# Synthesis and Biological Activity of Mercaptobenzoxazole Based Thiazolidinones and Their Arylidenes

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Arylidenes of thiazolidines with mercaptobenzoxazole, namely[(aryl-4-oxo-1,3-thiazolidin)-hydrazinoacetyl-mercaptobenxazole]; (5-arylidene)-2-aryl-4-oxo-1,3-thiazoliden hydrazinoacetyl-mercaptobenxazole were synthesized. Their chemical structures have been confirmed by $^1$H NMR, IR, mass spectra and also by microanalytical data. Antimicrobial evaluation was done by agar dilution method against three pathogenic bacteria viz. *Bacillus subtilis*, *Escherichia coli* and *Klebsiella pneumoniae* and three pathogenic fungi viz. *Aspergillus niger*, *Candida albicans* and *Fusarium oxysporum*. Among new derivatives evaluated, the chloro derivatives exhibited higher potency as compared to the standard drugs streptomycin (for bacteria) and griseofulvin (for fungi) against the tested organisms.

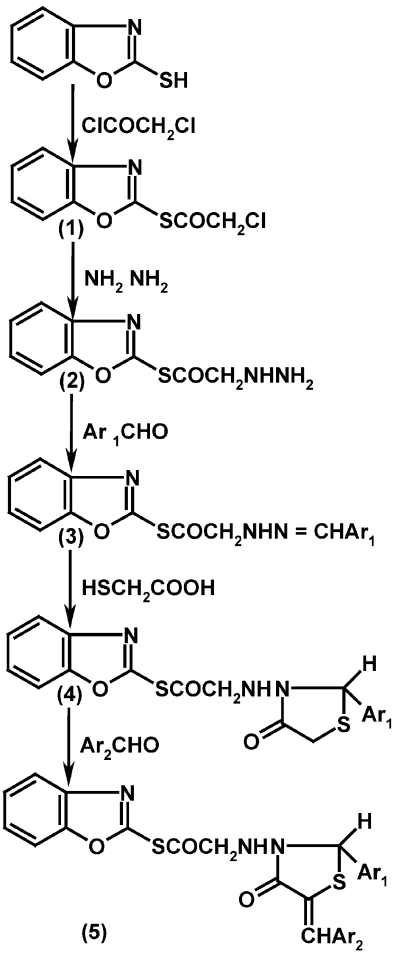
**Keywords:** Thiazolidines; Mercaptobenzoxazole; Antimicrobial agent.

## INTRODUCTION

Thiazolidinone moiety is well known for biological[1-4] and pharmacological activities[5-9] such as CNS stimulant anthelmintic,[10] antibacterial,[11] antifungal,[10,12] hypnotic, amoebicidal[13] mosquito repellant,[14] analgesic,[15,16] diurals, antiinflammatory, anticonvulsant,[17] nematocidal, antitubercular,[18] etc. 2-Mercaptobenzoxazole is also reported as a good medicinal[19] as well as a biological agent.[20] These findings focused particular interest on incorporatating thiazolidinon-arylidenes and 2-mercaptobenzoxazole in one framework with a view to obtain compounds of better antimicrobial activity. It has been found that these two moieties on incorporation enhance the biological activity.

For the synthesis of the target heterocycles the reaction sequences outlined in Scheme I were followed. The reaction of 2-mercaptobenzoxazole **1** with chloroacetyl chloride in methanol yielded 2-chloroacetyl mercaptobenzoxazole **1**. Compound **2** on condensation with different carbonyls afforded [2-(arylidinehydrazino acetyl) mercaptobenzoxazoles] **3**. These intermediate **3** on cycloaddition with mercaptoacetic acid yielded thiazolidine derivatives, (2-aryl-4-oxo-1,3-thiazolidin)-hydrazinoacetyl-mercaptobenzoxazoles **4**. The compound **4** on reaction with different carbonyls in ethanol furnished [(5-aryliden)-1-aryl-4-oxo-1,3-thiazolidin-hydrazinoacetyl-mercaptobenzoxazoles] **5**. All the compounds synthesized were adequately characterized by their elemental analyses, IR, $^1$H NMR and mass

**Scheme I**



spectral data.

## RESULTS AND DISCUSSION

### Biological Activity

### Antimicrobial activity

The compounds **3a-j**, **4a-j** and **5a-z** were screened for their antibacterial activity against *B. substilis, E. coli* and *K. pnenumoniae* and antifungal activity against *A. niger*, *C. albicans* and *F. oxysporum* by agar dilution method at different concentrations (50 and 100 ppm) using acetone as solvent. The plates were incubated at 37° for 24 h in the case of antibacterial activity and 48 h in the case of antifungal activity. The control was also maintained with 0.1 mL of acetone, and the zone of inhibition of the growth was measured in mm. The activity was compared with the standard drugs. A commercial antibacterial Streptomycin (50, 100 mg/mL) and antifungal Griseofulvin (50, 100 mg/mL) were also tested under similar conditions for comparison. The results are presented in Tables 2 and 3.

## EXPERIMENTAL SECTION

Melting points were determined in open capillaries. IR spectra were recorded on a Shimadzu 8416 FTIR ($\nu_{max}$ in $cm^{-1}$), $^1H$ NMR spectra on a Bruker DRX 300 in $CDCl_3$ at 300 MHz using TMS as an internal standard and the mass spectra on a Jeol SX-102 (FAB). Purity of compounds was monitored by TLC on silica gel coated plates.

### 2-Chloroacetyl mercaptobenzoxazole (1)

An equimolar solution of 2-mercaptobenzoxazole (0.06 mole) and chloroacetyl chloride (0.06 mole) in methanol (30 mL) in the presence of anhydrous potassiumcarbonate (2 g) was kept at room temperature for about 25 hours. The solvent was removed *in vacuo* and the residue was recrystallised from chloroform to furnish compound **1**. 72% of yield, mp 180-182 °C; IR (KBr) $\nu_{max}$ $cm^{-1}$: 3020, 1582, 1565, 1540, 1245, 1080, 1030, 640 (benzoxazole nucleus with aromatic ring), 1660 (C=O of amide), 1425 ($CH_2$), 720 (C-S-C); $^1H$ NMR δ 7.07-7.98 (m, 4H, Ar-H), 4.55 (s, 2H, $CH_2$); FAB-MS, *m/z*: 227 $[M]^+$, 201, 192, 178, 174, 144, 119, 109, 92, 90, 60. Anal. calcd for $C_9H_6NO_2ClS$: C, 47.4; H, 2.6; N, 6.15. Found: C, 47.2; H, 3; N, 6.08.

### [(2-Hydrazinoacetyl)-mercaptobenzoxazole] (2)

To a solution of **1** (0.02 mole) and hydrazine hydrate (0.02 mole) in methanol (30 mL) was kept at room temperature for about 20 hours. The solvent was removed *in vacuo* and the resulting solid was dried recrystallised from chloroform to produce analytical pure material: 70% of yield, mp 180-182 °C; IR (KBr) $\nu_{max}$ $cm^{-1}$: 3028, 1545, 1242, 1085, 1032, 643 (benzoxazole nucleus with aromatic ring), 3350, 3380 (-$NHNH_2$), 1665 (C=O of amide), 1430 ($CH_2$); $^1H$ NMR δ 9.13 (s, br, 1H, NH), 7.02-7.95 (m, 4H, Ar-H), 4.53 (s, 2H, $CH_2$), 4.40 (s, 2H, $NH_2$), FAB-MS, *m/z*: 223 $[M]^+$, 207, 195, 192, 178, 176, 164, 150, 131, 122, 118, 108, 92, 90, 79, 73, 66, 64, 65, 60. Anal. Calcd for $C_9H_9N_3O_2S$: C, 48.4; H, 4.0; N, 18.8. Found: C, 48.1; H, 3.89; N, 18.62.

### 2-(Aryliden-hydrazinoacetyl)-mercaptobenzoxazole (3a)

A mixture of compound **2** (0.008 mole) and benzaldehyde (0.008 mole) and 2-3 drops of gl. acetic acid in ethanol (25 mL) was kept at room temperature for about 24 hours. The solvent was removed *in vacuo* and the resulting solid was dried and recrystallised from chloroform : methanol (5%, v/v) mixture to get compound **3a**: 65% of yield, mp 185-187 °C, IR (KBr) $\nu_{max}$ $cm^{-1}$: 3028, 1590, 1563, 1546, 1247, 1045, 650 (benzoxazole nucleus with aromatic ring), 3342, 1339 (-NH), 1665 (C=O), 1622 (N=CH): $^1H$ NMR δ 9.12 (s, br, 1H, NH), 7.00-7.90 (m, 4H, Ar-H), 4.95 (s, 1H, N = CHAr), 4.57 (s, 2H, $CH_2$); FAB-MS, *m/z*: 311 $[M]^+$, 293, 261, 234, 207, 192, 178, 164, 150, 133, 124, 122, 119, 118, 108, 92, 90, 79, 77, 66, 64. Anal Calcd for $C_{16}H_{13}N_3O_2S$: C, 61.7; H, 4.18; N, 13.50. Found C, 61.2; H, 3.93; N, 13.28.

Likewise other compounds **3b-3j** were prepared in a similar way using different carbonyls. Characterization data are presented in Table 1.

### [(2-aryl-4-oxo-1,3-thiazolidin)-hydrazinoacetyl mercaptobenzoxazole] (4a)

To a mixture of **3a** (0.0003 mole), mercaptoacetic acid (0.0003 mole) was added in ethanol (30 mL) and kept at room temperature for about 20 hours. The solvent was removed *in vacuo* and the resulting solid was dried and recrystallised from methanol to get **4a**: 63% of yield, mp 190-192 °C; IR (KBr) $\nu_{max}$ $cm^{-1}$: 3030, 1588, 1560, 1550, 1240, 1039, 647 (benzoxazole nucleus with aromatic ring), 3340, 1336 (-NH-), 1717 (C=O cyclic), 2986 (N-CH-S),

Table 1. Characterization data of compounds **3a-j**, **4a-j** and **5a-z**

| Compounds | $Ar_1$ | $Ar_2$ | Yield (%) | Mol. formula | Found (Calcd)% | | |
|---|---|---|---|---|---|---|---|
| | | | | | C | H | N |
| **3a** | $C_6H_5$ | - | 60 | $C_{16}H_{13}N_3O_2S$ | 61.2(61.7) | 4.05(4.18) | 13.12(13.50) |
| **3b** | 2-$ClC_6H_4$ | - | 77 | $C_{16}H_{12}N_3O_2SCl$ | 55.3(55.5) | 3.28(3.47) | 11.8(12.1) |
| **3c** | 3-$ClC_6H_4$ | - | 75 | $C_{16}H_{12}N_3O_2SCl$ | 55.4(55.5) | 3.08(3.47) | 11.9(12.1) |
| **3d** | 4-$ClC_6H_4$ | - | 72 | $C_{16}H_{12}N_3O_2SCl$ | 55.0(55.5) | 3.19(3.47) | 12.0(12.1) |
| **3e** | 2-$NO_2C_6H_4$ | - | 69 | $C_{16}H_{12}N_4O_4S$ | 53.5(53.9) | 3.15(3.37) | 15.6(15.7) |
| **3f** | 3-$NO_2C_6H_4$ | - | 72 | $C_{16}H_{12}N_4O_4S$ | 53.7(53.9) | 3.30(3.37) | 15.3(15.7) |
| **3g** | 4-$NO_2C_6H_4$ | - | 70 | $C_{16}H_{12}N_4O_4S$ | 53.3(53.9) | 2.95(3.37) | 15.4(15.7) |
| **3h** | 2-$OCH_3C_6H_4$ | - | 65 | $C_{17}C_{15}O_3N_3S$ | 59.5(59.8) | 4.2(4.3) | 13.7(14.0) |
| **3i** | 3-$OCH_3C_6H_4$ | - | 68 | $C_{17}H_{15}O_3N_3S$ | 59.3(59.8) | 4.0(4.3) | 13.7(14.0) |
| **3j** | 4-$OCH_3C_6H_4$ | - | 66 | $C_{17}H_{15}O_3N_3S$ | 59.6(59.8) | 4.18(4.3) | 13.9(14.0) |
| **4a** | $C_6H_5$ | - | 65 | $C_{18}H_{15}N_3O_3S_2$ | 55.82(56.0) | 3.35(3.80) | 10.62(10.90) |
| **4b** | 2-$ClC_6H_4$ | - | 69 | $C_{18}H_{11}N_3O_3S_2Cl$ | 51.3(51.8) | 2.23(2.64) | 9.80(10.08) |
| **4c** | 3-$ClC_6H_4$ | - | 68 | $C_{18}H_{11}N_3O_3S_2Cl$ | 51.5(51.8) | 2.32(2.64) | 9.72(10.08) |
| **4d** | 4-$ClC_6H_4$ | - | 68 | $C_{18}H_{11}N_3O_3S_2Cl$ | 51.6(51.8) | 2.50(2.64) | 9.90(10.08) |
| **4e** | 2-$NO_2C_6H_4$ | - | 70 | $C_{18}H_{14}N_4O_5S_2$ | 50.0(50.23) | 3.12(3.25) | 12.75(13.0) |
| **4f** | 3-$NO_2C_6H_4$ | - | 72 | $C_{18}H_{14}N_4O_5S_2$ | 50.10(50.23) | 2.95(3.25) | 12.90(13.0) |
| **4g** | 4-$NO_2C_6H_4$ | - | 71 | $C_{18}H_{14}N_4O_5S_2$ | 49.8(50.23) | 2.88(3.25) | 12.74(13.0) |
| **4h** | 2-$OCH_3C_6H_4$ | - | 71 | $C_{19}H_{17}N_3O_4S_2$ | 54.4(54.9) | 3.8(4.0) | 10.0(10.12) |
| **4i** | 3-$OCH_3C_6H_4$ | - | 73 | $C_{19}H_{17}N_3O_4S_2$ | 54.7(54.9) | 3.78(4.0) | 9.82(10.12) |
| **4j** | 4-$OCH_3C_6H_4$ | - | 72 | $C_{19}H_{17}N_3O_4$ | 54.3(54.9) | 3.85(4.0) | 9.73(10.12) |
| **5a** | $C_6H_5$ | $C_6H_5$ | 65 | $C_{25}H_{19}N_3O_3S_2$ | 63.3(63.4) | 3.82(4.0) | 8.52(8.80) |
| **5b** | $C_6H_5$ | 2-$ClC_6H_4$ | 69 | $C_{25}H_{18}N_3O_3S_2Cl$ | 58.8(59.1) | 3.3(3.5) | 8.0(8.2) |
| **5c** | $C_6H_5$ | 3-$ClC_6H_4$ | 72 | $C_{25}H_{18}N_3O_3S_2Cl$ | 58.6(59.1) | 3.0(3.5) | 7.8(8.2) |
| **5d** | $C_6H_5$ | 4-$ClC_6H_4$ | 70 | $C_{25}H_{18}N_3O_3S_2Cl$ | 58.7(59.1) | 2.9(3.5) | 7.9(8.2) |
| **5e** | $C_6H_5$ | 2-$NO_2C_6H_4$ | 67 | $C_{25}H_{18}N_4O_5S_2$ | 57.5(57.9) | 3.27(3.47) | 10.4(10.8) |
| **5f** | $C_6H_5$ | 3-$NO_2C_6H_4$ | 69 | $C_{25}H_{18}N_4O_5S_2$ | 57.3(57.9) | 3.02(3.47) | 10.5(10.8) |
| **5g** | $C_6H_5$ | 4-$NO_2C_6H_4$ | 67 | $C_{25}H_{18}N_4O_5S_2$ | 57.7(57.9) | 3.13(3.47) | 10.3(10.8) |
| **5h** | $C_6H_5$ | 2-$OCH_3C_6H_4$ | 70 | $C_{26}H_{21}N_3O_4S_2$ | 61.8(62.0) | 3.9(4.1) | 8.0(8.3) |
| **5i** | $C_6H_5$ | 3-$OCH_3C_6H_4$ | 73 | $C_{26}H_{21}N_3O_4S_2$ | 61.9(62.0) | 3.7(4.1) | 8.2(8.3) |
| **5j** | $C_6H_5$ | 4-$OCH_3C_6H_4$ | 70 | $C_{26}H_{21}N_3O_4S_2$ | 61.9(62.0) | 4.02(4.1) | 7.8(8.3) |
| **5k** | 2-$ClC_6H_4$ | 2-$ClC_6H_4$ | 65 | $C_{25}H_{17}N_3O_3S_2Cl_2$ | 55.1(55.3) | 3.02(3.13) | 7.3(7.7) |
| **5l** | 2-$ClC_6H_4$ | 3-$ClC_6H_4$ | 60 | $C_{25}H_{17}N_3O_3S_2Cl_2$ | 55.0(55.3) | 2.8(3.13) | 7.4(7.7) |
| **5m** | 2-$ClC_6H_4$ | 4-$ClC_6H_4$ | 62 | $C_{25}H_{17}N_3O_3S_2Cl_2$ | 55.0(55.3) | 2.7(3.13) | 7.5(7.7) |
| **5n** | 2-$ClC_6H_4$ | 2-$NO_2C_6H_4$ | 73 | $C_{25}H_{17}N_4O_5S_2Cl$ | 54.0(54.2) | 2.9(3.0) | 10.02(10.13) |
| **5o** | 2-$ClC_6H_4$ | 3-$NO_2C_6H_4$ | 75 | $C_{25}H_{17}N_4O_5S_2Cl$ | 54.1(54.2) | 2.6(3.0) | 9.8(10.13) |
| **5p** | 2-$ClC_6H_4$ | 4-$NO_2C_6H_4$ | 78 | $C_{25}H_{17}N_4O_5S_2Cl$ | 53.8(54.2) | 2.8(3.0) | 9.7(10.13 |
| **5q** | 2-$ClC_6H_4$ | 2-$OCH_3C_6H_4$ | 66 | $C_{26}H_{20}N_3O_4S_2Cl$ | 57.8(58.1) | 3.52(3.72) | 7.52(7.82) |
| **5r** | 2-$ClC_6H_4$ | 3-$OCH_3C_6H_4$ | 62 | $C_{26}H_{20}N_3O_4S_2Cl$ | 57.7(58.1) | 3.60(3.72) | 7.63(7.82) |
| **5s** | 2-$ClC_6H_4$ | 4-$OCH_3C_6H_4$ | 64 | $C_{26}H_{20}N_3O_4S_2Cl$ | 57.5(58.1) | 3.65(3.72) | 7.02(7.82) |
| **5t** | 2-$NO_2C_6H_4$ | 2-$NO_2C_6H_4$ | 72 | $C_{25}H_{17}N_5O_7S_2$ | 53.0(53.2) | 2.72(3.0) | 12.2(12.4) |
| **5u** | 2-$NO_2C_6H_4$ | $C_6H_5$ | 70 | $C_{25}H_{18}N_4S_2O_5$ | 57.4(57.9) | 3.15(3.47) | 10.62(10.81) |
| **5v** | 2-$NO_2C_6H_4$ | 2-$OCH_3C_6H_4$ | 74 | $C_{26}H_{20}N_4O_6S_2$ | 56.4(56.8) | 3.32(3.64) | 10.02(10.20) |
| **5w** | 2-$OCH_3C_6H_4$ | 2-$OCH_3C_6H_4$ | 69 | $C_{26}H_{20}N_4O_6S_2$ | 56.4(56.8) | 3.32(3.64) | 10.02(10.20) |
| **5x** | 2-$OCH_3C_6H_4$ | $C_6H_5$ | 62 | $C_{26}H_{21}1N_3S_2O_4$ | 61.8(62.0) | 4.02(4.17) | 8.13(8.30) |
| **5y** | 2-$OCH_3C_6H_4$ | 2-$ClC_6H_4$ | 66 | $C_{26}H_{20}N_3O_4S_2Cl$ | 57.7(58.0) | 3.50(3.72) | 7.61(7.81) |
| **5z** | 2-$OCH_3C_6H_4$ | 2-$NO_2C_6H_4$ | 68 | $C_{26}H_{20}N_4O_6S_2$ | 58.13(58.42) | 3.32(3.74) | 7.43(7.86) |

1422 ($CH_2$), 718 (C-S-C); $^1$H NMR δ 9.10 (s, br. 1H, NH), 7.10-7.9 (m, 9H, Ar-H) 4.50 (s, 2H, $CH_2$), 4.48 (s, 2H $CH_2$ cyclic), 3.18 (s, 1H, Ar-CH-N); FAB-MS, *m/z*: 385 $[M]^+$, 343, 325, 311, 263, 207, 193, 192, 178, 165, 164, 162, 150, 136, 122, 118, 108, 92, 90, 79, 66, 64. Anal. Calcd for $C_{18}H_{15}N_3O_3S_2$: C, 56.0; H, 3.80; N, 10.9. Found: C, 56.0;

Table 2. Antibacterial activity data of compounds **3a-j**, **4a-j** and **5a-z**

| Compounds | *B. subtilis* | | *E. coli* | | *K. pneunoniae* | |
|---|---|---|---|---|---|---|
| | 50 ppm | 100 ppm | 50 ppm | 100 ppm | 50 ppm | 100 ppm |
| **3a** | - | + | - | + | + | + |
| **3b** | + | ++ | + | ++ | + | ++ |
| **3c** | ++ | ++ | + | ++ | ++ | +++ |
| **3d** | ++ | +++ | + | + | + | ++ |
| **3e** | + | +++ | + | ++ | + | ++ |
| **3f** | + | ++ | + | ++ | + | ++ |
| **3g** | + | ++ | + | ++ | + | +++ |
| **3h** | - | + | + | + | - | + |
| **3i** | + | + | + | ++ | + | + |
| **3j** | + | ++ | + | + | + | ++ |
| **4a** | + | ++ | + | ++ | + | ++ |
| **4b** | ++ | ++ | +++ | +++ | +++ | ++ |
| **4c** | +++ | +++ | +++ | +++ | ++ | +++ |
| **4d** | ++ | +++ | +++ | +++ | +++ | +++ |
| **4e** | ++ | ++ | ++ | ++ | + | ++ |
| **4f** | ++ | +++ | ++ | +++ | + | ++ |
| **4g** | ++ | +++ | ++ | +++ | ++ | +++ |
| **4h** | + | ++ | + | ++ | + | ++ |
| **4i** | + | + | + | ++ | + | ++ |
| **4j** | + | ++ | + | + | + | ++ |
| **5a** | + | + | + | ++ | + | ++ |
| **5b** | + | ++ | + | ++ | + | + |
| **5c** | + | + | + | ++ | + | ++ |
| **5d** | + | ++ | + | + | + | ++ |
| **5e** | ++ | ++ | + | ++ | ++ | ++ |
| **5F** | + | ++ | ++ | ++ | + | + |
| **5g** | ++ | ++ | + | ++ | + | ++ |
| **5h** | + | + | + | + | + | ++ |
| **5i** | + | ++ | + | + | + | ++ |
| **5j** | + | + | + | ++ | + | + |
| **5k** | +++ | ++++ | +++ | ++++ | +++ | ++++ |
| **5l** | ++ | +++ | +++ | ++++ | ++ | +++ |
| **5m** | ++ | +++ | +++ | ++++ | +++ | ++++ |
| **5n** | ++ | +++ | ++ | +++ | ++ | +++ |
| **5o** | ++ | +++ | ++ | +++ | ++ | ++ |
| **5p** | ++ | ++ | ++ | +++ | ++ | ++ |
| **5q** | + | ++ | + | ++ | ++ | ++ |
| **5r** | + | + | + | ++ | + | ++ |
| **5s** | + | + | + | ++ | + | ++ |
| **5t** | ++ | ++ | ++ | +++ | ++ | +++ |
| **5u** | ++ | +++ | ++ | +++ | ++ | ++ |
| **5v** | + | ++ | ++ | ++ | ++ | +++ |
| **5w** | + | ++ | ++ | ++ | + | ++ |
| **5x** | + | ++ | ++ | ++ | + | ++ |
| **5y** | ++ | +++ | ++ | +++ | ++ | +++ |
| **5z** | + | ++ | + | ++ | ++ | ++ |
| **Sm** | +++ | ++++ | +++ | ++++ | +++ | ++++ |

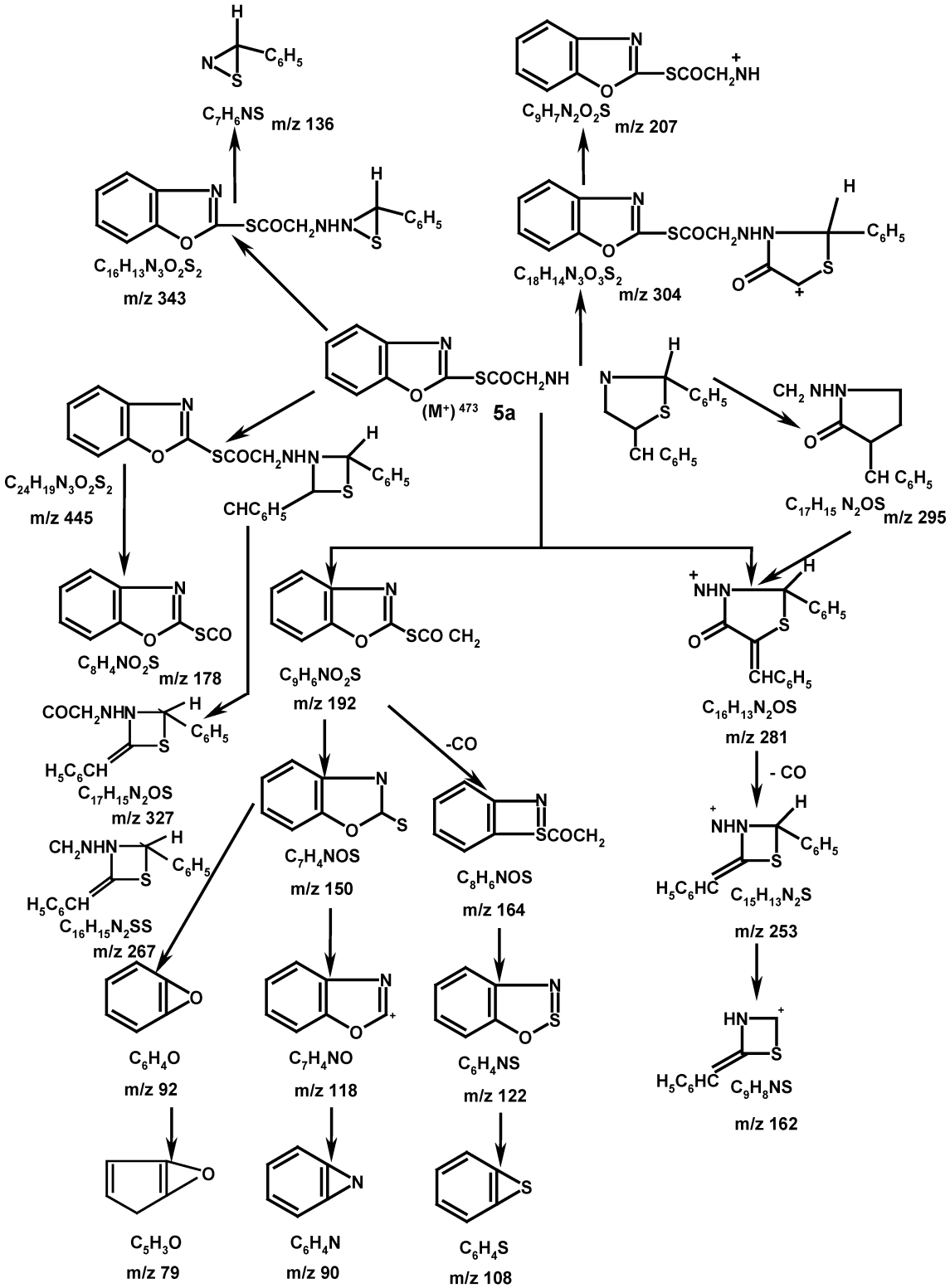
Sm = Streptomycin inhibition diameter in mm: (-) < 8, (+) 9-11, (++) 11-17, (+++) 17-23, (++++) 23-28.

Table 3. Antifungal activity data of compounds **3a-j**, **4a-j** and **5a-z**

| Compounds | *C. albicans* | | *F. oxysporum* | | *A. nigar* | |
|---|---|---|---|---|---|---|
| | 50 ppm | 100 ppm | 50 ppm | 100 ppm | 50 ppm | 100 ppm |
| **3a** | - | + | - | + | - | + |
| **3b** | + | ++ | + | + | + | ++ |
| **3c** | + | + | + | ++ | + | ++ |
| **3d** | + | ++ | + | + | + | ++ |
| **3e** | - | + | + | + | + | + |
| **3f** | + | ++ | ++ | +++ | + | ++ |
| **3g** | ++ | +++ | + | ++ | + | ++ |
| **3h** | - | + | + | + | - | + |
| **3i** | - | + | - | + | + | + |
| **3j** | + | + | + | + | - | + |
| **4a** | - | + | - | + | - | + |
| **4b** | + | + | + | + | + | ++ |
| **4c** | + | ++ | + | ++ | + | ++ |
| **4d** | + | + | + | ++ | + | ++ |
| **4e** | - | + | + | ++ | + | ++ |
| **4f** | + | + | + | +++ | + | ++ |
| **4g** | + | + | + | ++ | + | +++ |
| **4h** | - | - | - | + | - | + |
| **4i** | + | + | - | + | - | + |
| **4j** | + | + | - | + | + | + |
| **5a** | - | + | + | + | - | + |
| **5b** | ++ | ++ | ++ | +++ | ++ | +++ |
| **5c** | + | ++ | ++ | +++ | ++ | +++ |
| **5d** | ++ | +++ | + | ++ | ++ | +++ |
| **5e** | + | ++ | + | ++ | + | ++ |
| **5f** | ++ | ++ | + | ++ | + | ++ |
| **5g** | + | ++ | + | ++ | ++ | ++ |
| **5h** | - | + | + | ++ | + | ++ |
| **5i** | + | + | + | ++ | + | ++ |
| **5j** | + | ++ | + | ++ | + | ++ |
| **5k** | ++ | +++ | ++ | +++ | ++ | ++ |
| **5l** | ++ | ++ | ++ | +++ | ++ | +++ |
| **5m** | +++ | +++ | +++ | +++ | ++ | +++ |
| **5n** | + | ++ | + | ++ | ++ | ++ |
| **5o** | ++ | ++ | + | ++ | + | ++ |
| **5p** | ++ | +++ | ++ | ++ | ++ | +++ |
| **5q** | + | ++ | + | + | + | ++ |
| **5r** | + | ++ | + | ++ | + | ++ |
| **5s** | + | + | + | + | + | ++ |
| **5t** | ++ | ++ | + | ++ | ++ | ++ |
| **5u** | ++ | ++ | ++ | +++ | + | ++ |
| **5v** | ++ | ++ | ++ | +++ | + | ++ |
| **5w** | + | + | + | ++ | ++ | ++ |
| **5x** | + | ++ | + | ++ | + | ++ |
| **5y** | ++ | ++ | + | ++ | ++ | ++ |
| **5z** | ++ | ++ | ++ | ++ | + | ++ |
| **GF** | ++ | ++++ | +++ | ++++ | +++ | ++++ |

GF = Griseofulvin inhibition diameter in mm: (-) < 8, (+) 8-11, (++) 11-17, (+++) 17-23, (++++) 23-28.

**Chart 1** Mass fragmentation of the compound **5a**



H, 3.80; N, 10.9. Found: C, 55.82; H, 3.35; N, 10.62.

Other compounds **4b-j** were prepared in a similar way using **3b-j**; characterization data are respectively presented in Table 1.

**[(5-Benzylidene)-2-aryl-4-oxo-1,3-thiazolidinhydrazinoacetyl]-mercaptobenzoxazole 5a**

An equimolar solution of **4a** (0.0002 mole) and benzaldehyde (0.0002 mole) in methanol (25 mL) was kept at room temperature for about 24 hours. The solvent was removed *in vacuo* and the residue was dried and recrystallised from ethanol to afford pure material: 61% of yield, mp 185-187 °C; IR (KBr) $\nu_{max}$ $cm^{-1}$: 3342, 1590, 1545, 1239, 1040, 650 (benzoxazole nucleus with aromatic ring), 3348, 1342 (-NH), 2980 (N-CH-S), 1450 ($CH_2$), 1715 (C=O cyclic), 1630 (> C=CH Ar), 721 (C-S-C); $^1$H NMR δ 9.15 (s, 1H, NH), 7.04-7.96 (m, 14H, Ar-H), 5.15 (s, 1H > C=CHAr), 4.48 (s, 2H, $CH_2$) 3.20 (s, 1H, N-CH Ar). FAB-MS, *m/z*: 473 $[M]^+$, 445, 384, 343, 327, 295, 281, 267, 253, 207, 192, 178, 164, 162, 150, 136, 129, 122, 118, 108, 92, 90, 79, 66. The proposed mass fragmentation is cited in Chart 1. Anal. Calcd for $C_{25}H_{19}N_3O_3S_2$: C, 63.4; H, 4.0; N, 8.80. Found: C, 63.3; H, 3.82; N, 8.52.

**[2-(2-Chlorophenyl-4-oxo-1,3-thiazolidin)-hydrazinoacetyl-mercaptobenzoxazole] (4b)**

IR (KBr) $\nu_{max}$ $cm^{-1}$: 3032, 1585, 1557, 1248, 1040, 645 (benzoxazole nucleus with aromatic ring) 3342, 1330 (-NH-), 2988 (N-CH-S), 1720 (C=O, cyclic), 1424 ($CH_2$), 756 (Ar-Cl), 716 (C-S-C); $^1$H NMR δ: 9.12 (s, 1H, NH), 7.02-7.90 (m, 8H, Ar + H), 4.55 (s, 2H, $CH_2$), 4.50 (s, 2H, $CH_2$, cyclic), 3.17 (s, 1H, CH-Ar).

**[2-(2-Nitrophenyl-4-oxo-1,3-thiazolidin)-hydrazinoacetyl-mercaptobenzoxazole] (4c)**

IR (KBr) $\nu_{max}$ $cm^{-1}$: 3035, 1577, 1562, 1237, 1048, 650 (benzoxazole nucleus with aromatic ring) 3420-1350 (-NH), 2985 (N-CH-5) 1712 (> C=O, cyclic), 1429 ($CH_2$), 1495, 1345 (Ar-$NO_2$), 720 (C-S-C); $^1$HNMR δ: 9.14 (s, 1H, NH), 7.32-7.82 (m, 8H, Ar-H), 4.52 (s, 2H, $CH_2$), 4.49 (s, 2H, $CH_2$ (cyclic), 3.20 (s, 1H, CH-Ar).

**[2-(2-Methoxyphenyl-4-oxo-1,3-thiazolidin)-hydrazinoacetyl-mercaptobenzoxazole] (4h)**

IR (KBr) $\nu_{max}$ $cm^{-1}$: 3038, 1579, 1565, 1243, 1055, 642 (benzoxazole nucleus with aromatic ring), 3358, 1348 (-NH), 2867, 1172 (Ar-$OCH_3$), 2992 (N-CH-S), 1715 (C=O, cyclic), 1450 ($CH_2$), 723 (C-S-C); $^1$H NMR δ: 9.16 (s, 1H, NH), 7.38-7.89 (m, 8H, Ar-H), 4.59 (s, 2H, $CH_2$), 4.62 (s, 2H, $CH_2$, cyclic), 3.96 (s, 3H, $OCH_3$), 3.26 (s, 1H, N-CH-Ar).

**[(5-Arylidene-2-chlorophenyl-4-oxo-1,3-thiazolidin)-hydrazinoacetyl-mercaptobenzoxazole] (5b)**

IR (KBr) $\nu_{max}$ $cm^{-1}$: 3340, 1592, 1550, 1239, 1042, 652 (benzoxazole nucleus with aromatic ring), 3350, 1345 (-NH), 2982 (N-CH-S), 1440 ($CH_2$), 1718 (C=O, cyclic), 1632 (> C=CH Ar), 750 (Ar-Cl), 721 (C-S-C); $^1$H NMR δ: 9.10 (s, 1H, NH), 7.00-7.92 (m, 13H, Ar-H), 5.12 (s, 1H, > C=CH Ar), 4.51 (s, 2H, $CH_2$), 325 (s, 1H, N-CH-Ar).

**[(5-Arylidene-2-nitrophenyl-4-oxo-1,3-thiazolidin)-hydrazinoacetyl-mercaptobenzoxazole] (5c)**

IR (KBr) $\nu_{max}$ $cm^{-1}$: 3329, 1588, 1560, 1232, 1050, 660 (benzoxazole nucleus with aromatic ring), 3062, 1350 (-NH), 2988 (N-CH-S), 1490, 1350 (Ar-$NO_2$), 1450 ($CH_2$), 1721 (> C=O, cyclic), 1635 (> =CHAr), 718 (C-S-C); $^1$H NMR δ: 8.95 (s, 1H, -NH), 7.59-7.90 (m, 13H, Ar-H), 5.13 (s, 1H, > C=CH Ar), 4.55 (s, 2H, $CH_2$), 3.29 (s, 1H, N-CH-Ar).

**[(5-Arylidene-2-methoxyphenyl-4-oxo-1,3-thiazolidin)-hydrazinoacetyl-mercaptobenzoxazole] (5h)**

IR (KBr) $\nu_{max}$ $cm^{-1}$: 3320, 1590, 1564, 1237, 1047, 652 (benoxazole nucleus with aromatic ring) 3066, 1352 (-NH), 2983 (N-CH-S), 1453 ($CH_2$), 1716 (> C=O, cyclic), 1632 (> C=CH Ar), 2872, 1162 (Ar-$OCH_3$), 721 (C-S-C); $^1$H NMR δ: 9.02 (s, 1H, NH), 7.58-7.92 (m, 13H, Ar-H), 5.09 (s, 1H, > C=CH Ar), 4.49 (s, 2H, $CH_2$), 3.31 (s, 1H, N-CH-Ar), 3.90 (s, 3H, $OCH_3$).

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