ABSTRACT

The thesis presents the X-ray crystal structure determination and conformational studies of seven indole, three chalcone, two cyclophane and two cyclohexanol derivatives of biological interest. First chapter of the thesis gives an introduction to the biological and other important applications of compounds. The second chapter is devoted to various steps involved in the crystal structure determination and procedure for using single crystal X-ray diffraction data.

The structural and conformational details of seven indole derivatives are given in Chapters 3, 4 and 5. Chapter 3 describes the crystal structures of three indole derivatives viz. 3-bromo-2-(2-bromo-4,5-dimethoxybenzyl)-1-phenylsulfonyl-1H-indole (BPSI-BD), 3-bromo-2-(4-bromo-2,5-dimethoxybenzyl)-1-phenylsulfonyl-1H-indole (BPSI-DB) and N-{4-bromo -2- [ (3- bromo-1- phenylsulfonyl - 1H-indol-2- yl) methyl]-5-methoxyphenyl}acetamide (BPSI-BMA). The structures were solved by direct methods and refined by full-matrix least-squares technique. The final R-factors are 0.042 for BPSI-BD, 0.044 for BPSI-DB and 0.041 for BPSI-BMA, respectively. In all the three compounds, the sulfonyl-bound phenyl ring is orthogonal to the indole ring system with the dihedral angles of 86.9(1)° for BPSI-BD, 89.2(1)° for BPSI-DB and 89.09(8)° for BPSI-BMA. In these compounds, the orientations of the phenylsulfonyl and other substituents on the indole moiety are influenced by intramolecular C–H...Br, C–H...O and C–H...π interactions. In the compound BPSI-DB, π–π stacking
interactions involving the indole ring system link symmetry-related molecules into dimers.

Chapter 4 describes the crystal structure of two indole derivatives. 1-(3-bromo-1-phenylsulfonyl-1H-indol-2-ylmethyl) pyrrolidine-2,5-dione (BPSI-PY) and 2-(3-bromo-1-phenylsulfonyl-1H-indol-2-ylmethylsulfanyl)-6-methyl-1H-benzimidazole (BPSI-BZ). Both the structures were solved by direct methods and refined by full matrix least-squares technique and the final R values are 0.026 for BPSI-PY and 0.072 for BPSI-BZ. In these structures, the sulfonyl-bound phenyl ring form dihedral angles of 71.19(8)° and 88.5(2)°, respectively, with respect to indole system. In the compound BPSI-PY, the pyrrolidine ring adopts an extremely flattened envelope conformation.

Chapter 5 describes the crystal structure of two indole derivatives, 2-(2-acetamido-5-methylbenzoyl)-1H-indole (AMBI) and 2, 5-dimethyl-7-phenylsulfonyl-5, 6- dihydroindolo[2,3-c] benzazepin-12-one (BDPSI), which were solved by direct methods and refined by full matrix least-squares technique. The final R values are 0.077 for AMBI and 0.051 for BDPSI. The asymmetric unit of BDPSI contains two crystallographically independent molecules A and B. The sulfonyl-bound phenyl ring forms dihedral angles of 75.27(9)° and 76.96(12)° with the indole ring system of the molecules of A and B, respectively. In both A and B molecules, the seven membered rings adopt a distorted boat conformation.
In all the indole derivatives the molecular conformations are influenced by intramolecular C–H…O, C–H…Br, C–H…π and N–H…O interactions, and crystal packing are stabilized by C–H…O, C–H … π and N–H…N intermolecular interactions.

Chapter 6 reports studies on the antibacterial activities of five compounds viz. 3-bromo-2-(2-bromo-4,5-dimethoxybenzyl)-1-phenylsulfonyl-1H-indol, 3-bromo-2-(4-bromo-2,5-dimethoxybenzyl)-1-phenylsulfonyl-1H-indole, N-[4-bromo-2-[(3-bromo-1-phenyl-sulfonyl-1H-indol-2-yl) methyl] -5- methoxyphenyl] acetamide, 1-(3-bromo-1-phenylsulfonyl-1H-indol-2-ylmethyl) pyrroloidine-2,5-dione and 2-(3-bromo-1-phenyl sulfonyl-1H-indol-2-ylmethylsulfanyl)-6-methyl-1H-benzimidazole carried out by the Broth dilution technique. The bacterial cultures were found to exhibit relative antibacterial activity against *Escherichia coli* (*E.coli*) and these results are presented in detail.

Chapter 7 describes the crystal structure determination of three chalcone derivatives viz. 3-(3, 4-dimethoxyphenyl)-1-(4-hydroxyphenyl) prop-2-en-1-one (DPHPP), 1-(4-chlorophenyl)-3-(4-hydroxyphenyl) prop-2-en-1-one (CPHPP) and N-[4-bromo-2-[(3-bromo-1-phenylsulfonyl-1H-indol-2-yl) methyl]-5-methoxyphenyl] acetamide (MPBPP). All the structures were solved by direct methods and refined by full matrix least-squares technique to a R value of 0.040 for DPHPP, 0.045 for CPHPP and 0.069 for MPBPP. In all the three compounds, the configuration of the keto group with respect to the olefinic double bond is *s-cis*. The two benzene rings and the unsaturated ketone system together form a curved structure. The dihedral angle between the two benzene rings lies in the range 6.64(6)-
28.07(8)°. The crystal structures are stabilized by O–H...O and C–H...O hydrogen bonds.

Chapter 8 describes the crystal structure of two cyclophane derivatives viz. 7,16-dioxatetracyclo[16.2.4.5.2.21.22.23.24.0.9.14]tetracosa-1,3,5,9,11,13,17,19,21,23-decaene (DCTD-I) and 7,14-dioxatetracyclo[14.2.4.5.2.19.20.2.21.22.23.24]tetracosa-1,3,5,9,11,15,17,19,21,23-decaene (DCTD-II), which were solved by direct methods and refined by full matrix least-squares technique. The final R values are 0.077 for DCTD-I and 0.064 for DCTD-II. In both structures, the cavity enclosed by the three benzene rings is approximately 21.5 Å² in area. The crystal structure of these compounds are stabilized by intramolecular O–H...O hydrogen bonds.

Chapter 9 describes the crystal structure of two cyclohexanol derivatives viz. trans-2-(2-hydroxyphenyl)cyclohexanol (HPC) and trans-2-(2-bromo-4-methylphenyloxy)cyclohexanol (BMPC). Both the structures were solved by direct methods and refined by full matrix least-squares techniques. The final R values are 0.078 for HPC and 0.047 for BMPC. The crystal structures of HPC and BMPC contain two crystallographically independent molecules in the asymmetric unit. The cyclohexane rings of these two molecules adopt chair conformations. The crystal structures of both compounds are stabilized by O–H...O hydrogen bonds and weak C–H...π interactions involving the phenyl rings.

The last chapter gives an overall summary of the work presented in this thesis. Comparison of the structural details for various classes of compounds are also given.
All experimental crystallographic data of all compounds containing in this thesis were collected on BRUKER SMART diffractometer area detector equipped with CCD area detector and employing MoKα radiation (λ = 0.71073 Å) by ω and φ scans modes. The samples were crystallized by slow evaporation method at room temperature. The crystal structures were solved by direct methods using SHELXS97 (Sheldrick 1997) and refined by full matrix least squares method using SHELXL97 (Sheldrick 1997a). The geometrical parameters were calculated using PARST (Nardelli 1995) and the molecular plots were drawn using programs SHELXTL (Bruker 1998) and PLATON (Spek 2003).