ABSTRACT OF THE THESIS

Chapter I

The types and ordering of elements within each of the common forms of matter: solid, liquid, and gaseous which are the primary differences between them. The molecule that produces the high order crystalline solid has both positional order and orientation order. When most solids melt at specific temperatures in an isotropic liquid, both ordering are lost; the molecules drift and tumble arbitrarily. Conversely, some materials have intermediate states that are more ordered than liquids but less ordered than typical crystals. These fluids are organized into liquid crystals. This type of liquid crystal material has the properties of a liquid, such as flow, but certain of its properties, including the birefringence associated with crystalline solids, show considerable anisotropy. Austrian botanist Friedrich Reinitzer noted in 1888 that cholesterol benzoate exhibited two melting points when heated, an unusual melting behaviour. The solid ester melted first at 145.5 °C, forming a turbid liquid that disappeared at 178.5 °C and was replaced by a transparent, isotropic liquid. Lehmann investigated Reinitzer's substance using a polarising microscope and confirmed the existence of the new physical state of matter. A "liquid crystal" was defined as the innovative intermediate state existing between the crystalline solid and the isotropic liquid. The classification of liquid crystals was described in this chapter. A brief description on effect of the chemical constitution on mesomorphism was elaborated in this chapter. The applications of liquid crystals were also described in this chapter.

Chapter II

The structure of the thiadiazole molecule is the most significant and versatile area of research which motivates us to study the liquid crystal properties. In this chapter, two symmetrical homologous series of liquid crystalline thiadiazole Schiff's-base derivatives derived from 1,4-bis(4'-formylphenoxy)butane/1,3-bis(4'-formylphenoxy)propane and 5-(4'-alkoxyphenyl)-1,3,4-thiadiazole-2-amine have been synthesized. Spectral analysis including FT-IR, ^{1}H–NMR, and ^{13}C-NMR of every individual compound was carried out and was confirmed using elemental analysis. The microscopic textures of prepared compounds and their transition temperatures were observed using a polarizing optical microscope. The enthalpy change data value was measured using differential scanning calorimetry. Smectic and nematic phases were observed on heating as well as cooling cycles. The structure-property relationship was carefully studied to understand the effect of alkyl terminal chain length and the influence of azomethine linkages on the liquid crystalline behaviour of the compound. The thermal stability of the prepared compounds was recorded using a thermogravimetric analysis.

Chapter III

In recent years, enhancements in the research of coumarin derivatives have been found due to its wide range of applications in the field of organic light-emitting diodes (OLEDs), light harvesting materials, chemosensors, photorefractive materials, non-linear optical materials and photo alignment of mesomorphic material possessing photochemical and photophysical properties. In this chapter, novel homologous series of coumarin based Schiff's base derivatives derived from 4'-formyl phenyl 7-n-alkoxycoumarin-3-carboxylate and 4-n-(decyloxy)aniline have been synthesized. The proposed structures of all the newly prepared compounds were confirmed by FT-IR, ^{1}H-NMR, ^{13}C-NMR, and elemental analysis. The photophysical properties of the coumarin based Schiff's base derivatives have been studied. The textures of coumarin based Schiff's base derivatives and their transition temperature were observed and recorded under a polarizing optical microscope. The enthalpy change data were measured using Differential Scanning Calorimetry. By varying the alkoxy group (n = 1-10, 12, 14, 16) at the terminal position at one end of the moiety, the nematic phase was observed on heating as well as cooling. The thermal stability of all the compounds was recorded using thermal gravimetry analysis. All the synthesized compounds were screened for their in-vitro antibacterial activity against *Escherichia Coli* and *Staphylococcus aureus* showing good to moderate activity compared to the used standard.

Chapter IV

In this chapter, we have prepared unsymmetrical homologous series of nematogenic liquid crystal compounds possessing imine linkage incorporated in a molecule with an alkoxy group (n = 1-10, 12, 14, 16) attached at one of the terminal end and 4-n-decyloxy aniline at another terminal end of the molecule and studied the liquid crystalline behavior of all the compounds. The prepared structures were elucidated using FT-IR, ^{1}H-NMR, and ^{13}C-NMR and were confirmed using elemental analysis. The microscopic textures were observed under polarizing optical microscope and the transition temperatures were confirmed using differential scanning calorimetry. All the compounds possess enantiotropic behaviour. The effect of chemical constitution on mesomorphism was also studied thoroughly. The structure-mesomorphic relationship was thoroughly studied and the thermal stability of all the synthesized compounds was assessed using thermogravimetry analysis.

Chapter V

The oxazolone moiety has served as a crucial structural component for a number of physiologically active molecules during the past few decades, including both natural and manufactured drugs. An investigation into novel oxazolone compounds was done utilizing barley and moong seeds to demonstrate action like seed germination. In this chapter, we synthesized oxazolone derivatives using two different schemes. According to Scheme 1, 4-n-alkoxybenzoyl glycine and 3-methoxy-4-n-octyloxybenzaldehyde were used to prepare 3-methoxy-4-octyloxybenzylidene)-2-(4-alkoxyphenyl)oxazol-5-one. Another synthesis pathway, shown in Scheme 2, was used to prepare several novel Oxazolone (Azlactone) derivatives. Their characterization data, including FT-IR, ^{1}H-NMR, and Elemental Analysis, confirmed the final product. The TLC method has been used to verify the purity of the produced chemicals. The yield ranged between 64 and 75%. The impact of adding an electron-withdrawing group (-NO_2) and an alkoxy group on the germination of seeds was investigated in the novel oxazolone derivatives that were synthesized. To understand the correlation between mesomorphic properties and the molecular structure of heterocyclic compounds, the melting points of all the novel synthesized compounds (Scheme 1 & 2) were taken on Polarizing Optical Microscope.