In the present study various benzofuran derivatives were synthesized using different schemes 1-5. All the melting points were determined in open glass capillary tube method containing paraffin and are uncorrected. New synthesized compounds were characterized by elemental analysis, FT-IR, $^1$H-NMR and mass spectroscopic techniques. Antiinflammatory activity of all the compounds were performed by carrageenan induced rat paw edema method. Diclofenac was used as a standard. The antibacterial activity was performed by using cup plate method against *Staphylococcus aureus* and *E.coli* by using penicillin and streptomycin as a standards respectively. The antifungal activity was performed against fungus *Candida albicans* and *Aspergillus flavus* by using cup plate method using griseofulvin as a standard. In the antibacterial and antifungal activity the zone of inhibition was measured using vernier caliper.

Scheme 1 contained the synthesis of 5-(3-(substitutedphenylamino)-benzofuran-2-yl)-1,3,4-oxadiazole-2-thiols (4a-h).

![Scheme-1](image)

**Scheme-1**

All the synthesized compounds were characterized by elemental analysis, FT-IR and $^1$H-NMR. IR spectra of (4a-h) exhibited an absorption bands in the region 3360-3350, 1600-1490 and 1190-1182 cm$^{-1}$ confirmed the presence of N-H, C-N and C=S functionalities respectively. $^1$H NMR spectra of (4a-h) showed multiplet at δ 7.0-7.9 corresponding to aromatic protons, a broad singlet at δ 9.08-9.20 due to NH proton and a
singlet at δ 10.50-10.55 corresponding to proton of SH group. The structures and purity of the final compounds were confirmed on the basis of spectral and elemental analyses.

Antiinflammatory activity of compounds 4a-h of Scheme 1 was performed in rats by carrageenan induced rat paw edema method and almost all the compounds showed encouraging activity. The compounds 4a, 4c, 4f and 4e showed good anti-inflammatory activity. The compounds that bear the substituted aniline moiety gave better anti-inflammatory activity compared to unsubstituted aniline moiety. Further the compounds that contain the substituents at para position on aniline moiety showed the good activity. Compound 4c and 4e showed percent inhibition of edema 64 and 68 respectively contains the substitution of halo atoms. These compounds resembles the structure of fenamates where benzene moiety was substituted by benzofuran moiety and carboxylic acid moiety converted to oxadiazole ring. This modification gave improvement in the antiinflammatory activity.

Antibacterial activity of compounds 4a-h of Scheme 1 on Gm +ve bacteria Staphylococcus aureus and Gm -ve bacteria E. coli by using cup plate method was performed. It was observed that compound 4b, 4c, 4e and 4f are the most active among all tested compounds against Gm +ve bacteria. Against Gm –ve bacteria compounds 4b, 4d and 4f are the most active. The compound containing chlorine and fluorine atom as a substituents are most active antibacterial compounds. The compounds with methyl group as substituents showed moderate activity.

The antifungal activity of the compounds 4a-h of Scheme 1 was performed by using Candida albicans and Aspergillus flavus by cup plate method. It was observed that compound 4b, 4c, 4e, 4g and 4h are the most active among all tested compounds against
**Synopsis**

*Candida albicans*. Against *Aspergillus flavus* compounds 4a, 4c, 4f 4g and 4h are the most active compounds. The compound containing chlorine, fluorine atom and methyl group as substituents have high activity.

Scheme 2 contained the synthesis of 2-(2-(substitutedphenylcarbamoyl)-benzofuran-3-yloxy)-acetic acids (3a-o).

![Scheme-2](image-url)

Synthesized compounds were characterized by elemental analysis, FT-IR and $^1$H-NMR. IR spectra of (3a-o) exhibited an absorption bands in the region 3377-3330, 1692-1665, 1620-1530, 1560-1480 and 1135-1100 cm\(^{-1}\) confirmed the presence of N-H, C=O, C=N, C=C and C-O-C functionalities respectively. $^1$H NMR spectra of (3a-o) showed multiplet at $\delta$ 7.0-7.8 corresponding to aromatic protons, a singlet at $\delta$ 4.88-4.9 corresponding to CH\(_2\), a singlet at $\delta$ 8.0 due to NH proton and a singlet at $\delta$ 11.00 corresponding to proton of OH. The structures and purity of the final compounds were confirmed on the basis of spectral and elemental analyses.

Antiinflammatory activity of the compounds 3a-o of Scheme 2 in rats was performed by carrageenan induced rat paw edema method. All compounds showed good antiinflammatory activity. The compounds 3c, 3d, 3e, 3f, 3g and 3h exhibited maximum antiinflammatory activity with percent inhibition of edema 62, 65, 67, 66, 64, and 63 respectively. These compounds contain the group that contributes to the lipophilicity and that may be the reason for comparable antiinflammatory activity. The compound 3e have
chlorine and fluorine atom as a substituents on phenylcarbamoyl moiety. The compounds those have chloro, methyl and methoxy substituents on phenylcarbamoyl moiety showed comparable antiinflammatory activity as that of diclofenac sodium which was used as standard. The other compounds also have percent inhibition in the range of 58 to 53.

Antibacterial activity of compounds 3a-o of Scheme 2 on Gm +ve bacteria Staphylococcus aureus and Gm -ve bacteria E. coli was performed by using cup plate method. It was observed that compound 3a, 3c, 3e, 3m and 3n are the most active among all tested compounds against Gm +ve bacteria. The compound 3n have highest zone of inhibition against Gm +ve bacteria. This compound contains chlorine and nitro group substituents and this is the probable reason for higher activity. The compounds 3e, 3k, 3n and 3o are the most active compounds against Gm –ve bacteria. These have also chlorine, methyl and nitro group substituents. 3n and 3o display highest zone of inhibition against Gm –ve bacteria. In conclusion, the compounds containing halo atom and nitro group as substituents showed good zone of inhibition against both Gm +ve and Gm –ve bacteria. The high electron density due to electron withdrawing nature of these atom and group may contribute to the antibacterial activity.

Antifungal activity of the compounds 3a-o of Scheme 2 on Candida albicans and Aspergillus flavus was performed by using cup plate method. Compound 3c, 3e, 3f, 3k and 3n are the most active among all tested compounds against Candida albicans. Among these, compound 3n display highest zone of inhibition. Against Aspergillus flavus compounds 3b, 3e, 3f, 3k, 3l and 3n are the most active members. The compounds 3e and 3l have highest zone of inhibition. Compound with nitro and methyl group as substituent displays good antifungal activity.
Scheme-3 contained the synthesis of 2-(3-(benzofuran-2-yl)-4, 5-dihydro-5-substitutedphenylpyrazole-1-yl)-acetic acids (4a-j).

Synthesized compounds were characterized by elemental analysis, FT-IR and $^1$H-NMR. IR spectra of (4a-j) exhibited an absorption bands in the region 3245-3220, 1685-1660, 1635-1515, 1510-1485 and 1115-1090 cm$^{-1}$ confirmed the presence of N-N, C=O, C=N, C=C and C-O-C functionalities respectively. $^1$H NMR spectra of (4a-j) showed multiplet at $\delta$ 6.9-7.8 corresponding to aromatic protons, a doublet at $\delta$ 1.9-2.0 corresponding to CH$_2$ of pyrazole ring, a triplet at $\delta$ 3.7-3.9 corresponding to CH of pyrazole ring, a singlet at $\delta$ 3.49-3.5 corresponding to CH$_2$ of acid moiety and a singlet at $\delta$ 11.00-11.1 corresponding to proton of OH. The structures and purity of the final compounds were confirmed on the basis of spectral and elemental analyses.

Antiinflammatory activity of compounds 4a-j of Scheme 3 was performed in rats by using carrageenan induced rat paw edema method. All compounds showed good antiinflammatory activity. The compounds 4e, 4g, 4h, 4i and 4j exhibited maximum antiinflammatory activity with percent inhibition of edema 63, 60, 65, 62 and 63 respectively. The compound 3h showed highest percent inhibition of edema contains chlorine atom as a para substituent on phenyl ring which is attached to pyrazole moiety. The compounds with chlorine atom and nitro group as a substituents have shown greater...
antiinflammatory activity which comparable to diclofenac sodium. The probable reason of the higher activity is the higher lipophilicity of the compounds due to the lipophilic substituents. Also the compounds containing electron withdrawing group showed good antiinflammatory activity.

Antibacterial activity of compounds 4a-j of Scheme 3 on Gm +ve bacteria *Staphylococcus aureus* and Gm -ve bacteria *E. coli* was performed by using cup plate method. It was observed that compounds 4d, 4e and 3i are the most active among all tested compounds against Gm +ve bacteria. The compound 4e and 4i have highest zone of inhibition against Gm +ve bacteria. These compounds contain nitro group and chlorine atom as a substituents. The halo atoms and nitro group are having high electron cloud and due to this these compounds displayed highest zone of inhibition. The compounds 4b, 4e, 4h and 4i are the most active compounds against Gm –ve bacteria. here also the halo atom and nitro group may contributes to the activity.

Antifungal activity of the compounds 4a-j of Scheme 3 on *Candida albicans* and *Aspergillus flavus* by using cup plate was performed. It was observed that compound 4d, 4e, 4f, 4g and 4i are the most active among all tested compounds against *Candida albicans* and *Aspergillus flavus*. These compounds showed high zone of inhibition as compared to other compounds. They have zone of inhibition in the range of 20-23 mm. The damage to the microorganism by some groups like nitro group may be the reason for antifungal activity. Other compounds have also shown good antifungal activity.

Scheme-4 contained the synthesis of 2-(2-(4, 5-dihydro-5-substitutedphenylisoxazol-3-yl)-enzofuran-3-yloxy)-acetic acids (4a-j).
Synthesized compounds were characterized by elemental analysis, FT-IR and $^1$H-NMR. IR spectra of (4a-j) exhibited an absorption bands in the region 1690-1635, 1645-1615, 1515-1470 and 1115-1080 cm$^{-1}$ confirmed the presence of C=O, C=N, C=C and C-O-C functionalities respectively. $^1$H NMR spectra of (4a-j) showed multiplet at $\delta$ 7-7.8 corresponding to aromatic protons, a doublet at $\delta$ 1.7-1.9 corresponding to CH$_2$ of isoxazol ring, a triplet at $\delta$ 4.5 corresponding to CH of isoxazole ring, a singlet at $\delta$ 4.88-4.9 corresponding to CH$_2$ of acid moiety and a singlet at $\delta$ 11.00 corresponding to proton of acid OH. The structures and purity of the final compounds were confirmed on the basis of spectral and elemental analyses.

Antiinflammatory activity of compounds 4a-j of Scheme 4 was performed in rats by using carrageenan induced rat paw edema method. The compounds 4e, 4h, 4i and 4j exhibited maximum antiinflammatory activity with percent inhibition of edema 64, 66, 64, and 64 respectively. The compound 4h showed highest percent inhibition of edema contains chlorine atom as a para substituent on phenyl ring which is attached to isoxazole moiety. Here also observed that the compounds with halo atom and nitro group as substituents showed good antiinflammatory activity. The compound 4j containing methoxy group substituent also showed comparable activity. Here also the probable...
reason for activity is lipophilicity and the electron withdrawing nature of the substituents. Other compounds have also showed encouraging antiinflammatory activity.

Antibacterial activity of compounds 4a-j of Scheme 4 was performed on Gm +ve bacteria *Staphylococcus aureus* and Gm -ve bacteria *E. coli* by using cup plate method. It was observed that compound 4c, 4d, 4e, 4f, 4g and 3i are the most active among all tested compounds against Gm +ve bacteria. The compounds 4c, 4d, 4e, 4f, 4g and 4h showed high antibacterial activity by displaying higher zone of inhibition against Gm –ve bacteria. All the active compounds have nitro and halo substituents that mite contributes to the antibacterial activity. The compounds with halo atom and nitro group as substituents showed good antibacterial activity against Gm +ve and Gm –ve bacteria.

Antifungal activity of the compounds 4a-j of Scheme 4 was performed on *Candida albicans* and *Aspergillus flavus* by using cup plate method. It was observed that compound 4d, 4e, 4f, 4g, 4h and 4i are the most active compounds. These compounds showed high zone of inhibition as compared to other compounds. They have zone of inhibition in the range of 20-22 mm. These compounds as usual have groups which have high electron density due to high electron withdrawing capacity and may cause the damage to the microorganisms.

Scheme-5 contained the synthesis of 2-(2-(2-(substitutedbenzylideneamino)-thiazol-4-yl)-benzofuran-3-yloxy)-acetic acid (5a-o).

![Scheme-5](image-url)
Synthesized compounds were characterized by elemental analysis, FT-IR and $^1$H-NMR. IR spectra of (5a-o) exhibited an absorption bands in the region 1690-1660, 1635-1515, 1510-1480 and 1115-1085 cm$^{-1}$ indicates the presence of C=O, C=N, C=C and C-O-C functionalities respectively. $^1$H NMR spectra of (5a-o) show multiplet at C 6.8-7.1 corresponding to aromatic protons, a singlet at δ 4.88 due to the CH$_2$ of acid moiety. The CH of thiazole nucleus shows absorption in the aromatic proton range. A singlet at δ 8.1 corresponds to the benzyldiene H of CH and finally the OH of acid shows singlet far downfield at δ 11.00. Further the compounds those have substituents containing protons shows absorption with their proper chemical shift. The elemental analysis was performed for the compounds and calculated and found values are within the range. The structures and purity of the final compounds were confirmed on the basis of spectral and elemental analyses.

Antiinflammatory activity of compounds 5a-o of Scheme 5 was performed in rats by using carrageenan induced rat paw edema method. The compounds 5d, 5f, 5h, 5j, 5k and 5n exhibited maximum antiinflammatory activity with percent inhibition of edema 60, 61, 64, 63, 61 and 58 respectively. The compound 4h and 4j showed highest percent inhibition of edema contains chlorine atom and methoxy group as a substituent respectively. Other compounds containing nitro group showed higher activity compared to other. The all other compounds have encouraging antiinflammatory activity. The probable reason for activity is lipophilic nature of the substituents.

Antibacterial activity of compounds 5a-o of Scheme 5 on Gm +ve bacteria Staphylococcus aureus and Gm -ve bacteria E. coli by using cup plate method was performed. It was observed that compound 5c, 5g, 5i, 5l and 5o are the most active
among all tested compounds against Gm +ve bacteria. The compound 5h have highest zone of inhibition against Gm +ve bacteria. This compound contains chlorine and nitro group substituents and this is the probable reason for higher activity. The compounds 5d, 5e, 5g and 5i are the most active compounds against Gm –ve bacteria, E. coli. These have also chlorine and nitro group substituents. In conclusion, the compounds containing halo atom and nitro group as substituents showed good zone of inhibition against both Gm +ve and Gm –ve bacteria. The high electron density due to electron withdrawing nature of these atom and group may contribute to the antibacterial activity.

Antifungal activity of the compounds 5a-o of Scheme 5 on Candida albicans and Aspergillus flavus by using cup plate method was performed. Compound 5d, 5f, 5h and 5n are the most active among all tested compounds against Candida albicans. Among these, compound 5d display highest zone of inhibition. Against Aspergillus flavus compounds 5d, 5f, 5h, 5k and 5n are the most active members. The compounds 5f and 5n have highest zone of inhibition. Compound with halo atoms and nitro group showed good activity.