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RESEARCH ARTICLE

Effect of Laterally Substituted Methoxy Group on the Liquid Crystalline Behavior of Novel Ester Molecules

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Abstract: ***Background*:** The aim of this research is to study the effect of length-to-width ratio on mesomorphism to enhance the understanding of its potential applications. This will be achieved by synthesizing a unique and innovative series of identical ester molecules, including lateral methoxy groups and terminal ethyl benzoate groups. In this research, we aim to find new insights into the relationship between molecular structures and mesomorphic behaviors, which could have significant implications for the development of advanced materials with adapted properties.

The objective of the study is to investigate the mesophase behavior of new ester mesogens and determine how they are influenced by lateral methoxy groups. By identifying the underlying perspectives and relationships between these variables, we hope to better understand the unique properties and potential applications of these materials.

***Method*:** In this research work, the focus is on the synthesis of ethyl*(E)*-4-((3-(4-alkoxy-3-methoxyphenyl)acryloyl)oxy)benzoate, which is prepared from Steglich esterification method by using (*E*)-3-(4-alkoxy-3-methoxyphenyl)acrylic acid and ethyl 4-hydroxybenzoate. Synthesis processes involve precise reaction sequences designed to ensure maximum yield and purity of the final product. By providing a detailed report on the experimental process, this study contributes to the ongoing research efforts aimed at the development of innovative compounds with various applications in liquid crystals.

***Result*:** A new set of liquid crystal derivatives has been synthesized and studied to investigate the effect of molecular structure on the behavior of liquid crystals, with particular attention to the group -OCH_3 located laterally. This series was composed of 12 derivatives (C_1-C_{16}). Among them, the first six derivatives (C_1-C_6) did not have the characteristics of a liquid crystal, while the remaining derivatives (C_7 and C_8) had a monotropic behavior, and C_{10}-C_{16} had an enantiotropic smectogenic liquid crystal behavior without exhibition of the nematic phase. The average thermal stability of the smectic property was 87.33 °C, and the mesophase range was 2 °C to 14 °C. The molecular structure was confirmed by analytical and spectral analysis. The properties of liquid crystals of this new series were compared with those of other known structurally similar homologous series. The transition temperatures were determined with an optical polarizing microscope equipped with a heating phase.

***Conclusion*:** The mesomorphic thermal and optical properties of the compounds have been validated by DSC and POM techniques. The result shows that the length of the alkyl chain has a significant influence on the mesomorphic characteristics and thermal stability of the different mesophases. Evaluation of the compounds studied indicates that the molecules are sensitive to their lateral substituent, which influences the thermal characteristics and stability of the mesophase.

Keywords: Liquid crystals, smectic, mesomorphism, ester, DSC, POM.

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