CHAPTER VIII

SUMMARY AND CONCLUSIONS

In Chapter I, a brief introduction about the various types of anionic sigma complexes is documented. This chapter also includes literature survey pertaining to the carbanionic sigma complexes and the reactants 1,3-dichloro-4,6-dinitrobenzene (DCDNB) and pyrimidine-2,4,6 (1H, 3H, 5H)-trione [common name : barbituric acid (BA)] to bring forth the novelty of the products (a new type of carbanionic sigma complexes) of the present findings.

In Chapter II, the aim, objectives and scope of the present work are illustrated. It enlightens the need for the discovery of new anticonvulsant agents for grand mal type of epilepsy.

Purification procedures adopted with various reagents and the protocols of screening for various biological activities such as anticonvulsant, hypnotic, acute toxicity, cytotoxicity, antimalarial and antituberculosis activity of synthesized molecules are presented in Chapter III.

In Chapter IV, synthesis and characterization of a new type of carbanionic sigma complexes from DCDNB, BA and aliphatic amines such as trimethylamine, triethylamine, tri-n-butylamine and N,N-diethylethanolamine have been discussed. As DCDNB has polarized C-Cl bond, it is expected to undergo aromatic nucleophilic substitution when reacted with a mixture of BA (containing acidic hydrogen atom) and aliphatic amine. But in the present investigation the aromatic nucleophilic substitution reaction is subsequently followed by enolization reaction which leads to the formation of a new type of carbanionic sigma complex. The structure was revealed through UV-VIS, $^1$H NMR, $^{13}$C NMR and mass (EI / HRMS) spectral data and elemental analysis results.

The interaction between DCDNB and BA in the presence of heterocyclic bases has been examined and presented in Chapter V. Though quaternization
reaction and charge transfer interactions are expected between these bases and DCDNB, the major product (yield > 80%) is that of a new type of carbanionic sigma complexes. This reflects the extraordinary stability of carbanionic sigma complexes.

In Chapter VI the single crystal XRD results of carbanionic σ complexes of present findings are discussed. The single crystal XRD results ascertain the structure revealed through spectral data. The carbanionic sigma complexes crystallize either in monoclinic or triclinic crystal system. In the crystal, the inversion related barbiturates are linked through \( R_{2}^{2}(8) \) motifs. A number of weak C–H…O and N–H…O hydrogen bonds are also noticed in the crystals.

The biological activities of the synthesized carbanionic sigma complexes are scrutinized in Chapter VII. The synthesized carbanionic σ complexes are screened for various biological activities such as (i) anticonvulsant activity (ii) hypnotic activity (iii) acute toxicity (iv) cytotoxicity (v) antibacterial activity (vi) antimalarial activity and (vii) antituberculosis activity. Most of the complexes exhibit anticonvulsant activity even at low dosage (~25 mg/kg). Unlike the marketed barbiturates, the barbiturates of the present findings have high LD\(_{50}\) value (>1500 mg/kg ; fall under class 4). Animals did not show any sign of acute toxicity and behavioral changes after experimentation. Cytotoxicity reports on human breast cancer cells (MCF – 7) indicate that the complexes are non-cytotoxic.

The new type of carbanionic sigma complexes of present findings are soluble in water and also in n-octanol, possess noticeable anticonvulsant activity even at low concentration (25 mg/kg), induce hypnosis in albino mice, exhibit high LD\(_{50}\) value (>1500 mg/kg) and low cytotoxicity (IC\(_{50}\) > 450 \( \mu \)M). They are extraordinarily stable at room temperature and their aqueous solutions are stable towards light and atmospheric oxygen. They are also easily prepared through cheap laboratory chemicals. These novel characteristic features of the barbiturates of present findings may receive attention of researchers in the field of epilepsy in future.