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SYNTHESIS AND EVALUATION OF NEW PHENYLAMINO-THIADIAZOLO-OXADIAZOLO-1,3BENZOXAZOLES FOR THEIR ANTIBACTERIAL ACTIVITY

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ABSTRACT

In view of various biological activities of benzoxazoles, thiadiazoles and oxadiazole derivatives, it was our interest to prepare benzoxazole derivatives involving 1,3,4-thiadiazole and 1,3,4-oxadiazole nucleus and evaluate them for antibacterial activity. The key intermediate thiosemicarbazides was obtained from reaction of acid hydrazides with phenylisothiocyanate in reasonable good yield. Thiadiazoles (Scheme-1) were prepared by the treatment of thiosemicarbazides with conc. Sulphuric acid; other derivatives were prepared by Scheme-2, 3 and 4. The structures of the synthesized compounds were confirmed by IR, ^{1}H-NMR and MASS spectral data. All the synthesized compounds were screened for antibacterial activity. The compounds were found to have good activity against gram-positive bacteria than gram-negative bacteria. Among all the active compounds thiadiazole and oxadiazole derivatives showed good activity.

KEYWORDS

Benzoxazoles, thiadiazoles, antibacterial agents, oxadiazoles, schiff bases.

INTRODUCTION

Heterocycles by far are the largest classical divisions of organic chemistry and are of immense importance biologically and industrially. The majority of pharmaceuticals and biologically active agrochemicals are heterocyclic while countless additives and modifiers used in industrial application ranging for cosmetics, reprography, information storage and plastics are heterocyclic in nature. One striking structural feature inherent to heterocyclic's, which continue to be exploited is their ability to manifest substituent around a core scaffold i.e. benzoxazole.

Benzoxazole and its derivatives are important class of bioactive molecules. Their importance is due to their versatile application in the field of drugs and pharmaceuticals as well as in chemical systems. Zoxazolamine, which is a benzoxazole analogue, is mainly used as skeletal muscle relaxant[1]. Moreover, some benzoxazole derivatives have been demonstrated to be potent

antimicrobial[2], anti HIV[3], analgesic[4], anti-inflammatory[4] and anticancer agents[5].

During the last few decades, a considerable attention has been devoted to the synthesis of 1,3,4-thiadiazole, and 1,3,4-oxadiazole derivatives. 1,3,4-thiadiazole derivatives exhibit diverse pharmacological activities possibly due to presence of N=C=S[6] moiety. Moreover, compounds with thiadiazole ring have been produced as anticonvulsant[7], antibacterial[8], anti-inflammatory[9], fungicidal[10] and anticancer agents[11]. Acetazolamide and methazolamide bearing thiadiazole moiety are commonly used as diuretics[12].

1,3,4-Oxadiazoles are a class of heterocycles, which have attracted significant interest in medicine, pesticide chemistry and material science. They are of significant interest in medicinal chemistry in a number of biological targets including, anti-inflammatory[13], human *β*-tryptase inhibitors[14], anticonvulsant[15], antibacterial and antifungal agents[16].

In recent years, various antitumor drugs have been developed for the treatment of cancer. Among these, compounds incorporating schiff base structure were synthesized as antimicrobial[17] and antitumor[18] agents.

Some of azole derivatives used as common antibiotics such as Amphotericin-B posses a toxic effect on humans as well as their antimicrobial effects. Besides this, although there are antimicrobial agents having different structures are frequently used in the treatment of microbial infections; there is resistance to these drugs. To overcome the development of drug resistance it is crucial to synthesize a new class of antibiotics possessing different chemical properties from those of used commonly. Benzoxazole ring containing a side chain that has thiosemicarbazide structure in it is an ideal heterocyclic for this purpose.
In view of these facts, the aim of present study is the synthesis of benzoxazole derivatives involving 1,3,4-thiadiazole and 1,3,4-oxadiazole nucleus and to obtain benzoxazole derivatives incorporating schiff base as antibacterial agents as shown in Scheme-1,2,3, and 4.

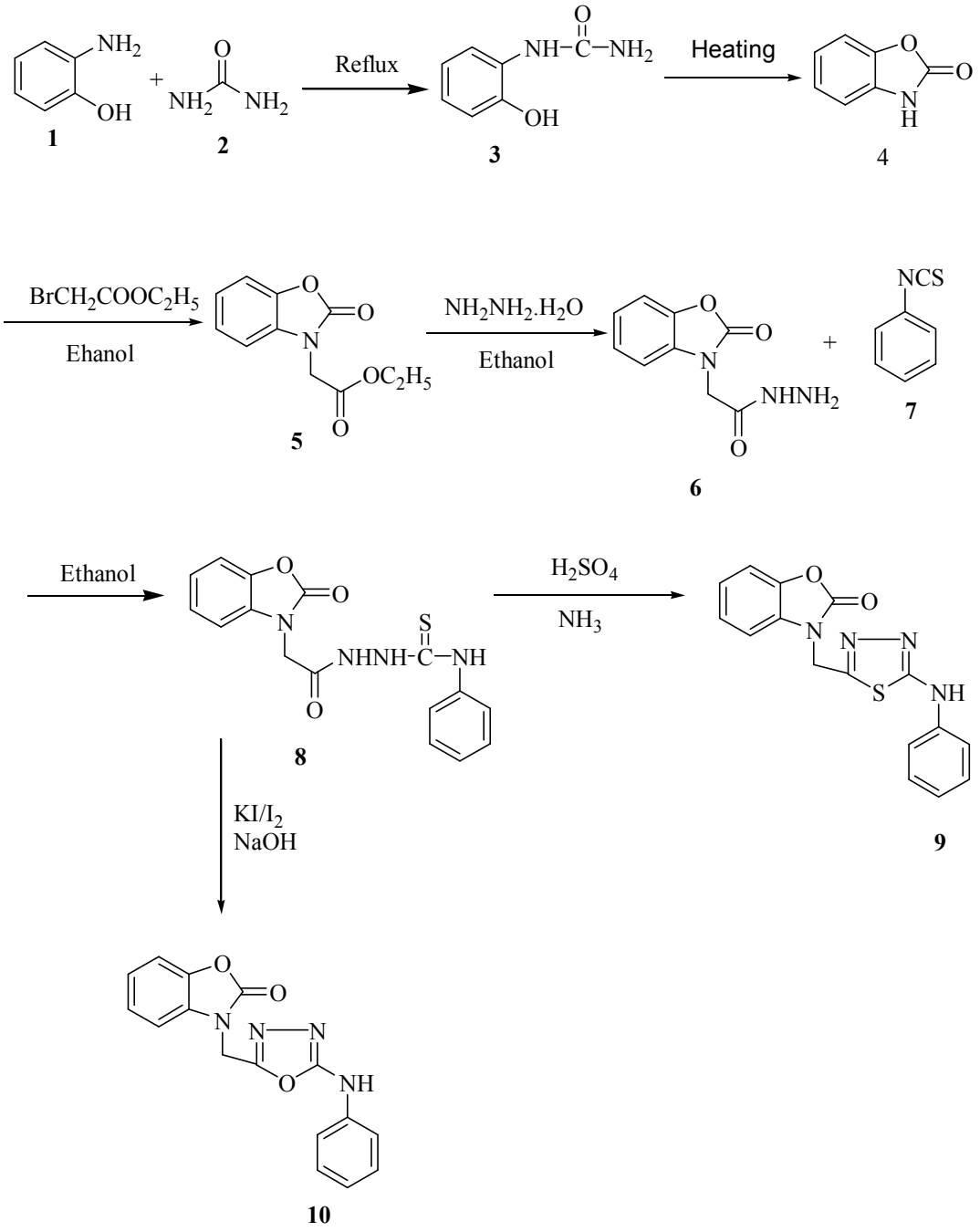
The various synthesized derivatives were characterized by determination of melting point T.L.C, I.R, N.M.R. and MASS. Melting point – By Fischer John's melting point apparatus. T.L.C. – By using Chloroform: methanol (1:1). I.R. - By using Thermo Nicolet Nexus 670 FT-IR. N.M.R. – Bruker 200 spectrospin. MASS – AUTO SPEC-M

Preparation of o-hydroxyphenylurea (3):
O-aminophenol (10 g, 91.7mmol) was thoroughly mixed with finely ground urea (10 g, 166.7 mmol) and heated at 160 ^{o}C for 25 min. The melt was allowed to cool and was extracted with 4 M HCl solution (350 ml). This purple acidic solution was in turn extracted with ether (300 ml).The residue resulting from evaporation of dried ether layer was taken up in boiling methanol, decolorized, and the product allowed to crystallize. Yield: 84%, m.p: 130-132 ^{o}C.

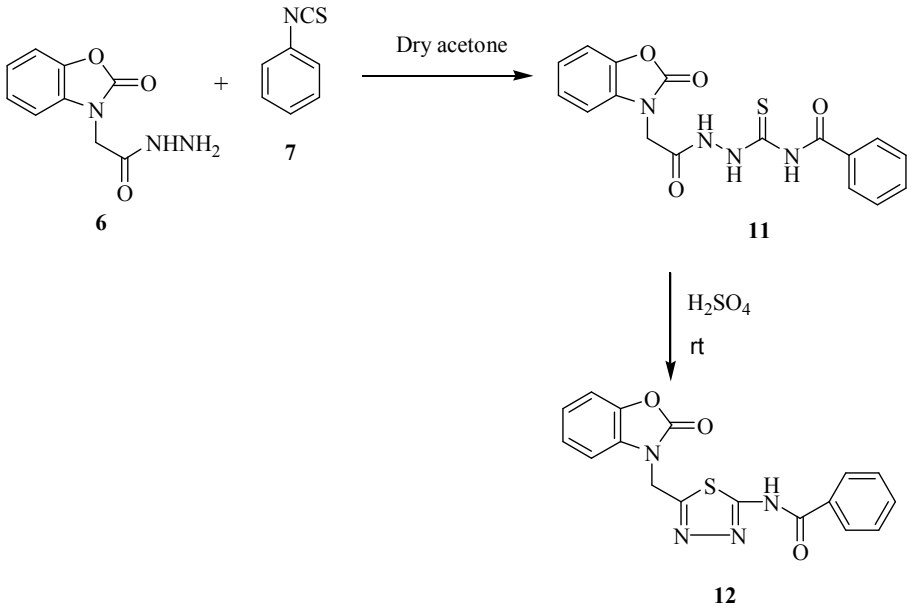
Preparation of 3 H-benzooxazole-2one (4):
Dry *o*-hydroxyphenylurea (5 g) was placed in round bottom flask and heated at 160 ^{o}C for 15 min. The cooled melts were dissolved in hot methanol, decolorized and the products allowed to crystallize. Yield: 78%, m.p: 135-138 ^{o}C.

Preparation of (2-Oxobenzooxazol-3-yl) acetic acid ethyl ester (5):
The corresponding 3*H*-Benzooxazol-2-one **4** (5 g, 37 mmol) was refluxed with equivalent amount of sodium in absolute ethanol for 2 h. Then ethyl bromo acetate (6.79 g, 40 mmol) was added and mixture was refluxed for additional 5 h. After concentrating the reaction mixture at 35-40 ^{o}C under reduced pressure a semisolid mass appeared this was recrystalized from ethanol to get the desired compound as a solid. Yield: 78.87%, m.p: 88-90 ^{o}C.

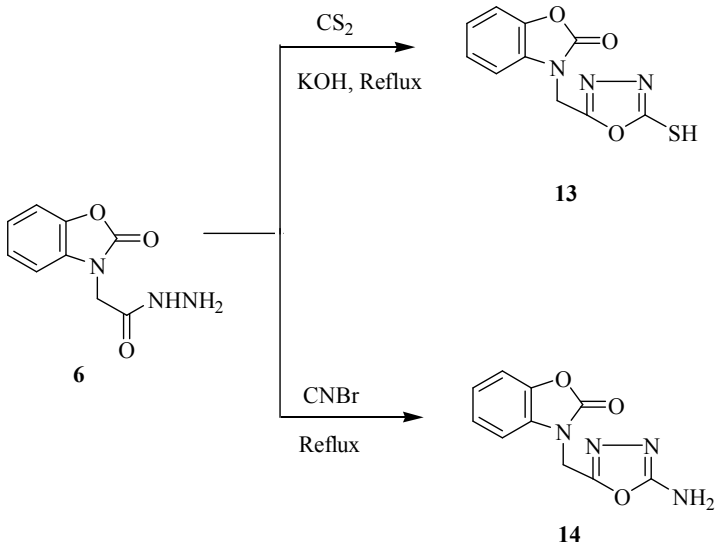
MATERIALS AND METHODS



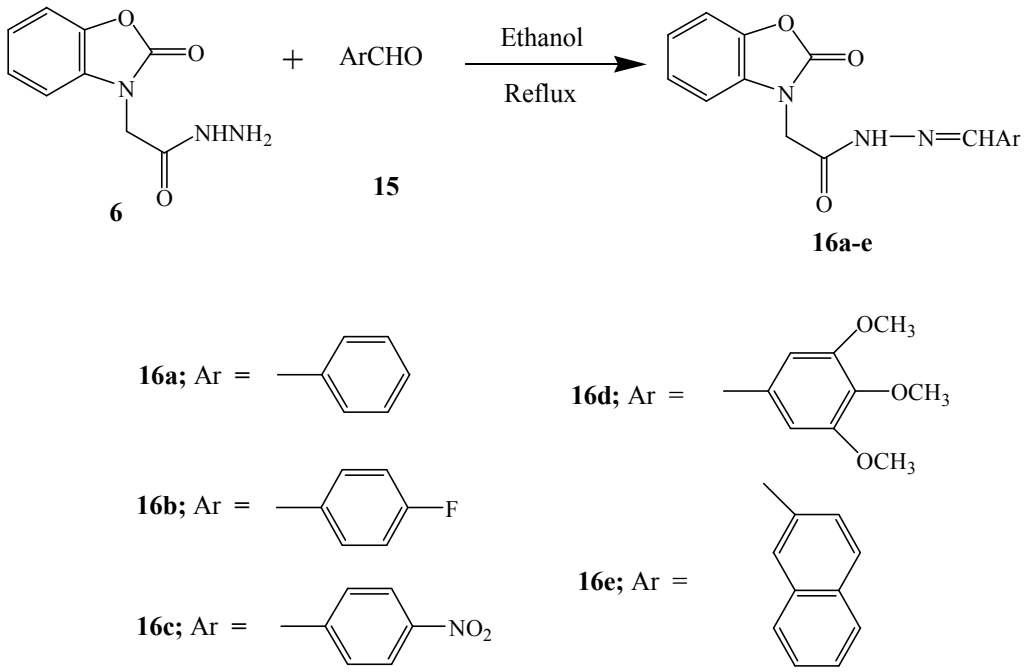
Scheme-1



Scheme-2



Scheme-3



Scheme-4

Preparation of (2-oxobenzooxazol-3yl) acetic acid hydrazide (6):
A solution of the corresponding (2-oxobenzooxazol-3yl) acetic acid ethyl ester 5 (3.5 g, 15 mmol) in ethanol was refluxed with hydrazine hydrate (1.9 g, 37 mmol) for 4 h. After concentrating the reaction mixture a white solid mass appeared this was recrystalized from an ethanol to get desired product as a solid. Yield: 55%, m.p.189-190 ^{o}C.

Preparation of 2-(2-(2-Oxobenzo [d] oxazol-3 (2H)-yl) acetyl)-N Phenylhydrazine Carbothioamide (8):
A mixture of corresponding acid hydrazide 6 (0.8 g, 3.8 mmol) and phenyl isothiocynate (0.769 g, 0.5 mmol) was refluxed in ethanol for 8 h. The solution was cooled and a white solid was appeared. This was filtered and recrystalized from ethanol to get desired product as a solid. Yield: 65.89%, m.p. 190-192 ^{o}C.

Preparation of 3-(5-Phenylamino- [1,3,4] thiadiazol-2yl methyl)-3H-benzooxazol-2-one (9):
A mixture of the corresponding thiosemicarbazide 8 (0.4 g, 1.1 mmol) in cold concentrated sulfuric acid (3.00 ml) was stirred for 10 min. Then the mixture was allowed to room temperature. After stirring for an additional 30 min, the resulting solution was poured into ice-cold water and made alkaline to P^{H} 8 with ammonia. The precipitated product was filtered and recrystalized from ethanol to get desired product as a solid. Yield: 73.68%, m.p. 223-225 ^{o}C.

Preparation of 3-(5-phenylamino- [1, 3, 4] oxadiazol-2yl methyl)-3H- Benzooxazol-2-one (10):
Thiosemicarbazide 8 (0.15 g, 0.4 mmol) in ethanol was dissolved in aqueous sodium hydroxide (5 N, 1 ml) with cooling and stirring, resulting in a clear solution. To this iodine in potassium iodide solution (5%) was added gradually with stirring till the colour of iodine persisted at room temperature. The reaction mixture was then refluxed for 1 h on oil bath. It was then cooled and poured over crushed ice. The solid mass that separated out was filtered, dried and recrystalized from ethanol to get desired product as a solid. Yield: 57.36%, m.p: 173-175 ^{o}C.

Preparation of N- {N- [2-(2-oxo-benzooxazol-3yl)-acetyl]-hydrazinocarbothioyl} benzamide (11):

A mixture of (2-oxobenzooxazol-3yl) acetic acid hydrazide 6 (0.2 g, 0.9 mmol) and phenyl-isothiocynate (0.121 g, 0.8 mmol) in dry acetone (5 ml) was stirred for an hour at room temperature and further washed with water and dried to get desired product as a solid.
Yield: 55.00%, m.p: 190-192 ^{o}C.

Preparation of N- [5-(2-oxobenzooxazol-3yl methyl)-[1,3,4] thiadiazol-2yl] benzamide (12):

A mixture of {*N*-[2-(2-oxobenzooxazol-3yl)-acetyl-hydrazinocarbothioyl] benzamide 11 (0.9 g, 2 mmol) was added to cold conc. sulphuric acid. The mixture was stirred at room temperature for 2 h. The resultant solid mass was poured on to crushed ice with stirring. The product was filtered, washed with water and dried to get as a solid. Yield: 71.50%, m.p:112-115 ^{o}C.

Preparation of 3-(5-mercapto- [1,3,4] oxadiazol-2yl methyl)- 3H-benzooxazol-2-one (13):

A mixture of (2-oxobenzooxazol-3yl) acetic acid hydrazide 6 (0.2 g, 1 mmol), KOH (0.056 g, 1 mmol) and carbon disulphide (1 ml) in ethanol was refluxed on oil bath for 12 h. The solution was then concentrated, cooled and acidified with dilute HCl. The solid mass the separated out was filtered, washed with ethanol, dried and recrystallized from ethanol to get as a solid.
Yield: 57.36%, m.p: 130-132 ^{o}C.

Preparation of 3-(5-Amino- [1, 3, 4] oxadiazol-2yl methyl) - 3H-benzooxazol-2-one (14):

To an ethanolic solution of (2-Oxobenzooxazol-3yl) acetic acid hydrazide 6 (0.3 g, 1 mmol), cynogen bromide (0.106 g, 1 mmol) was added. The reaction mixture was warmed at 55-60 ^{o}C for 90 min. The resulting solution was cooled and neutralized with sodium bicarbonate solution. The solid thus obtained thus separated out as filtered, washed with water, dried and recrystalized from methanol to get desired product as semisolid. Yield: 65.00%.

Preparation of (2 oxo-benzooxazol-3yl) acetic acid benzylidine hydrazide (16a):

A solution of the corresponding (2-oxobenzooxazol-3yl) acetic acid hydrazide (0.050 g, 0.2 mmol) in ethanol was refluxed with benzaldehyde (0.021 g, 0.2 mmol) for 24 h. After cooling to room temperature, a white solid appeared. This crude product was recrystalized from ethanol to get desired product as solid. Yield: 60.97%, m.p.235-240 ^{o}C.

Preparation of (2-oxo-benzooxazol-3yl) acetic acid (4-fluro benzylidine) - hydrazide (16b):

A solution of the corresponding (2-oxobenzooxazol-3yl) acetic acid hydrazide (0.05 g, 0.2 mmol) in ethanol was refluxed with 4-fluoro benzaldehyde (0.024g, 0.2 mmol) for 24 h. After cooling to room temperature, a white solid appeared. This crude product was recrystalized from ethanol to get desired product as solid. Yield: 94.69%, m.p: 245-250 ^{o}C.

Preparation of (2-oxo-benzooxazol-3yl) acetic acid (4-nitro benzylidine)-hydrazide (16c):

A solution of the corresponding (2-oxobenzooxazol-3yl) acetic acid hydrazide (0.05 g, 0.2 mmol) in ethanol was refluxed with 4-nitro benzaldehyde (0.03 g, 0.2 mmol) for 24 h. After cooling to room temperature, a white solid appeared. This crude product was recrystalized from ethanol to get desired product as solid. Yield: 88.95%, m.p: 275-280 ^{o}C.

Preparation of (2-oxo-benzooxazol-3yl) acetic acid (3, 4, 5-trimethoxy benzylidine)-hydrazide (16d):

A solution of the corresponding (2-oxobenzooxazol-3yl) acetic acid hydrazide (0.05 g, 0.2 mmol) in ethanol was refluxed with 3,4,5-trimethoxy benzaldehyde (0.03 g, 0.2 mmol) for 24 h. After cooling to room temperature, a white solid appeared. This crude product was recrystalized from ethanol

to get desired product as solid. Yield: 65.73%, m.p: 235-240 ^{o}C.

Preparation of (2-oxo-benzooxazol-3yl) acetic acid naphthalene 1-yl methylene hydrazide (16e):

A solution of the corresponding (2-oxobenzooxazol-3yl) acetic acid hydrazide (0.05 g, 0.2 mmol) in ethanol was refluxed with 4-nitro benzaldehyde (0.031 g, 0.2 mmol) for 24 h. After cooling to room temperature, a white solid appeared. This crude product was recrystalized from ethanol to get desired product as solid. Yield: 74.35%, m.p.220-225 ^{o}C.

3-(5-Phenylamino- [1,3,4] thiadiazol-2yl methyl)-3H-benzooxazol-2-one (9):

IR (KBr): υ_{max} 3301 (NH), 1736 (lactone C=O), 1544 (C=N) cm^{-1}. ^{1}HNMR (200 MHz, DMSO-d_6): δ 5.4 (s, 2H, NCH_2), 6.95-7.62 (m, 9H, Ar-H). EI-MS: m/z = 324 (M^+)

3-(5-phenylamino- [1, 3, 4] oxadiazol-2yl methyl)-3H- Benzooxazol-2-one (10):

IR (KBr): υ_{max} 3369-3437 (NH), 1775 (lactone C=O), 1488 (C=N) cm^{-1}.^{1}HNMR (200 MHz, DMSO-d_6): δ 5.02 (s, 2H, NCH_2), 6.9-7.62 (m, 9H, Ar-H), 10.2 (s, 1H, NH). EI-MS: m/z = 308 (M^+).

N- {N- [2-(2-oxo-benzooxazol-3yl)-acetyl]-hydrazinocarbothioyl} benzamide (11):

IR (KBr): υ_{max} 3136-3261 (3NH), 1757 (amide C=O), 1483 (C=S) cm^{-1}. ^{1}HNMR (200 MHz, DMSO-d_6): δ 4.65 (s, 2H, NCH_2), 6.82-7.75 (m, 9H, Ar-H), 9.5 (s, 1H, CONH). EI-MS: m/z = 370 (M^+).

N- [5-(2-oxobenzooxazol-3yl methyl)-[1,3,4] thiadiazol-2yl] benzamide (12):

IR (KBr): υ_{max} 3431 (NH), 1741 (lactone C=O), 1491 (C=N) cm^{-1}. ^{1}HNMR (200 MHz, DMSO-d_6): δ 5.40 (s, 2H, NCH_2), 6.90-8 (m, 9H, Ar-H), 10.10 (s, 1H, NH). EI-MS: m/z = 352 (M^+).

3-(5-mercapto- [1,3,4] oxadiazol-2yl methyl)-3H-benzooxazol-2-one (13):

IR (KBr): υ_{max} 1757 (lactone C=O), 1483 (C=N), cm$^{-.1}$HNMR (200 MH_Z, DMSO-d_6): δ 5.15 (s, 2H, NCH_2), 7.05-7.03 (m, 1H, Ar-H), EI-MS: m/z = 249 (M^+) .

3-(5-Amino- [1, 3, 4] oxadiazol-2yl methyl) - 3H-benzooxazol-2-one (14):

IR (Neat): υ_{max} 3447 (NH_2), 1769 (lactoneC=O), 1458 (C=N), 1489 (C=N) cm^{-1}. ^{1}HNMR (200 MHz, DMSO-d_6): δ 4.70 (s, 2H, $NCH_)$, 6.00 (s, 2H, NH_2), 6.70-7.40 (m, 4H, Ar-H). EI-MS: m/z = 232 (M^+).

(2 oxo-benzooxazol-3yl) acetic acid benzylidine hydrazide (16a):

IR (KBr): υ_{max} 3188 (NH), 1770 (lactone C=O), 1679 (amide C=O), 1679 (amide C=O) 1489 (C=*N)* cm^{-1}. ^{1}HNMR (200 MHz, DMSO-d_6): δ 5 (s, 2H, CH_2), 6.95- 7.8 (m, 9H, Ar-H), 8 (s, 1H, CH), 11.69 (s, 1H, NH). EI-MS: m/z = 295 (M^+).

(2-oxo-benzooxazol-3yl) acetic acid (4-fluro benzylidine) - hydrazide (16b):

IR (KBr): υ_{max} 3190 (NH), 1777 (lactone C=O), 1677 (amide C=O), 1492 (C=N) cm^{-1} .^{1}HNMR (200 MHz, DMSO-d_6): δ 5.1 (s, 2H, CH_2), 7.15-7.85 (m, 8H, Ar-H), 8.1 (s, 1H, CH), 11.8 (s, 1H, NH). EI-MS: m/z = 313 (M^+).

(2-oxo-benzooxazol-3yl) acetic acid (4-nitro benzylidine)-hydrazide (16c):

IR (KBr): υ_{max} 3322 (NH), 1783 (lactone C=O), 1677 (amide C=O), 1593 (C=N) cm^{-1}. ^{1}HNMR (200 MHz, DMSO-d_6): δ 5.15 (s, 2H, CH_2), 6.80 - 7.25 (m, 4H, Ar-H), 8.25 (d, 2H, NO_2-Ar-H), 12.10 (s, 1H, NH). EI-MS: m/z = 340 (M^+).

(2-oxo-benzooxazol-3yl) acetic acid (3, 4, 5-trimethoxy benzylidine)-hydrazide (16d):

IR (KBr): υ_{max}1772 (lactone C=N), 1681 (amide C=O), 1582 (C=N) cm^{-1}. ^{1}HNMR (200 MHz, DMSO-d_6): δ 3.90-3.95 (2s, 9H, 3-OCH_3), 5.06 (s, 2H, CH_2), 6.85- 7.25 (m, 6H, Ar-H), 7.95 (s, 1H, CH), 11.68 (s, 1H, NH). EI-MS: m/z =385 (M^+).

(2-oxo-benzooxazol-3yl) acetic acid naphthalene 1-yl methylene hydrazide (16e): IR (KBr): u_{max} 3181 (NH), 1775 (lactone C=O), 1679 (amide C=O), 1489 (C=N) cm^{-1}. ^{1}HNMR (200 MHz, DMSO-d_6): δ 5.50 (s, 2H, N-CH_2), 7.00- 8.00 (m, 11H, Ar-H), 8.70 (s, 1H, N=CH), 8.25 (d, 2H, NO_2-Ar-H). EI-MS: m/z = 345 (M^+).

Table-1

Physico-Chemical data of the synthesized compounds

Compound code	Molecular formula	Molecular weight	M.P. °C	% Yield
9	$C_{16}H_{12}N_4O_2$	324	223-225	73.68
10	$C_{16}H_{12}N_4O_3$	308	173-175	57.36
11	$C_{17}H_{14}N_4O_4S$	370	190-192	55.00
12	$C_{17}H_{12}N_4O_3S$	352	112-115	71.50
13	$C_{10}H_7N_3O_3S$	249	130-132	57.36
14	$C_{10}H_8N_4O_3$	332	Liquid	65.00
16a	$C_{16}H_{13}N_3O_3$	295	238-240	60.97
16b	$C_{16}H_{12}N_3O_3F$	313	248-250	94.69
16c	$C_{16}H_{12}N_4O_5$	340	277-280	88.95
16d	$C_{19}H_{19}N_3O_6$	385	238-240	65.73
16e	$C_{20}H_{15}N_3O_3$	345	222-225	74.35

ANTIBACTERIAL ACTIVITY

Table 2

Different strains of bacteria used for antibacterial activity

Gram positive bacteria	Gram negative bacteria
Bacillus subtilis	*Pseudomonas aeruginosa*
Staphylococcus aureus	*Escherichia coli*
Staphylococcus epidermidis	*Klebsiella pneumoniae*

The antibacterial activity of title compounds had been assayed against six different strains of bacteria by serial dilution method [19, 20].

The method adopted in this investigation was serial dilution method. In this method serial dilutions of the antibiotic / test compounds were made in a liquid medium which was inoculated separately with six strains of bacteria and incubated at 37 ± 1˚C for 24 h. The lowest concentration (highest dilution) of compound preventing the appearance of turbidity is considered to be the minimal inhibitory concentration (MIC). At this dilution the compound is known to be bacteriostatic.

RESULTS AND DISCUSSION

All synthesized compounds were screened for antibacterial activity against three gram-positive and gram-negative bacteria by serial dilution method taking drug at a concentration of 150 µg/ml. The minimum inhibitory concentration (MIC) was taken as a parameter of antibacterial activity. The MIC of the test compound is compared to that of the standard drugs *i.e.,* Penicillin and Streptomycin.

All the compounds 9, 10, 12, 13, 14, 16a-e (Table-3) have showed activity against Gram-positive and Gram-negative bacteria. Oxadiazole derivatives 10, 13 and 14 and schiff base derivative 16b-c showed good activity.

The MIC exhibited by the compound 14 against *S. aureus* was at 4.68 µg/ml where as compound 14 showed MIC at 4.68µg/ml against *P.aeruginosa*. The MIC exhibited by the compound 10 was at 9.37µg/ml against *S.epidermidis*. Schiff base derivatives 16b showed good activity against *S. epidermidis.* The MIC exhibited by these compounds was at 18.75 µg/ml.

Compounds 16a and 16d showed significant activity against *B. sublitis*, MIC was observed at 75 µg/ml, where as compounds 9, 10, 12, 13, 14,16b, 16c and 16e (Table-3) showed MIC at 150 µg/ml against *B. subtilis*. Oxadiazole derivative 14 showed good activity against *S. aureus*. The MIC exhibited by these compounds was at 4.68 µg/ml. Compound 10 showed good activity against *S. aureus* and MIC for these compounds was observed at 9.37µg/ml. whereas compounds 9 and 16d showed significant activity against *S. aureus*. The MIC exhibited by 9 and 16d was at 37.5µg/ml. The compounds 13, 16b and 16c (Table-3) showed moderate activity against *S. aureus.* The MIC exhibited by 13, 16b and 16c was at 75 µg/ml. whereas compounds 12, 16a and 16e showed MIC at 150 µg/ml

Oxadiazole derivatives 10 showed good activity against *S. epidermidis*. The MIC exhibited by these compounds was at 9.37µg/ml. The MIC exhibited by 16b and 16c was at 18.75µg/ml the compounds 13 (Table-3) showed MIC at 37.5µg/ml and were found to have significant activity. The compounds 12, 14 and 16e (Table-3) showed moderate activity and the MIC exhibited by these compounds was at 75 µg/ml where as the compound 9, 16a and 16d showed MIC at 150 µg/ml.

Oxadiazole derivatives, 10, 13 and 14 (Table-3) showed good activity against *P. aeruginosa*, the MIC exhibited the compound 14 was at 4.68µg/ml. Compound 10 showed activity against *P. aeruginosa* and MIC for these compounds was observed at 9.37µg/ml where as compound 13 showed significant activity against *P. aeruginosa*. The MIC exhibited by this compound was at 18.75µg/ml. The compounds 9, 12 and 16a-e showed MIC at 150µg/ml against *P. aeruginosa*.

All the compounds 9, 10, 12, 13, 14 and 16a-e (Table-3) showed MIC at 150µg/ml against *E. coli* and *K. pneumoniae*.

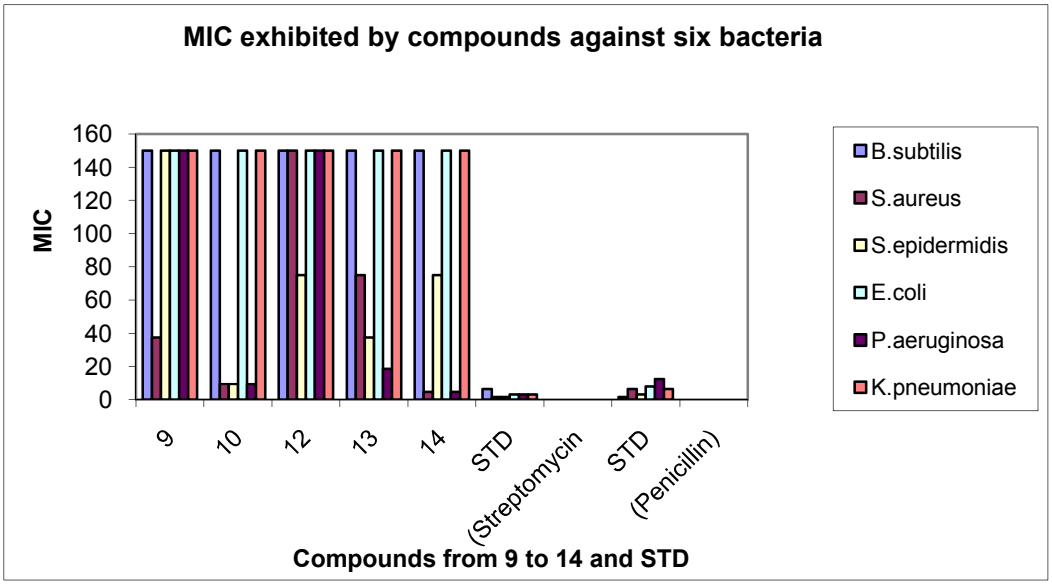
Table 3

Antibacterial activity of compounds

Minimum Inhibitory concentration (µg / ml)						
	Gram positive organisms			Gram negative organisms		
Compound No	***B.subtilis***	***S.aureus***	***S.epidermidis***	***E.coli***	***P.aeruginosa***	***K.pneumoniae***
9	150	37.5	150	150	150	150
10	150	9.37	9.375	150	9.37	150
12	150	150	75	150	150	150
13	150	75	37.5	150	18.75	150
14	150	4.68	75	150	4.68	150
16a	75	150	150	150	150	150
16b	150	75	18.75	150	150	150
16c	150	75	18.75	150	150	150
16d	75	37.5	150	150	150	150
16e	150	150	75	150	150	150
STD(Streptomycin)	6.25	1.56	1.562	3.125	3.125	3.125
STD(Penicillin)	1.526	6.25	3.125	7.81	12.5	6.25

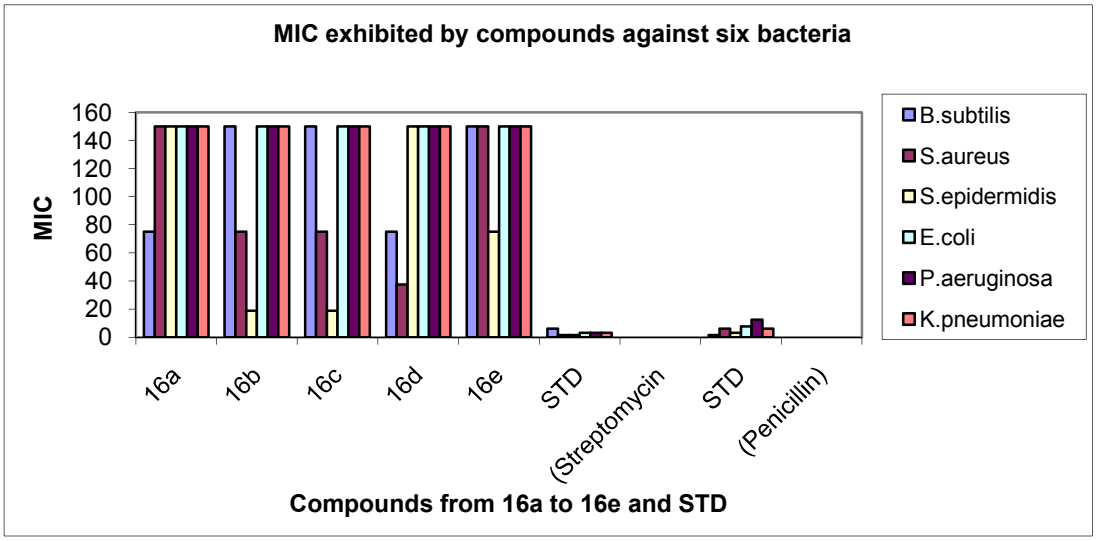
Graph 1

MIC exhibited by compounds 9 to 14 against six bacteria



Graph 2

MIC exhibited by compounds 16a to 16e against six bacteria



CONCLUSION

The proposed benzoxazole derivatives i.e. thiadiazoles, oxadiazoles, and schiff bases were synthesized successfully. All the compounds were evaluated for antibacterial activity. The compounds were found to have good activity against gram-positive bacteria then gram-negative bacteria. Among all the active compounds thiadiazole and oxadiazole derivatives showed good activity.

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