Studies in Non-Conventional Liquid Crystals:
Molecular Design, Synthesis and Evaluation of Mesomorphic Behavior

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Liquid crystals (LCs) are ordered fluids formed of shape-anisotropic molecules. Thermotropic LCs comprising conventional rod-like and disc-like molecules have attracted much attention owing to their enormous significance in display technology. However, LC behavior is also realizable with molecules differing in their shape-anisotropy from conventional ones. Liquid crystal oligomers, bent-cores molecules, dendrimers and polycatenars are some of the well known examples of such LCs. Of these, oligomers and bent-core mesogens are attracting a great deal of attention due to their remarkable transitional behavior. Thus, a variety of such materials have been designed, synthesized and characterized. The results of these studies are embodied in the present doctoral thesis, which comprises of five Chapters, as briefly mentioned below.

The first Chapter introduces the readers to both classical and non-conventional LCs.

The second Chapter deals with the design, synthesis and thermal behavior of several achiral and chiral unsymmetrical dimers. It begins with the preparation and properties of a homologous series of achiral dimeric ligands comprising salicylaldimine core covalently linked to a cyanobiphenyl entity *via* an alkylene spacer, as well as their metal-complexes. The ligands exhibit a rich smectic behavior, while the complexes possess only the nematic phase. In view of the unique property of cholesterol, four different series of chiral dimers are synthesized in which it is attached either to a tolane or biphenyl or phenylbenzoate or salicylaldimine segment through an odd/even-parity alkylene spacer. These compounds display chiral and/or frustrated mesophases depending on the length and parity of the spacer, as also the nature of aromatic core they possess.

The third Chapter presents the synthesis and characterization of achiral and chiral bent-core compounds. To begin with, five series of banana-shaped compounds differing in their molecular architecture are described. This is followed by an account of three different types of chiral bent-core molecules, in which the chemical nature of central core and the terminal chiral tails is varied; the occurrence of banana and conventional phases are evidenced, which appear to critically depend on the types of molecular fragments they comprise. Several of V-shaped molecules synthesized are shown to exhibit classical mesophases.

The fourth Chapter deals with achiral and chiral bent-rod dimers which are formed by covalent linking of banana-shaped core with either a polar achiral (e.g., cyanobiphenyl) or chiral rod-like (viz., cholesterol) segments through an odd/even-parity alkylene spacer respectively. It is clearly illustrated that achiral dimers are capable of forming the biaxial nematic and biaxial smectic A phases; comparatively chiral ones show frustrated structure in addition to new and unprecedented sequence of layered/two-dimensional phases.

The fifth Chapter discusses the chiral disc-rod oligomers in which four or six cholesteryl ester entities are covalently connected to a central anthraquinone-core through odd/even parity paraffinic spacers varying in their length. These compounds exhibit chiral nematic and / or columnar phase/s, and most importantly they serve as the first examples of antraquinone-based chiral liquid crystals.

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