 2.1 (s, 3H, CH₃), 7.1-8.1 (m, 26H, Ar-H, CH=CH); Anal. for C₃⁹H₃⁰N₂O₇S (638.7): Calcd.: C, 71.49; H, 4.40; N, 4.28%.

Synthesis of (Z)-(5-oxo-2-phenyl-1-(4-((3-arylacyl)phenyl)-1H-imidazol-4(5H)-ylidene)methyl)phenyl-4-methylbenzenesulfonate 5a-c.

Yellow sheets; Yield 43%; m.p. 265-267°C; IR (KBr): ν/cm⁻¹: 1670 (CO, amidic), 3200-3260 (NH), 1360 (SO₃), 1600 (C=N); EIMS (m/z (%)): 638 (M⁺, 32), 576 (44), 480 (54), 340 (100), 213 (23), 81 (15), 65 (34); ¹H NMR (DMSO) (δ, ppm), 2.4 (s, 3H, CH₃), 3.1 (d, 2H, CH₂), 8.15 (t, 1H, CH), 9.5 (s, 1H, -NH), 7.1-8.2 (m, 23H, Ar-H, CH=CH); Anal. for C₃⁹H₃⁰N₂O₇S (638.7): Calcd.: C, 71.45; H, 4.73; N, 4.87%.
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General procedure

A mixture of compound \( \text{5a-c} \) (0.01 mole), malononitrile (0.012 mole) and ammonium acetate (0.08 mole) was refluxed for 5 hours in ethanol (30 ml). The reaction mixture was left to cool and poured into beaker containing 5 hours of water. The solid that separated out was filtered off, washed with water and re-crystallized several times methanol to give \( \text{8a-c} \).

\( (Z)-4-((1-(4-(5-cyano-6-imino-4-(4-methoxyphenyl)-1,6-dihydropyridin-3-yl)phenyl)-5-oxo-2-phenyl-1H-imidazol-4(5H)-ylidene)methyl)phenyl-4-methylbenzenesulfonate \) \( \text{8a-c} \):

Yellow crystals; Yield 43%; m.p. 149-151°C; IR (KBr): ν/cm\(^{-1}\) 1680 (CO, amidic), 3279-3330 (2NH), 2100 (CN), 1600 (C=N), EIMS (m/z (%)): 687 (M\(^+\), 32), 573 (15), 477 (44), 340 (100), 228 (24), 131 (10), 65 (28); \(^1\)H NMR (DMSO) (δ, ppm), 2.4 (s, 3H, CH), 3.5 (s, 1H, OCH\(_3\)), 6.5 (s, 1H, CH), 6.8-8.2 (m, 24H, Ar-H, CH=C, NH); Anal. for C\(_{42}\)H\(_{31}\)N\(_5\)O\(_4\)S (702.7): Calcd.: C, 71.8; H, 4.25; N, 10.18%; Found: C, 71.1; H, 4.22; N, 10.11%.

\( (Z)-4-((1-(4-(5-cyano-6-imino-4-methyl)-1,6-dihydropyridin-3-yl)phenyl)-5-oxo-2-phenyl-1H-imidazol-4(5H)-ylidene)methyl)phenyl-4-methylbenzenesulfonate \) \( \text{8c} \):

Yellow crystals; Yield 39%; m.p. 222-224°C; IR (KBr): ν/cm\(^{-1}\) 1690 (CO, amidic), 3279-3330 (2NH), 2100 (CN), 1600 (C=N), EIMS (m/z (%)): 701 (M\(^+\), 23), 686 (15), 567 (43), 472 (100), 278 (33), 161 (15), 65 (36); Anal. for C\(_{42}\)H\(_{31}\)N\(_5\)O\(_5\)S (717.79): Calcd.: C, 70.8; H, 4.357; N, 9.75%; Found: C, 70.21; H, 4.42; N, 9.71%.

\( (Z)-4-((1-(4-(5-cyano-6-imino-4-(4-methoxyphenyl)-1,6-dihydropyridin-3-yl)phenyl)-5-oxo-2-phenyl-1H-imidazol-4(5H)-ylidene)methyl)phenyl-4-methylbenzenesulfonate \) \( \text{8b} \):

Yellow crystals; Yield 39%; m.p. 188-190°C; IR (KBr): ν/cm\(^{-1}\) 1690 (CO, amidic), 3279-3330 (2NH), 2100 (CN), 1600 (C=N), EIMS (m/z (%)): 717 (M\(^+\), 23), 686 (15), 567 (43), 472 (100), 278 (33), 161 (15), 65 (36); Anal. for C\(_{42}\)H\(_{31}\)N\(_5\)O\(_5\)S (717.79): Calcd.: C, 70.8; H, 4.357; N, 9.75%; Found: C, 70.21; H, 4.42; N, 9.71%.

\( (Z)-4-((1-(4-(5-cyano-6-imino-4-p-tolyl)-1,6-dihydropyridin-3-yl)phenyl)-5-oxo-2-phenyl-1H-imidazol-4(5H)-ylidene)methyl)phenyl-4-methylbenzenesulfonate \) \( \text{8a} \):

Yellow crystals; Yield 49%; m.p. 188-190°C; IR (KBr): ν/cm\(^{-1}\) 1690 (CO, amidic), 3279-3330 (2NH), 2100 (CN), 1600 (C=N), EIMS (m/z (%)): 701 (M\(^+\), 23), 686 (15), 567 (43), 472 (100), 278 (33), 161 (15), 65 (36); Anal. for C\(_{42}\)H\(_{31}\)N\(_5\)O\(_5\)S (717.79): Calcd.: C, 70.8; H, 4.357; N, 9.75%; Found: C, 70.21; H, 4.42; N, 9.71%.

\( (Z)-4-((1-(4-(5-cyano-6-imino-4-(3-oxobutanoxy)phenyl)-2-phenyl-1H-imidazol-4(5H)-ylidene)methyl)phenyl-4-methylbenzenesulfonate \) \( \text{9} \):

Yellow crystals; Yield 39%; m.p. 222-224°C; IR (KBr): ν/cm\(^{-1}\) 1690 (CO, amidic), 3279-3330 (2NH), 2100 (CN), 1600 (C=N), EIMS (m/z (%)): 701 (M\(^+\), 23), 676 (27), 545 (34), 462 (100), 278 (53), 181 (13), 65 (12); Anal. for C\(_{42}\)H\(_{31}\)N\(_5\)O\(_5\)S (717.79): Calcd.: C, 71.88; H, 4.45; N, 9.97%; Found: C, 71.81; H, 4.42; N, 9.88%.

**Analysis**

A solution of compound 3 (0.01 mole) in freshly distilled ethylacetate (0.01 mole) was slowly added to powdered sodium metal (0.02 mole). The reaction mixture was refluxed for 8 hours, cooled then acidified with acetic acid. The precipitated solid product was separated and recrystallized from ethanol to give 9.
Orange crystals; Yield 28%; m.p. 206-208°C; IR (KBr): v/cm\(^{-1}\): 1682 (CO, amide), 1618-1622 (two CO), 1360 (SO\(_3\)), 1600 (C==N); EIMS (m/z) (%): 577 (M\(^-\)* - 1, 26), 426 (70), 392 (29), 342 (42), 224 (50), 169 (92), 131 (100), 80 (84); Anal. for C\(_{35}\)H\(_{27}\)N\(_6\)O\(_4\)S (567.6): Calcd.: C, 63.71; H, 4.40; N, 9.65 %.

Hydrate (0.06 mol) in ethanol (50ml) was heated under reflux for 12 hours. The reaction mixture was concentrated under reduced pressure and then poured onto ice-cold water. The solid that separated was filtered off, and dried.

(8gm) of these solid products were subjected to a column chromatography using silica gel as an adsorbent. Elution of the column was performed using two different ratios of petroleum ether/ethylacetate.

Fraction 1: This was eluted by petroleum ether/ethylacetate (3:1) as eluent from column afforded a pure compound (13)

**Ethyl-4-((4Z)-5-hydrazono-2-phenyl-4-(4-(tosyloxy)benzylidene)-4,5-dihydro-1H-imidazol-1-yl)benzoate (13).**

White crystals; Yield 25%; m.p. 251-253°C; IR (KBr): v/cm\(^{-1}\): 1724 (ester, CO), 3411-3460 (NH\(_2\)), 1370 (SO\(_3\)), 1637 (C==N); EIMS (m/z) (%): 580 (M\(^-\)* - 1, 47), 429 (32), 349 (59), 293 (65), 213 (39), 177 (34), 137 (78), 119 (24), 61 (100); \(^1\)H NMR (DMSO) (δ, ppm), 2.4 (s, 3H, CH\(_3\)), 3.91-4.42 (q, 2H, CH\(_2\)CH\(_3\)), 7.1-8.3 (m, 18H, Ar-H, CH=C); Anal. for C\(_{33}\)H\(_{26}\)N\(_2\)O\(_5\)S (578.6): Calcd.: C, 68.5; H, 4.53; N, 4.84%.

Fraction 2: This was eluted by petroleum ether/ethylacetate (3:1) as eluent from column afforded a pure compound (14).

**Ethyl-4-((6-oxo-3-phenyl-1,6-dihydro-1,2,4-triazin-5(2H)-ylidene)methyl)phenyl-4-methyl benzene sulfonate (14).**

White crystals; Yield 15%; m.p. 111-113°C; IR (KBr): v/cm\(^{-1}\): 1686 (CO, amide), 3282-3315 (2NH), 1630 (SO\(_3\)), 1645 (C==N); EIMS (m/z) (%): 423.2 (M\(^-\)* -1, 46), 371 (100), 225 (50), 189 (50), 127 (60), 110 (88), 85 (52), 56 (96); \(^1\)H NMR (DMSO) (δ, ppm), 2.4 (s, 3H, CH\(_3\)), 4.2 (br, H, NH), 7.2-8.2 (m, 15H, Ar-H, CH=C, NHCO); Anal. for C\(_{37}\)H\(_{29}\)N\(_3\)O\(_5\)S (627.7): Calcd.: C, 63.73; H, 4.42; N, 9.69 %;

Fraction 3: This was eluted by petroleum ether/ethylacetate (3:3) as eluent from column afforded a pure compound (15).

**Z-4-((6-oxo-3-phenyl-1,6-dihydro-1,2,4-triazin-5(2H)-ylidene)methyl)phenyl-4-methyl benzene sulfonate (15).**

White crystals; Yield 21%; m.p. 134-136°C; IR (KBr): v/cm\(^{-1}\): 1652 (CO, amide), 3430 (NH), 3268-3380 (2NH\(_2\)), 1360 (SO\(_3\)), 1640 (C==N); EIMS (m/z) (%): 567 (M\(^-\)* -1, 21), 481 (10), 411 (100), 339 (75), 247 (16), 224 (57), 179 (11), 105 (87); \(^1\)H NMR (DMSO) (δ, ppm), 2.4 (s, 3H, CH\(_3\)), 9.1 (s, 1H, NHCO), 7.1-8.3 (m, 22H, Ar-H, CH=C, NHCO); Anal. for C\(_{39}\)H\(_{31}\)N\(_3\)O\(_5\)S (657.6): Calcd.: C, 63.48; H, 4.79; N, 14.81 %;

Fraction 4: This was eluted by petroleum ether/ethylacetate (3:2) as eluent from column afforded a pure compound (16).

**Z-4-((4-(4-hydrazinocarbonyl)phenyl)-5-oxo-2-phenyl-1H-imidazol-4(5H)-ylidene)methyl)phenyl-4-methyl benzene sulfonate (16).**

White crystals; Yield 33%; m.p. 141-143°C; IR (KBr): v/cm\(^{-1}\): 1690 (CO, amide), 3460 (NH), 3407-3469 (NH\(_2\)), 1600 (C==N); EIMS (m/z) (%): 577 (M\(^-\)* - 1, 26), 426 (70), 392 (29), 342 (42), 224 (50), 169 (92), 131 (100), 80 (84); Anal. for C\(_{37}\)H\(_{29}\)N\(_3\)O\(_5\)S (627.7): Calcd.: C, 63.73; H, 4.42; N, 9.69 %;
1370 (SO$_3$), 1644 (C=N); EIMS (m/z (%): 551.6 (M$^+$-1, 17), 518 (14), 427 (28), 306 (11), 244 (39), 189 (53), 104 (70), 63 (100); $^1$H NMR (DMSO) (δ, ppm): 2.4 (s, 3H, CH$_3$), 12.2 (s, 1H, NH), 6.9-8.6 (m, 20H, Ar-H, CH=C, NH$_2$); Anal. for C$_{30}$H$_{24}$N$_4$O$_5$S (552.6): Calcd.: C, 65.2; H, 4.38; N, 10.14 %; Found: C, 65.1; H, 4.33; N, 10.15 %.

**Synthesis of 4-(2-benzamido-2-(4-oxo-4H-benzo[d][1,3]oxazin-2-yl)vinyl)phenyl-4-methylbenzenesulfonate (17).**

A mixture of oxazolone 2 (0.05 mole) and anthranilic acid (0.05 mole) in acetic acid was heated under reflux for 14 hours. The product obtained after cooling was filtered off and recrystallized from acetic acid to give 17.

Yellow crystals; Yield 70%; m.p. 190-192°C; IR (KBr): 1760 (C=O, lactone), 3470 (NH), 1360 (SO$_3$), 1595 (C=C), 1640 (C=N); EIMS (m/z (%): 538 (M$^+$, 16), 383 (35), 275 (100), 224 (54), 155 (42), 119 (15), 91 (97); $^1$H NMR (DMSO) (δ, ppm): 2.4 (s, 3H, CH$_3$), 4.9 (s, 1H, CH=C), 7.1-8.3 (m, 19H, Ar-H, CH=C, NH$_2$); Anal. for C$_{30}$H$_{22}$N$_2$O$_6$S (538.5): Calcd.: C, 66.9; H, 4.12; N, 5.19 %; Found: C, 66.4; H, 4.1; N, 5.18%.

**Microbiological procedures for the activity study.**

Materials and method:

Media: Nutrient agar and Potato Dextrose Agar plates were used for bacterial and fungal organisms respectively.

Preparation of microbial suspension: The bacterial and fungal strains were subculture at 37°C for six hrs in the corresponding medium of three successive days. These suspensions were used to insulate the antibiograms.

Preparation of the biograms: The agar disk diffusion method was performed on each of the tested substance solutions. Filter paper discs were impregnated with 1 ml of the solution and placed on the inoculated plates. These plates at standing at 4°C for 2 hours were incubated at 37°C for 24 hours. The diameters of the inhibition zones were measured in millimeters.

**5. Conclusions**

A series of novel substituted imidazoline derivatives were synthesized by the reaction of oxazolone derivative 2 with some primary aromatic amines namely, p- aminoacetophenone, ethyl p-aminobenzoate and anthranilic acid. All the compounds were subjected to biological screening. Most of the compounds exhibited good activities, where 3, 5b, 5c, 6a, 7b, 7c, 8a, 9, 11, 13 and 14 exhibited good activities against *Bacillus Thuringensis* and *Klebsella Pneumonia*, while compounds 3, 4, 6a, 6b, 6c, 7a, 8a, 8b, 11, 12 and 16 exhibited good activities against *Trichoderma Herzia*um and *Trichoderma Virdi*. This proves the high therapeutic value of these compounds and encourages further study to explore their biological potential.

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