Al-Nahrain Journal of Science
Al-Nahrain J. Sci., Vol. 29, Issue 2, pp. 1 – 11, June, 2026.

Synthesis, Characterization and Liquid Crystal Properties of some Chalcone-Schiff Bases Compounds

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Article's Information

Received: 30.04.2025
Accepted: 24.06.2025
Published: 15.06.2026

Keywords:
Mesomorphic,
Azomethine,
Chalcone,
Linearity,
4-aminoacetophenone.

Abstract

This research examines the alteration of mesomorphic behavior in azomethine chalcone compounds as liquid crystals, influenced by the linearity of molecule and alkoxy groups' position. Compounds were synthesized by the reaction of 4-substituted benzaldehydes with 4-aminoacetophenone using catalysts appropriate for the reaction type. The synthesized compounds were characterized using FT-IR, ^{1}H NMR, and ^{13}C-NMR techniques. Mesomorphic characteristics were examined by differential scanning calorimetry (DSC), while the resultant textures were featured using polarized optical microscopy (POM). Compounds (R_1-R_3) showed an absence of mesomorphic properties due to the lack of molecular linearity, while compounds (M_1-M_3) exhibited nematic phases distinguished by a marble-like texture.

http://doi.org/10.22401/ANJS.29.2.01

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1. Introduction

Liquid crystals are anisotropy and structured fluids that exist thermodynamically located among the isotropy liquid phase and the crystal solid phase with a three-dimensional form. In reality, the anisotropy of the physicals characteristics in LC is because of the directional order and anisotropic of the molecules that comprise these materials. For a variety of materials (pure chemicals or mixtures), LC phases, also known as mesophases, take place in a series of steps [1-3]. These substances have anisotropic characteristics like solid crystals yet flow similarly to regular liquids in the crystal phase [4]. In actuality, the directional orientation and anisotropic of the molecules that comprise liquid crystals are what caused the anisotropy of their physical characteristics. Thermodynamically stable liquid crystals are characterized by their anisotropic characteristics and absence of a three-dimensional crystal lattice [5-8]. A liquid crystalline phase, also known as mesomorphism, is the result of a pure compound changing from an ordered crystalline state to a disordered liquid in one of two ways: either by melting when the temperature changes, as in the case of thermotropic liquid crystals, or by dissolving a mesogen after adding an appropriate solvent [9-11]. Liquid crystals are classified as nematics, cholesterics, smectics, and columnar mesophases based on the symmetry or arrangement of the molecules inside a mesophase [12-15]. Research within the creation and generation of thermotropic liquid crystals (LCs) have been going on for a while since these materials are intriguing from a basic and practical application perspective, these ordered soft materials are being used in more advanced technological domains, such as liquid crystal thermometers, chemical and biological sensors [16-20].In order to create appropriate new applications, among the main goals while creating LC material is to comprehend the interactions between molecules that occur at the LC mesophases. Molecule morphologies are the most important and crucial component in the evolution of novel liquid crystal materials because they dictate the kind of molecular organization that will take place within a specific temperature range, apart from the impact of the molecule morphologies themselves, minor alterations to the liquid crystal materials' structural parts can have a substantial impact on their physical characteristics [21]. This research suggests that the liquid crystalline properties were influenced by hydrogen bonds and substituents in compounds containing benzylidene aniline [22]. Other research demonstrates the effect of bromine as a terminal

substituent on the molecular polarizability and intermolecular interactions of 4-bromo-4'-alkanoyloxychalcone compounds, the study also reveals how varying side chain lengths of alkanoyloxy groups influence mesomorphic properties, indicating that certain compounds exhibit a stable nematic phase due to their shorter terminal chains [23].

This study aims to synthesize azomethine chalcone compounds and state the effect of the attachment sites of alkoxy and substituted groups on their liquid crystalline properties. Therefore, the importance of this work is to clarify the effect of some factors which enhance the liquid crystalline properties of compounds with alpha-beta unsaturated ketone and bearing azomethine group without homologues series of hydrocarbon

2. Experimental Details

2.1. Materials

Sigma-Aldrich was the source of all starting materials. They weren't further purified before being utilized. The FTIR spectra was as ATR (cm^{-1}) recorded using Bruker-Tensor twenty seven spectrometer. DMSO-d_6 was used as the solvent using Bruker 400 MHz spectrometer to record ^1H (400 MHz) and ^{13}C (101 MHz,) NMR spectra (ppm). A NOVEL hot stage POM, and Mettler Toledo DSC 823 (DSC) with a heating 10 °C/ min., all reactions were monitored using TLC.

2.2. Synthesis Procedure

2.2.1. Synthesis of 4-(octyloxy) benzaldehyde

In 250 mL round-bottom flask, (7.1g, 58.00 mmol) of 4-hydroxybenzaldehyde was dissolved in (50 mL) DMF then (2.34g, 58.00 mmol) of NaOH was added, thereafter (8.64g, 0.058 mol) of Octanoyl chloride was put into a reaction flask, the mix came refluxed for 10 hrs. After completion, a reaction flask was cooled, and the mix was put into a beaker that contained crushed ice. The product was extracted twice using dichloromethane-Water (100mL: 100mL) anhydrous magnesium sulfate was used to dry the organic layer, and dichloromethane subsequently evaporates, and the pure product is gathered in the form of brown oily substance [24].

2.2.2. Synthesis of Shiff base M

In a 50 mL round-bottom flask, (1.54g, 6.60 mmol) of 4-octyloxy Benzaldehyde with 3 drops of glacial acetic acid was dissolved into (8 mL) of pure ethanol then allowed to reflux for 15 min, thereafter (0.89g, 6.60 mmol) of 4-Aminoacetophenone dissolved into (5 mL) of pure ethanol was added. The mix refluxed for 5 hrs., after cooling white precipitate was formed, filtered, washed with cold ethanol and water, re-crystallized with isopropanol [25].

2.2.3. Synthesis of chalcones (M_1-M_3)

In a 50 mL round-bottom flask charged with 10 mL of T.H.F, (0.40g, 1.14 mmol) of compound M and the corresponding replacement substituted benzaldehyde were dissolved. Subsequently, 5 mL of 3% NaOH solution, was added dropwise. The Mixture stirred overnight at room temperature. Hence, the mixture was poured on crushed ice, the formed powder was filtered, washed with water and recrystallized from ethanol [26].

(1-(4-(octyloxy) benzylidene) amino) phenyl) ethan-1-one) (M). Solid, white, yield 75.0 %; m.p. (113–115 C°), R_f 0.82(EtOAc: Hexane, 3:7); FTIR cm^{-1} :□ 3064 (C-H ar.), 2955, 2871 (C-$H_{al.}$),1624 (C=O_{ketone}), 1601 (C=N), 1588, 1509 (aromatic ring), 1246 (C-O_{ketone}), 720 (OOP methylene). ^{1}HNMR: δ 8.59 (s, 1H,CH=N), 8.21, (d, 2H,Ar-H), 7.92 (d, 2H,Ar-H), 7.86 (d, 2H,Ar-H), 7.36 (d, 2H,Ar-H), 7.09 (d, 2H,Ar-H), 4.09 – 4.03(m, 2H,O-CH_2), 2.68 (s, 3H,α CH_2), 1.73 (p, 2H), 1.47 – 1.38 (m, 4H,$(CH_2)_n$), 1.37 – 1.22 (m, 6H,$(CH_2)_n$), 0.87 (t, 3H,CH_3). ^{13}CNMR: δ 197.76, 167.84, 165.12, 157.98, 135.36, 132.19, 126.26, 115.78, 70.90, 30.83, 29.51, 21.38, 14.44.

(3-(4-bromophenyl)-1-(4-((-4-(octyloxy) benzylidene) amino) phenyl) prop-2-en-1-one) (M_1). Solid, yellow, yield 54.3 %; m.p. (194–196 °C), R_f 0.66 (EtOAc: Hexane, 2:8); FTIR cm^{-1} □ 3071 (C-H ar.), 2987, 2887 (C-$H_{al.}$), 1652 (C=O_{ketone}), 1602 (C=N), 1585, 1561 (ar.), 1276 (C-O ketone), 714 (OOP methylene) cm^{-1}. ^{1}HNMR: δ 8.70 (s, 1H,CH=N), 8.26 (d, 1H,CH=C-C=O), 8.08 – 7.93 (m, 4H,Ar-H), 7.75 (d, 2H,Ar-H), 7.63 (d, 2H,Ar-H), 7.54 (d, 2H,Ar-H), 7.41 (d, 1H,C=CH-C=O), 7.07 (d, 2H,Ar-H), 4.05 (d, 2H,O-CH_2), 1.74 (s, 2H,CH_2), 1.41 (s, 2H,CH_2), 1.24 (d, 8H,$(CH_2)_n$), 0.85 (d,3H,CH_3). ^{13}CNMR: δ 188.46, 161.91, 156.00, 142.77, 137.10, 131.11, 130.62, 129.56, 128.80, 123.28, 121.80, 113.21, 64.10,31.79, 29.49, 22.55, 14.39.

(3-(4-(dimethylamino) phenyl)-1-(4-(octyloxy) benzylidene) amino) phenyl) prop-2-en-1-one (M_2). Solid yellow, yield 35.2 %; m.p. (127–129 °C), R_f 0.57 (EtOAc: Hexane,3:7); FTIR cm^{-1} □ 3065 (C-H ar.), 2987, 2865 (C-$H_{al.}$), 1648 (C=O_{ketone}), 1609 (C=N), 1574, 1518 (ar.), 1255 (C-O_{ketone}), 723 (OOP methylene). ^{1}HNMR: δ 8.59 (s, 1H,CH=N), 8.17 (s, 1H CH=C-C=O), 7.95 – 7.89 (m, 2H,Ar-H), 7.72 (d, 2H Ar-H), 7.56 (s, 2H Ar-H), 7.34 (d, 1H C=CH-C=O), 7.09 (d, 2H,Ar-H), 6.76 (s, 2H,Ar-H), 6.64 – 6.54 (m, 2H, Ar-H), 4.05 (s, 2H,O-CH_2), 3.02 (s, 6H,N$(CH_3)_2$), 1.74 (s, 2H,CH_2), 1.43 (s, 2H,CH_2), 1.26 (d, 8H,$(CH_2)_n$), 0.87 (s, 3H,CH_3).^{13}CNMR: δ 186.28, 164.17, 161.85, 153.84, 152.01, 145.28, 142.93,

132.29, 131.34, 131.16, 130.63, 130.14, 129.95, 126.41, 123.03, 122.57, 121.56, 117.07, 115.36, 115.23, 113.13, 112.26, 68.50, 68.25 31.71, 29.22, 29.17, 29.13, 28.95, 25.96, 25.90, 22.56, 14.44.

(3-(4-methoxyphenyl)-1-(4-((-4-(octyloxy) benzylidene) amino) phenyl) prop-2-en-1-one) (M_3). Solid yellow, yield 58.1 %; m.p. (111–113 °C), R_f 0.51 (EtOAc: Hexane) (2:8); FTIR cm^{-1} □ 3070 (C-H ar.), 2990, 2865 (C-$H_{al.}$), 1649 (C=O_{ketone}), 1605 (C=N), 1584, 1508 (ar.), 1251` (C-O_{ketone}), 723 (OOP methylene). ^{1}HNMR: δ 8.60 (s, 1H,CH=N), 8.21 (d, 1H,CH=C-C=O), 7.89 (m, 6H,Ar-H), 7.73 (d, 2H,Ar-H), 7.36 (d, 1H,C=CH-C=O), 7.09 (d, 2H,Ar-H), 7.04 (d, 2H,Ar-H), 4.07 (s, 2H,O-CH_2), 3.84 (s, 3H,O-CH_3), 1.75 (s, 2H,CH_2), 1.44 (s, 2H,CH_2), 1.36 – 1.19 (m, 8H,$(CH_2)_n$), 0.90 – 0.86 (m, 3H,CH_3).^{13}CNMR: δ 189.24, 170.61, 156.44, 141.98, 131.71, 115.26, 63.71, 55.87, 29.50, 22.57, 14.44.

2.2.4. Synthesis of chalcone R

In a 50 mL round-bottom flask charged with 10 mL of ethanol, (1.73g, 7.40 mmol) of 4-(octyloxy) benzaldehyde and 4-aminoacetophenone (1.00g, 7.40 mmol) were dissolved. Subsequently, 5 mL of 18% NaOH solution was added dropwise. The mixture was stirred overnight at room temperature. Additionally, the mixture was poured on crushed ice, the formed powder was filtered, washed with water and recrystallized from ethanol [26].

2.2.5. Synthesis of Shiff bases (R_1-R_3)

In a 50 mL round-bottom flask, 1.40 mmole of corresponding substituted benzaldehyde with 3 drops of glacial acetic acid was dissolved into 10 mL of pure ethanol then refluxed for 15 min, thereafter (0.49g, 1.4 mmol) of compound R dissolved into 10 mL of pure ethanol was added. The mix is refluxed for 6 hrs. After cooling white precipitate was formed, filtered, washed with cold ethanol, recrystallized from ethanol [25].

(1-(4-aminophenyl)-3-(4-(octyloxy) phenyl) prop-2-en-1-one) (R). White solid, yield 70.0 %; m.p. 115–117 °C, R_f 0.72 (EtOAc: Hexane, 3:7); FTIR cm^{-1} □ 3457,3337 (NH_2), 3025 (C-H ar.), 2917, 2854 (C-$H_{al.}$), 1656 (C=O_{ketone}), 1598, 1510 (ar.), 1285 (C-O_{ketone}), 712 (OOP methylene). ^{1}HNMR: δ 8.37 (d, 3H,Ar-H, CH=C-C=O), 7.73 (s, 2H, Ar-H), 7.58 – 7.41 (m, 3H,Ar-H, C=CH-C=O), 7.29 (s, 2H,Ar-H), 5.74 (s, 2H,NH_2), 4.41 (d, 2H,O-CH_2), 2.15 (s, 2H,CH_2), 1.68 (s, 10H,$(CH_2)_n$), 1.29 (s, 3H,CH_3). ^{13}CNMR: δ 186.86, 173.22, 171.55, 169.12, 128.21, 123.78, 68.39, 32.57, 23.87, 19.21, 17.34, 14.28.

(1-(4-(4-bromobenzylidene) amino) phenyl)-3-(4-(octyloxy) phenyl) prop-2-en-1-one) (R_1). Yellow solid, yield 50.9 %; m.p. 195–197 °C, R_f 0.88 (EtOAc: Hexane, 3:7); FTIR cm^{-1} □ 3068 (C-H ar.), 2955, 2870 (C-$H_{al.}$), 1656 (C=O_{ketone}), 1624 (C=N), 1589, 1511 (ar.), 1253 (C-O_{ketone}), 720 (OOP methylene). ^{1}HNMR: δ 8.07 (s, 1H,CH=N), 7.52 (d, 1H,CH=C-C=O), 7.42 (d, 2H,Ar-H), 7.38 (d, 2H,Ar-H), 7.19 (d, 2H,Ar-H), 6.98 (d, 2H,Ar-H), 6.88 (d, 2H,Ar-H), 6.83 (d, 1H,C=CH-C=O), 6.59 (d, 2H,Ar-H), 3.63 – 3.49 (m, 2H,O-CH_2), 1.89 (d, 2H,CH_2), 1.70 (t, 4H,$(CH_2)_n$), 1.25 (t, 6H,$(CH_2)_n$), 0.96 – 0.69 (m, 3H,CH_3). ^{13}CNMR: δ 191.69, 161.98, 156.49, 154.09, 145.96, 134.36, 132.27, 131.35, 131.16, 130.66, 129.98, 129.30, 128.92, 128.80, 121.50, 115.35, 68.51, 31.71, 29.48, 29.39, 25.95, 25.89, 22.55, 14.41.

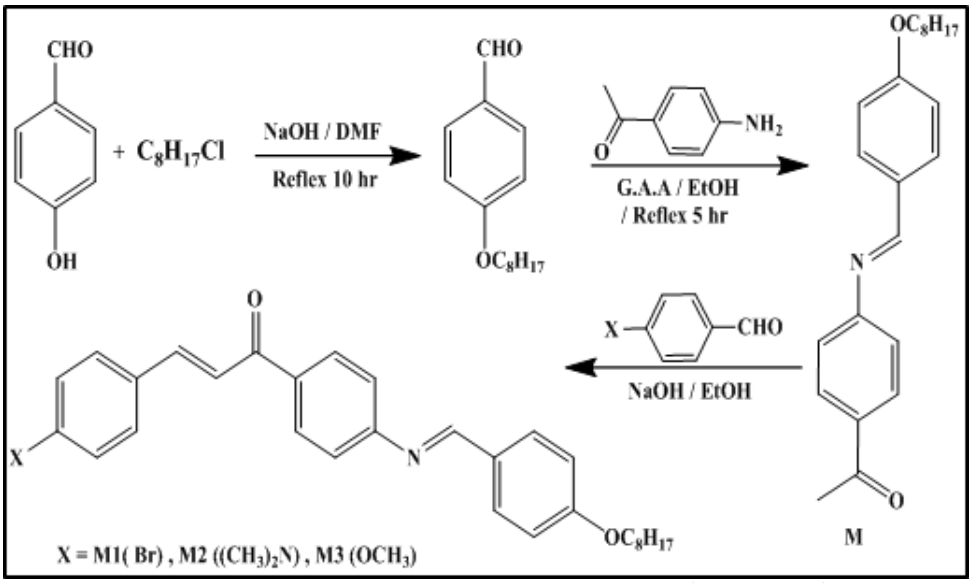
(1-(4-(4-(dimethylamino) benzylidene) amino) phenyl)-3-(4-(octyloxy) phenyl) prop-2-en-1-one) (R_2). Orange solid, yield 65.6 %; m.p. 133–135 °C, R_f 0.38 (EtOAc: Hexane, 3:7); FTIR cm^{-1} □ 3074 (C-H ar.), 2991, 2851 (C-$H_{al.}$), 1649 (C=O_{ketone}), 1611 (C=N), 1579, 1511 (ar.), 1266 (C-O_{ketone}), 725 (OOP methylene). ^{1}HNMR: δ 8.44 (s, 1H,CH=N), 8.20 (d, 1H,CH=C-C=O), 7.97 (d, 2H,Ar-H), 7.86 (d, 2H,Ar-H), 7.77 (d, 2H,Ar-H), 7.27 (d, 2H,Ar-H), 7.11 (d, 1H,C=CH-C=O), 7.01 (d, 2H,Ar-H), 6.80 (d, 2H,Ar-H), 4.06 (dd, 2H,O-CH_2), 3.03 (s, 6H,N$(CH_3)_2$), 1.72 (s, 2H,CH_2), 1.41 (s, 2H,CH_2), 1.31 – 1.20 (m, 8H,$(CH_2)_n$), 0.86 (s, 3H,CH_3). ^{13}CNMR: δ 191.76, 161.95, 157.08, 153.16, 146.13, 143.40, 133.79, 132.31, 131.23, 130.10, 123.84, 121.48, 115.35, 111.89, 68.50, 31.72, 29.17, 27.09, 25.90, 22.57, 14.46.

(1-(4-(4-methoxybenzylidene) amino) phenyl)-3-(4-(octyloxy) phenyl) prop-2-en-1-one) (R_3). Yellow solid, yield 66.7 %; m.p. 112–114 °C, R_f 0.76 (EtOAc: Hexane, 2:8); FTIR cm^{-1} □ 3065 (C-H ar.), 2955, 2871 (C-$H_{al.}$), 1651 (C=O_{ketone}), 1602 (C=N), 1587, 1509 (ar.), 1247 (C-O_{ketone}), 722 (OOP methylene). ^{1}HNMR: δ 8.55 (s, 1H,CH=N), 8.22 (s, 1H,CH=C-C=O), 7.95 (d, 2H,Ar-H), 7.34 (d, 3H,Ar-H,C=CH-C=O), 7.10 (s, 2H,Ar-H), 7.01 (s, 2H,Ar-H), 6.87 (s, 2H,Ar-H), 6.69 (s, 2H,Ar-H), 4.05 (s, 2H,O-CH_2), 3.91 (s, 3H,O-CH_3), 1.73 (s, 2H,CH_2), 1.42 (s, 2H,CH_2), 1.24 (s, 8H,$(CH_2)_n$), 0.91 – 0.81 (m, 3H,CH_3). ^{13}CNMR: δ 188.38, 152.56, 140.36, 126.60, 124.98, 58.66, 29.19, 25.95.

3. Results and Discussion

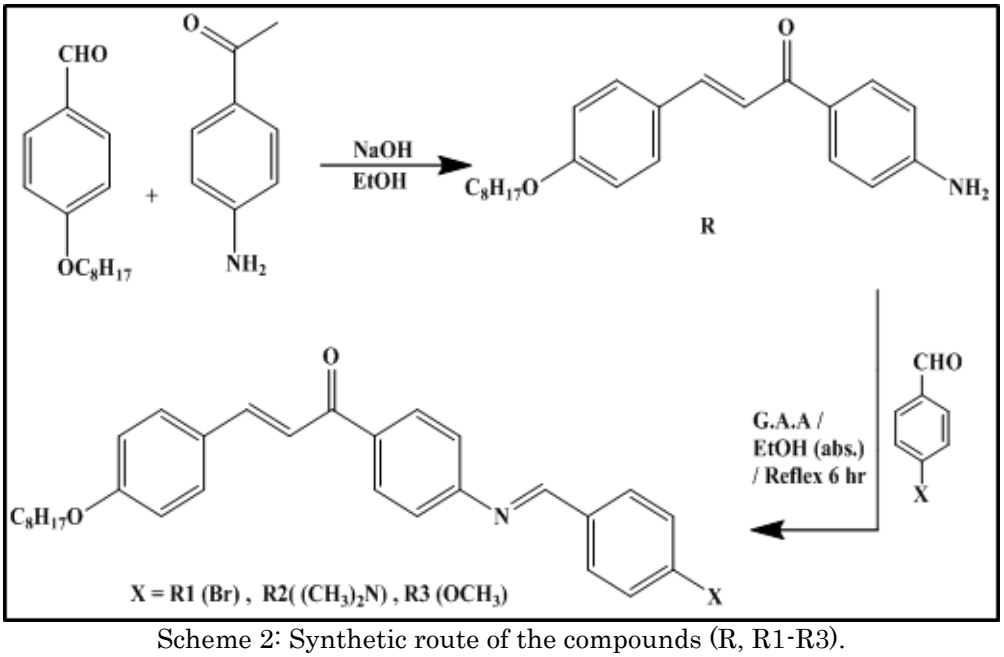
3.1. Synthesis

The desired Compound's (M) was synthesised by the reaction of 4-octyloxy benzaldehyde and 4-aMinoacetophenone utilizing glacial acetic acid to be a catalyst and pure ethanol is solvent. The Claisen-Schmidt condensation reaction of Schiff base (M) and 4-X-benzaldehyde [X = Br, $(CH_3)_2N$, OCH_3], three azomethines-chalcone derivatives (M1-M3) were synthesized, Scheme 1.



Scheme 1: Synthetic route of the compounds (M, M1-M3).

The target chalcone compound R was synthesized by condensing reaction Claisen-Schmidt of 4-aMinoacetophenone and 4-(octyloxy) benzaldehyde utilizing pure ethanol as a solvent and sodium hydroxide to be a catalyst, it's condensation reaction with corresponding aldehydes X = (Br, $N(CH_3)_2$, OCH_3), in the presence of ethanol is solvent and glacial acetic acid to be a catalyst, three Schiff bases derivatives (R_1-R_3) of chalcone were synthesized, Scheme 2.



Scheme 2: Synthetic route of the compounds (R, R1-R3).

3.2. Characterization

Compound 4-(octyloxy)benzaldehyde was identified in the FT-IR spectrum as Figure 1 shows of the band of stretching due to the hydroxyl group (O-H) and the appearance of the band of stretching due to the aliphatic C-H group being observed. The spectrum of the compound showed two stretching bands in (2924, 2854) cm^{-1} due to aliphatic C-H groups, a stretching

band at (1690) due to the aldehyde carbonyl group, bands at (1576-1509) due to the stretching of the aromatic C=C groups, and a band at (722) due to (γ CH_2) group. The FT-IR spectra of the compound's (M, M_1-M_3) and the compounds (R_1-R_3) showed the disappearance of the stretching vibration bands of the NH_2 group as well as the stretching bands of C-H and C=O aromatic aldehydes. In the FT-IR spectra of the compound's (M,M_1-M_3), as Figure 2 weak absorption band appeared in the range 3064-3071 cm^{-1} attributed to C-H aromatic, the band of absorption in the range 2865-2990 cm^{-1} attributed to C-H aliphatic, band in the range 1624-1655 cm^{-1} attributed to C=O $_{ketone}$, the vibration band in the range 1601-1609 cm^{-1} attributed to C=N of azomethines , bands in the range 1509-1588 cm^{-1} attributed to the aromatic rings and absorption within the range 714-723 cm^{-1} attributed to OOP of methylene groups [27]. In the FT-IR spectra of compounds (R,R_1-R_3), as Figure 3 absorption ranges appeared in the range 3337-3457 cm^{-1} attributed to NH_2 group present in compound R, band of absorption in the range 3025-3074 cm^{-1} attributed to C-H aromatic, band of absorption in the range 2851-2991 cm^{-1} attributed to C-H aliphatic, band of absorption in the range 1649-1556 cm^{-1} attributed to the $C=O_{ketone}$, absorption band in the range 1602-1624 cm^{-1} attributed to the azomethine group, an absorption band in the range 1510-1598 cm^{-1} attributed to aromatic rings and band of absorption in the range 712-725 cm^{-1} attributed to OOP of methylene groups.

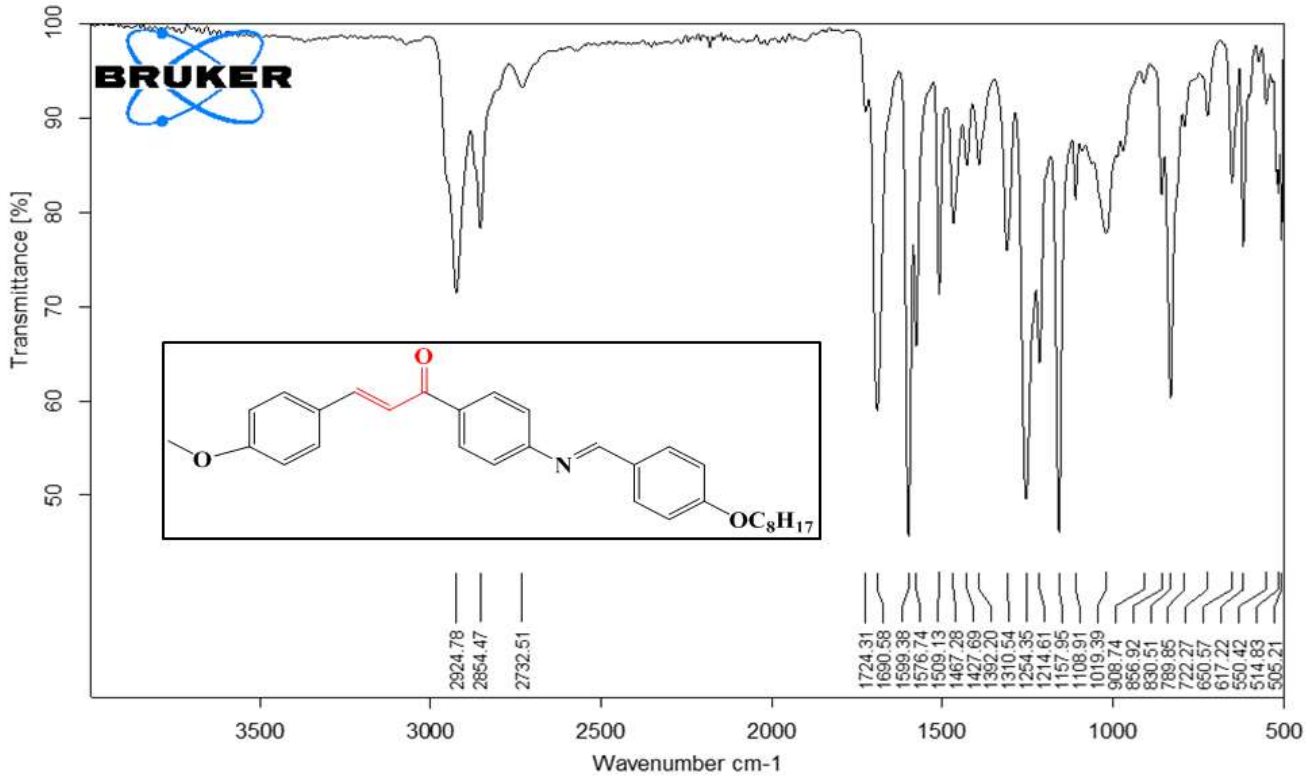


Figure 1. FT-IR spectrum of 4-(octyloxy)benzaldehyde.

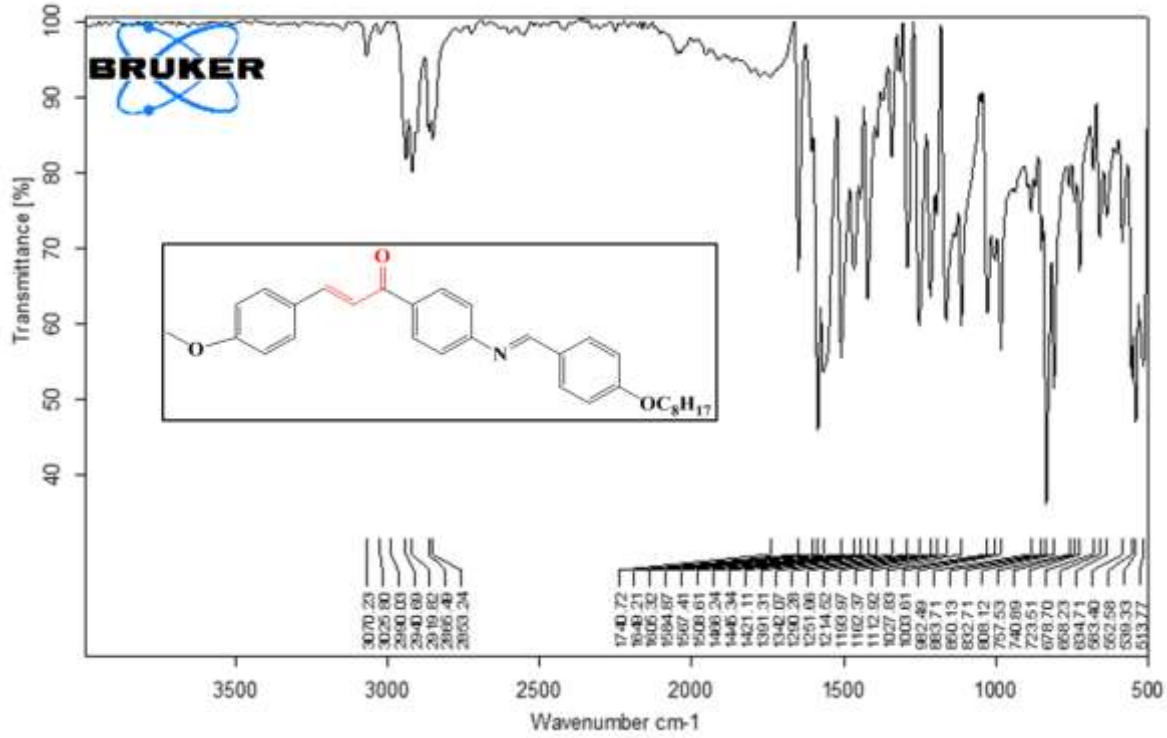


Figure 2. FT-IR spectrum of compound M3.

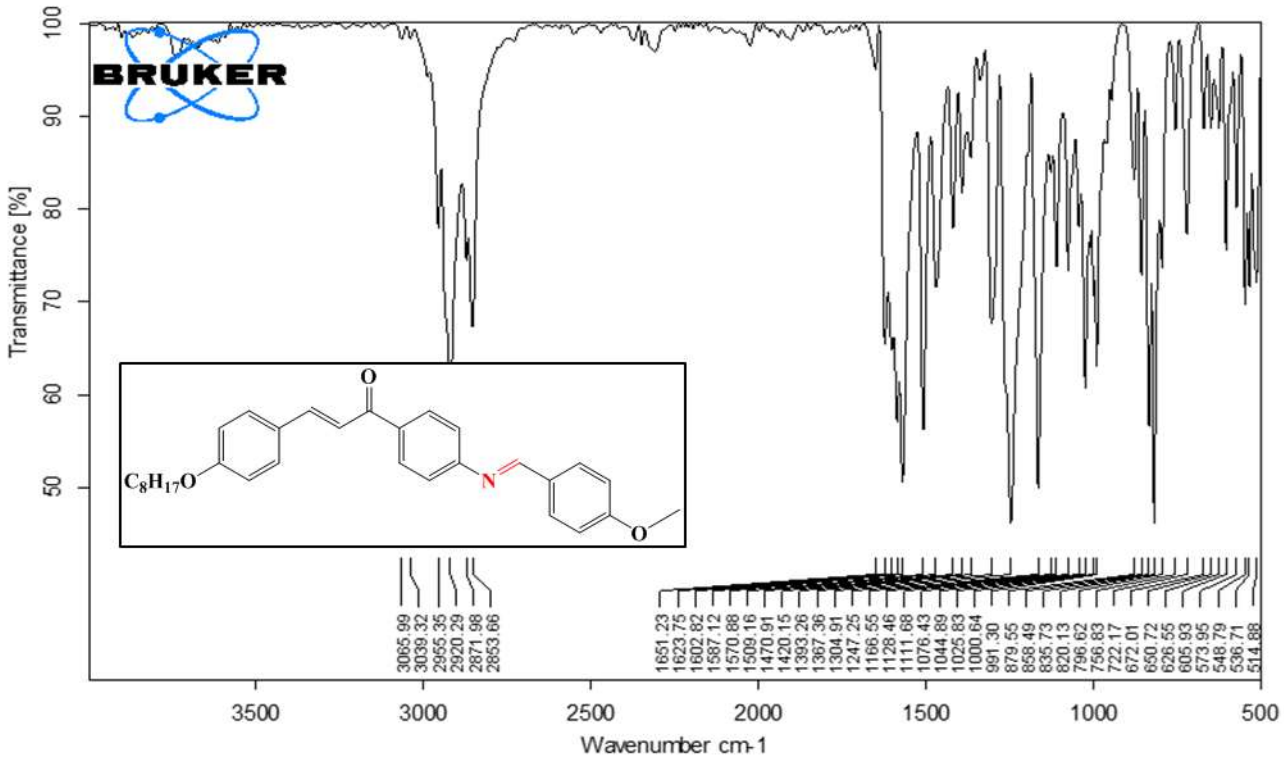


Figure 3. FT-IR spectrum of compound R3.

^{1}H-NMR spectra of compounds (M, M_1-M_3) consisted of a singlet signal at a range 8.59-8.70 ppm due to a proton of (H-C=N), a double signal at a range 8.17-8.26 ppm due to a proton of the chalcone (H-C=C), a doublet signal at a range 7.34-7.41 ppm due to a proton of the chalcone C=CH-C=O, and the appearance of several different signals at a range 6.54-8.21 ppm are due to the protons of the aromatic rings, and a signal at the range 4.05-4.09 ppm due to the protons of the methylene group in the hydrocarbon chain (O-CH_2-C). Several different signals appeared within the range 0.85-1.75 ppm attributable to the protons of the hydrocarbon chain ^{1}H-NMR spectrum of compound M_3 as in Figure .4.As for the ^{1}H-NMR spectra of compounds (R, R_1-R_3) showed a singlet signal at 5.74 ppm due to the proton of the amine group in compound R, as well as a singlet signal at a range 8.07-8.55 ppm to a proton of the azomethine group (CH=N) in compound (R1-R3) respectively. A signal within the range of 7.52-8.37 ppm to the proton of the chalcone (H-C=C), a doublet signal within the range 6.83-7.58 ppm to the proton of the chalcone (C=CH-C=O), and various signals within the range 6.59-7.97 ppm to the aromatic protons, a signal within the range 3.49-4.41 ppm to the proton of the ethylene group in the hydrocarbon chain (O-CH_2-C) , and various signals within the range 0.86-1.77 ppm to the protons of the hydrocarbon chain. The structure of the compounds (M, M_1-M_3) and (R, R_1-R_3) was confirmed by ^{13}C-NMR spectroscopy. The compounds showed a signal within the range 186-191 ppm to the carbonyl group in the chalcone (C=C-C=O), a signal within the range 161-170 ppm to the carbon atom in the group azomethines (C=N), a signal at a range 140-146 ppm to one of the carbon atoms in the chalcone and the second atom showed a signal within the range 121-124 ppm, signals within the range 111-161 ppm attributable to the carbon atoms in the aromatic rings, a signal within the range 63-70 ppm to a carbon atom of the group methylene (O-CH_2), and a signal in the range 14-31 ppm to the carbon atoms in the hydrocarbon chains ^{13}C-NMR spectrum of compound M_2 as in Figure .5, The synthesized chemicals are characterized by stability and do not need specialist processes [28] to avoid environmental contamination.

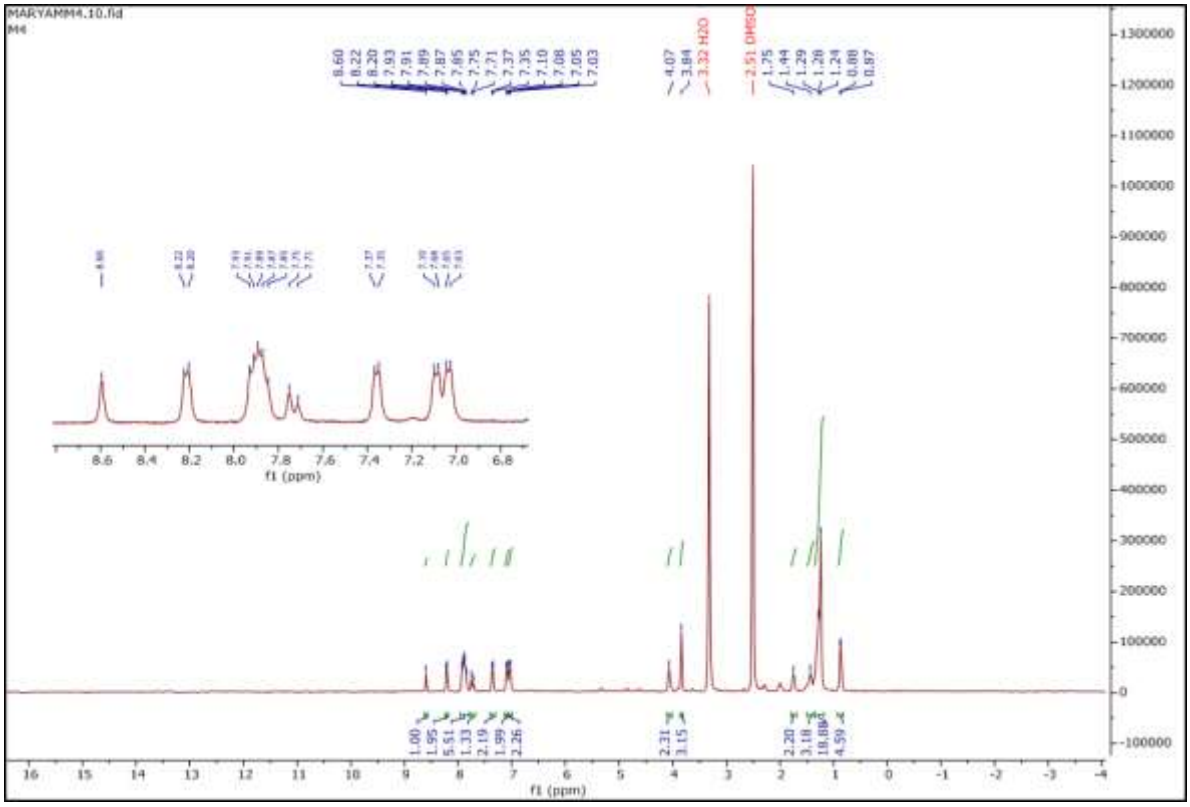


Figure 4. ^{1}H-NMR spectrum of compound M_3

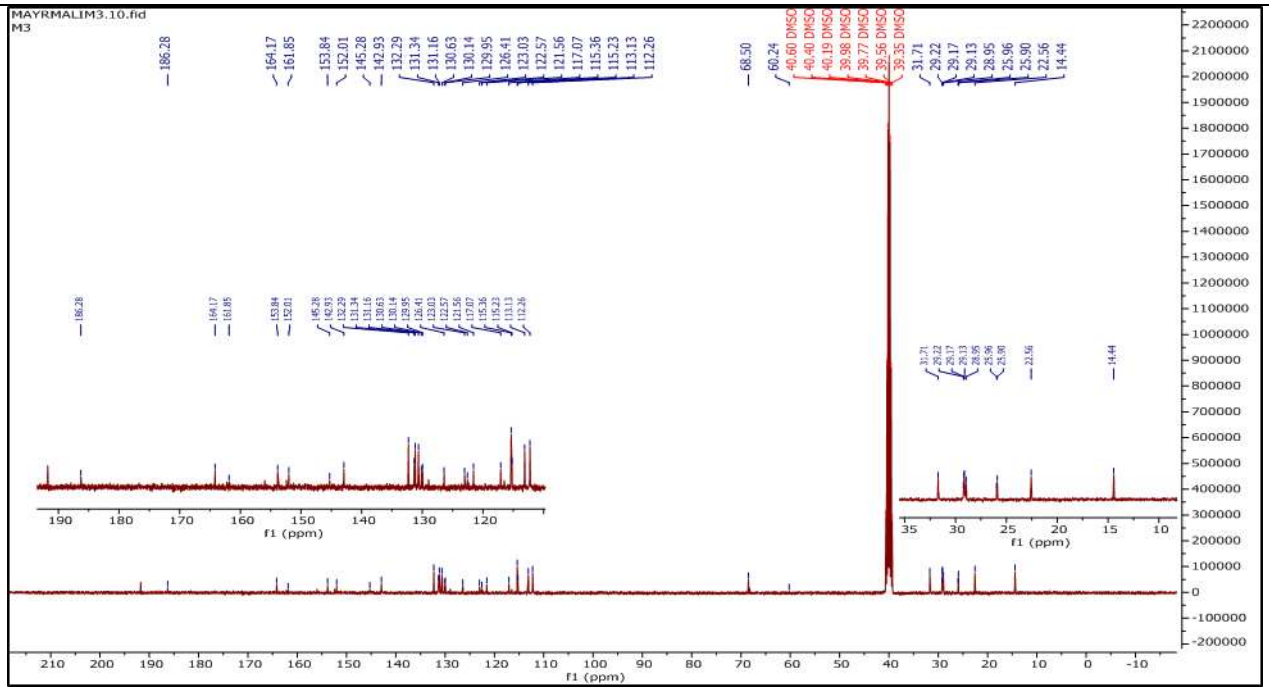


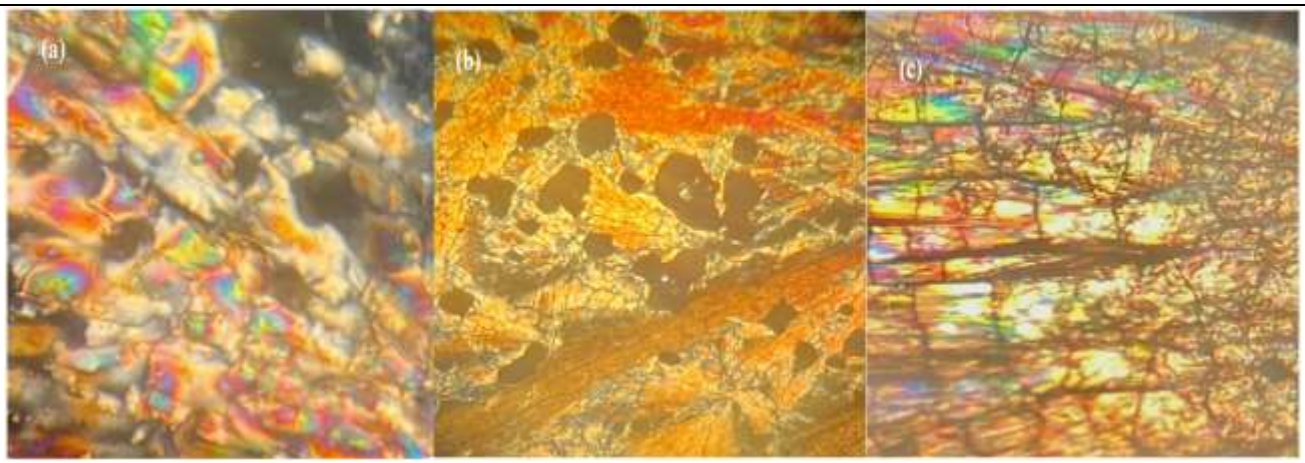
Figure 5. ^{13}C-NMR spectrum of compound M_2

3.3. A Study of the Synthesized Compounds of Mesomorphic Properties

The characteristics of Mesomorphic compound synthesized were examined using (DSC), and the textures were Meticulously observed by polarized optical Microscopy (POM). The findings indicated that compounds (R1-R3) do not exhibit Mesomorphic features due the link of N-phenyl for the torsion angle is around 55 degrees for the C=N bond and octanoxy position, preventing Molecular linearity and resulting in a lack of lateral and terminal attractions that prevent Mesophase formation. While compounds (M_1-M_3) exhibits Mesomorphic properties, as all Monomorphic compounds show the nematic phase only upon heating. The thermal transitions (heat transfer temperature) of the compounds ΔH and ΔS are given in table 1. The formation of the nematic Marble textures was observed during POM investigation. Optical Micrographs of the formed phases are shown in Figure 6, and DSC thermograms of the compound M_3 are shown in Figure 7.

Table 1. Information and Mesomorphic structures of compounds (M1-M3).

Comp.	Transition	Peak temp. C°	ΔT_N C°	ΔH (KJ.Mol^{-1})	ΔS (J.Mol^{-1}. K^{-1})
M_1	Cr-N	33.44	-	25.836855	34.312932
	N-I	196.11	162.69	17.89862	38.154420
M_2	Cr-N	108.42	-	12.472193	32.699368
	N-I	129.07	20.65	19.335760	48.090532
M_3	Cr-N	70.45	-	7.180643	20.9073897
	N-I	113.61	43.16	29.220379	75.581021



(a) (b) (c)

Figure 6. polarization optical Microscopy to the following: (a) compound M_1 (nematic- Marble at 33.44° C); (b) compound M_2 (nematic- Marble - at 108.42 ° C); (c) compound M_3 (nematic- Marble at 70.45 ° C).

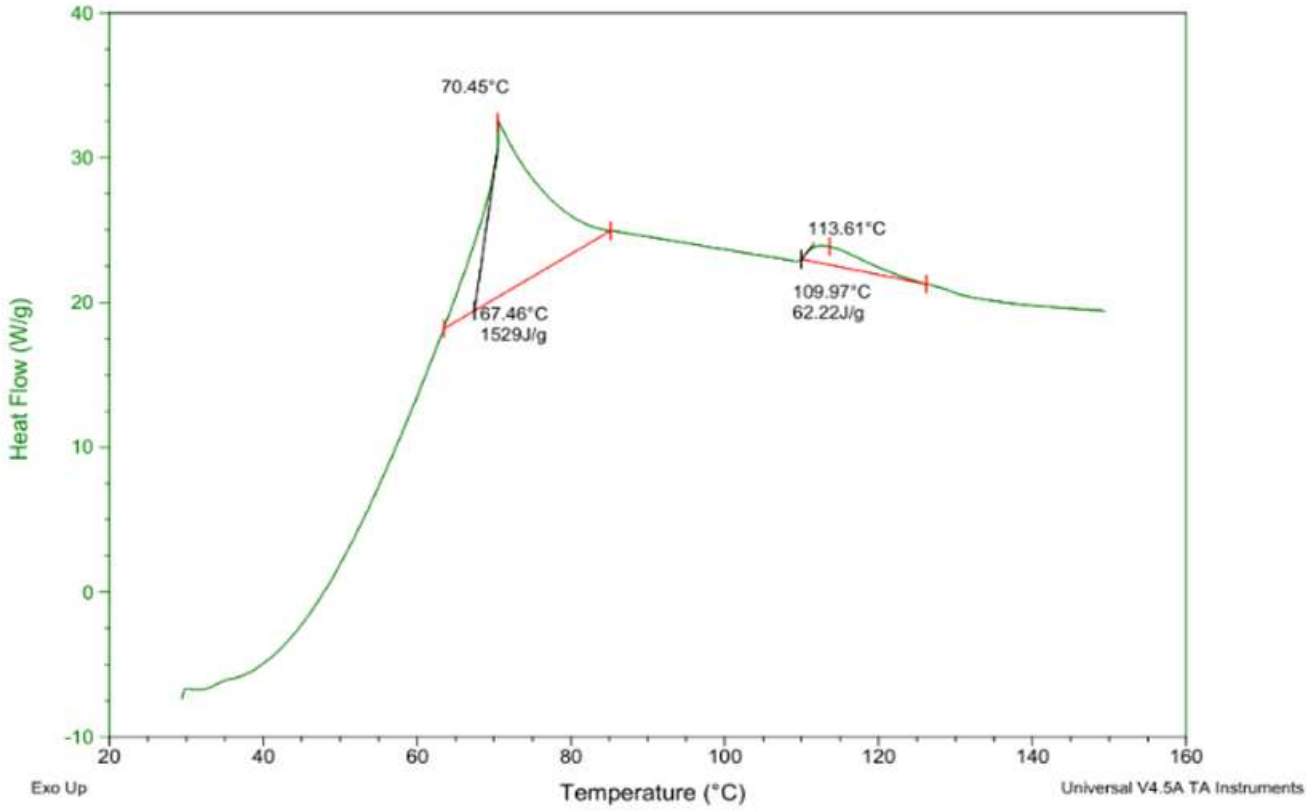


Figure 7. DSC thermogram of the compound M_3

Consequently, the study demonstrated that the mesogenic capabilities of certain synthetic chemicals are influenced by the linearity of their molecular structure. Moreover, by the variability of substitutions groups, which sometimes leads to distortion of the molecular shape, and absence of liquid crystalline property.

4. Conclusions

Azomethines chalcones were produced and described. This research revealed that the appearance of crystalline characteristics is affected by altering the location of alkoxy groups and a substituted group on the azomethine and chalcone ends. When the alkoxy groups substituted on the chalcone end in the compound (R_1-R_3), the liquid crystalline properties

will not appear, due to preventing the linearity of Molecules. However, when the ether group is substituted on the azomethine end (M_1-M_3), all of them show liquid crystalline properties during the heating process, this is due to enhancement of Molecule linearity and the improvement of liquid crystalline properties.

Acknowledgments: We would like to acknowledge all those who have helped us in this research. We extend our thanks to the staff in the laboratory of the Department of Chemistry, University of Anbar.

Conflicts of Interest: There are no conflicts of interest, according to the authors.

Funding:

This research is self-funded.

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