

Synthesis and characterization of some acridone derivatives

Sh. Espahbodinia⁽¹⁾, F. Kandil⁽²⁾ and A. Chehadeh⁽³⁾

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ABSTRACT

New Schiff base compounds were prepared via condensation of 9(10H) acridone with hydrazine hydrate and with ethylenediamine in 2:1 ratio, and with thioacetamide in 1:1 ratio. The structures of the prepared Schiff base compounds and next stage products have been determined by FT-IR, LC-MS and ¹H-NMR methods.

Key Words: Schiff base, Acridone, Acridone derivatives, Acridine derivatives.

⁽¹⁾ Ph.D., Student, ⁽²⁾ Supervisor, ⁽³⁾ Associated supervisor, Department of Chemistry, Faculty of Sciences, Damascus University, Syria

اصطناع بعض المشتقات الجديدة للأكريدون وتوصيفها

شكوفة إسبهبدي نيا⁽¹⁾ و فاروق قنديل⁽²⁾ و عدنان شحادة⁽³⁾

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الملخص

حضرت مركبات أسس شيف جديدة من تكائف الأكريدون مع كل من هيدرات الهيدرازين وثنائي أمينو الإيتلين بنسبة مولية 1:2 ومع تيواستاميد بنسبة مولية 1:1. حُدِّت بنى المركبات الناتجة بأطياف ¹H-NMR, LC-MS, FT-IR.

الكلمات المفتاحية: أكريدون، أساس شيف، مشتقات الأكريدون، مشتقات الأكردين.

(1) طالبة دكتوراه، (2) الأستاذ المشرف، (3) الأستاذ المشرف المشارك، قسم الكيمياء، كلية العلوم، جامعة دمشق، سورية.

Introduction:

Schiff bases are condensation products of primary amines with carbonyl compounds and they were first reported by Schiff in 1864. These compounds are also known as anils, imines or azomethines (-C=N-). Several studies showed that the presence of a lone pair of electrons in an sp^2 hybridized orbital of nitrogen atom of the azomethine group is of considerable chemical and biological importance. Where R may be an aliphatic or aromatic group. Schiff bases of aromatic aldehydes, having an effective conjugated system, are more stable. In this paper three Schiff bases product from carbonyl group in acridone and three aliphatic amines, and then in the next step the hydrogen connected to secondary amine group in position 10 of acridone was replaced by benzyl chloride. The method of preparation, and spectral characterization of series of schiff base compounds and next stage products were discussed [1-9].

Experimental

Materials and apparatus

All the starting materials [9(10H)-acridinone, Hydrazine hydrate, Thioacetamide, Benzyl chloride, HCl (37%)] were used from Sigma-Aldrich and DMSO (Dimethylsulphoxide) were used from Avonchem and sodium hydroxide pellets were used from Panreac.

Melting points were measured on a Stuart SMP-30 capillary melting point apparatus and are uncorrected ($<390^\circ\text{C}$). Shimadzu 8300 FTIR spectrophotometer in the range $(4000-400)\text{ cm}^{-1}$. NMR spectra ($^1\text{H-NMR}$) were acquired in $\text{DMSO-}d_6$ solution using Bruker AMX400 MHz spectrometer with tetramethylsilane (TMS) as an internal standard. Mass spectra were recorded on a Finnegan-MAT model 8430 GC MS-DS spectrometer.

Synthesis of 1,2-di(acridine-9(10H)-ylidene)hydrazine (I)

Acridone (2 mmol = 0.3904 g) and Hydrazine hydrate (1 mmol = 0.5 g) were dissolved in DMSO (100 cm^3), and the mixture was stirred and refluxed for 5 h. The resulting mixture was cooled, and added (100 cm^3) cold water, then filtered and washed by distilled water (100 cm^3). The purity of the product was tested by TLC. The product (0.28 g) was obtained as a yellow solid. FTIR (KBr, cm^{-1}): 3234.0 (-NH), 1432.5 (N=N). $^1\text{H-NMR}$ (DMSO- d_6 , ppm): 6.867-7.613 (m, 8H, Ar-H), 3.961 (s, 1H, -NH). (Ms, $m/z = 386$)

Synthesis of N^1, N^2 -di(acridine-9(10H)-ylidene)ethane-1,2-diamine (II)

Acridone (2 mmol=0.3904 g) and ethylenediamine (1 mmol=0.06.g) were dissolved in DMSO (100 cm³) as solvent, and the mixture was stirred and refluxed for 5 h. The resulting solution was cooled on the ice bath, filtered and washed by distilled water – ethanol (50-50). The purity of the product was tested by TLC and petroleum ether and ethyl acetate (85:15) as the developing solvents for mobile phase in TLC. The product (0.32g = 83 %) was obtained as a yellow solid. ¹H-NMR (DMSO- d₆, ppm): 7.285 - 8.345 (m, 8H, Ar-H), 4.0 (s, 1H, -NH), 5.2 (t, 2H, -CH₂). (Ms, m/z=414)

Synthesis of N-(acridine-9(10H)-ylidene) ethanethioamide (III)

Acridone (1 mmol = 0.3904 g) and Thioacetamide (1 mmol =0.075 g) were dissolved in DMSO (100 cm³) as solvent, and the mixture was stirred and refluxed for 5 h. The resulting solution was cooled on the ice bath, filtered and washed by distilled water. After 2 days precipitates were filtered and washed by acetone. The product (0.344 g = 88 %) was obtained as a white solid. M.P = 346- 348°C, yield= 76 %. FTIR (KBr, cm⁻¹): 1317.2 (C=S), 2658.1 (CH_{Aliph}) 1714.5 (C=N), 3415.9 (NH), 2999.7 (CH_{Ar}). ¹H-NMR (DMSO-d₆,ppm): 7.285 – 9.412 (m, 8H, Ar-H), 4.1 (s,1H,-NH), 1.3 (s,3H,-CH₃). Ms, m/z=252.2

Synthesis of 1,2-bis (10-benzylacridine-9(10H)-ylidene) hydrazine (A) and N¹, N²-bis (10-benzylacridine-9(10H)-ylidene)ethane-1,2-diamine (B)

A solution of (10 mmol=0.4 g) of NaOH, (100cm³) DMSO, and (5 mmol) of compound (I) or compound (II) was placed in flask and dissolved by heating. Then, (10 mmol = 1.27g) benzyl chloride was added and the mixture refluxed for 6 h. Then, diluted HCl was added dropwise and cooled on ice bath to get the crystalline product. It was recrystallized from distilled water. (Schemes II, III).The product A (0.95g = 49 %) and product B (0.98 g = 51 %) were obtained as a light yellow solid. ¹H-NMR (A) (DMSO-d₆, ppm): 6.95 - 7.61 (m, 13H, Ar-H), 4.285 (s, 2H, -CH₂). ¹H-NMR (B) (DMSO-d₆, ppm): 6.899 – 7.689 (m, 13H, Ar-H), 5.284 (t, 4H, -CH₂), 4.361 (s, 2H, -CH₂). Ms, m/z of A (566.4) and Ms,m/z of B (594.4)

Synthesis of N-(10-benzylacridine-9(10H)-ylidene)ethanthioamide (C)

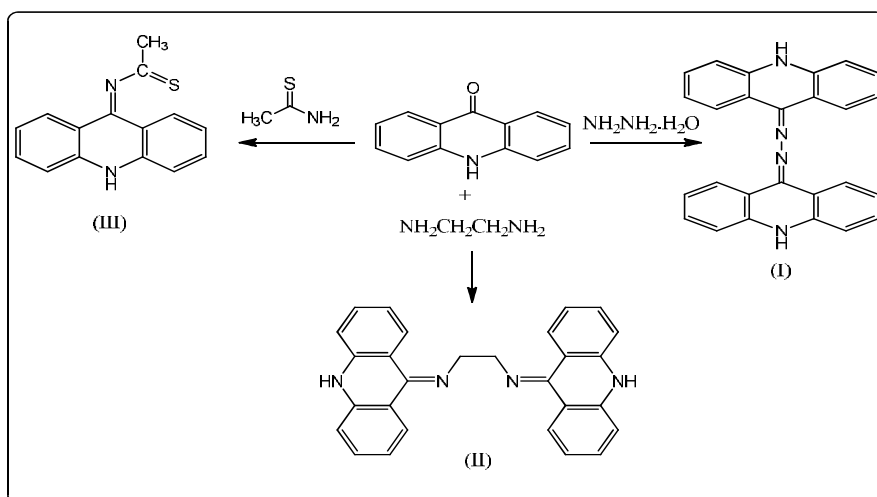
A solution of (10 mmol=0.4 g) of NaOH and (100cm³) DMSO was prepared and (5 mmol) of compound (III) was placed in a flask and

dissolved by heating. Then, (5 mmol=0.635 g) benzyl chloride was added and the mixture refluxed for 4 h. Then, diluted HCl (50 cm³) was added dropwise and the mixture was cooled on ice bath to get the crystalline product. It was recrystallized from distilled water. (Scheme IV). The product (1.02g = 53 %) was obtained as a bright white solid. Ms(342.4) m/z. ¹H-NMR (C) (DMSO-d₆, ppm): 1.24 (s, 3H, -CH₃), 4.28 (s, 2H, -CH₂), 7.19 – 7.86 (m, 13H, Ar-H)

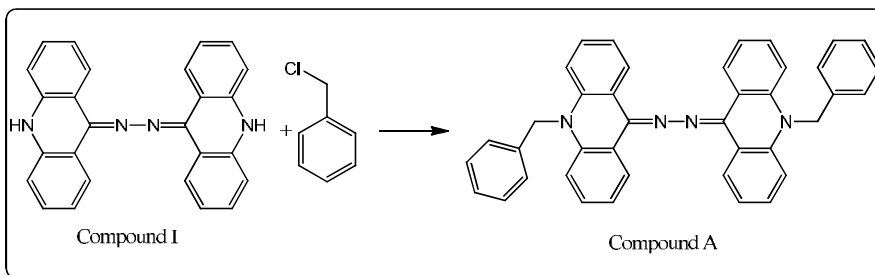
Table1, The physical properties of prepared compounds

product	M.F	M.W (g)	M.P (°C)	Colour	Yield (%)
I	C ₂₆ H ₁₈ N ₄	386.0	265-266	Yellow	72
A	C ₄₀ H ₃₀ N ₄	566.7	320-322	Light-yellow	49
II	C ₂₈ H ₂₂ N ₄	414.2	299-300	yellow	83
B	C ₄₂ H ₃₄ N ₄	594.5	359-360	Light-yellow	51
III	C ₁₅ H ₁₂ N ₂ S	252.3	384-386	White	88
C	C ₂₂ H ₁₈ N ₂ S	342.1	390dec.	Bright White	53

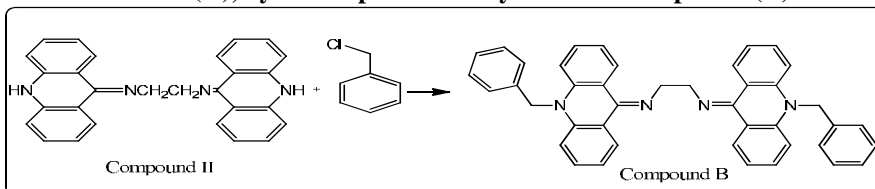
The following schemes show the reaction routes according to the prepared compounds were synthesized.



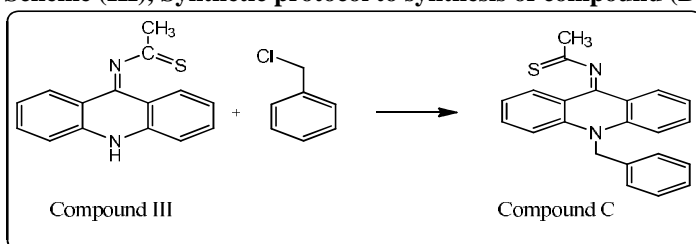
Scheme (I), Synthetic protocol to synthesis of compounds (I,II,III)



Scheme (II), Synthetic protocol to synthesis of compound (A)



Scheme (III), Synthetic protocol to synthesis of compound (B)



Scheme (IV), Synthetic protocol to synthesis of compound (C)

Results and discussion:

In this work we have synthesized new Schiff bases based on 9-(10H) acridone (I, II, III, A, B, C). The structures of these compounds were determined by FT-IR, $^1\text{H-NMR}$ and LC-MS spectra of these compounds. Compound (I) was prepared by reaction of 9(10H) acridone with hydrazine hydrate in ratio 2:1 in DMSO. The IR spectrum ($\text{KBr}, \text{cm}^{-1}$) of (I) : 3234 ($-\text{NH}_{\text{str}}$), 1432.5 ($\text{N}=\text{N}$).

$^1\text{H-NMR}$ ($\text{DMSO-d}_6, \text{ppm}$): 6.867-7.613 (m, 8H, Ar-H), 3.961 (s, 1H, NH). MS, m/z (386). The compound (II) was prepared by reaction of 9(10H) acridone with ethylenediamine in ratio 2:1 in DMSO. FTIR ($\text{KBr}, \text{cm}^{-1}$): 34322 ($-\text{NH}_{\text{str}}$), 1631 ($-\text{C}=\text{N}-$). $^1\text{H-NMR}$ ($\text{DMSO-d}_6, \text{ppm}$): 7.285- 8.345 (m, 8H, Ar-H), 4.0 (s, 1H, -NH), 5.2 (t, 2H, $-\text{CH}_2$). Ms, m/z (414). The compound (III) was synthesized by reaction of 9(10H) acridone with thioacetamide in ratio 1:1 in DMSO.

IR (KBr, Cm^{-1}) 3418(-NH)_{str}, 1317(C=S). $^1\text{H-NMR}$ (DMSO-d₆, ppm) 7.285-9.412 (m, 8H, ArH), 4.1 (s, 1H, -NH), 1.3 (s, 3H, -CH₃). MS, m/z(252). In IR spectra of (I, II, III) may observe the disappearance of carbonyl group of 9(10H)acridone and appearance of imine group (-C=N-), which confirm the formation of prepared compounds. The compound (A) was prepared by reaction of (I) with benzylchloride in DMSO. $^1\text{H-NMR}$ (DMSO-d₆, ppm): 6.95-7.61(m, 13H, ArH), 4.285 (s, 2H, -CH₂). MS (566.4) m/z. The compound (B) was prepared by carrying out reaction between (II) and benzyl chloride in DMSO. $^1\text{H-NMR}$ of (B) (DMSO-d₆, ppm): 6.899-7.689 (m, 13H, ArH), 5.284 (t, 4 H, -CH₂-CH₂), 4.361 (s, 2H, -CH₂). MS, (594.4) m/z. The compound (C) was prepared by carrying out reaction between (III) and benzyl chloride in DMSO. $^1\text{H-NMR}$ of (C) (DMSO-d₆, ppm): 1.24 (s, 3H, -CH₃), 4.28 (s, 2H, -CH₂), 7.19 – 7.86 (m, 13H, Ar-H). Ms (342.4) m/z.

Conclusion

New schiff bases based on 9(10H)acridone were synthesized by condensation of 9(10H)acridone with:

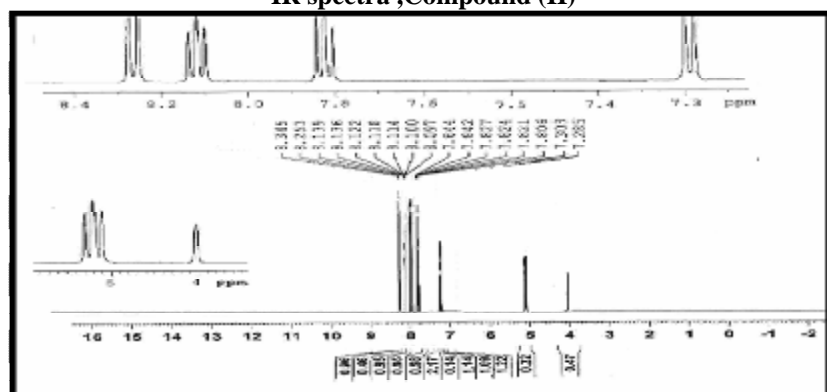
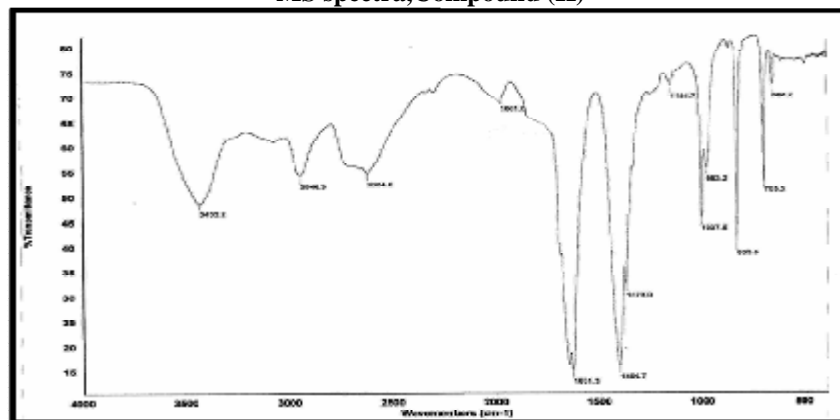
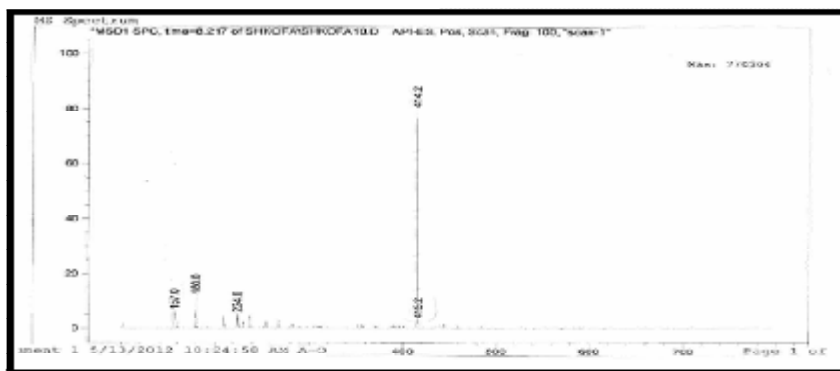
- Hydrazine hydrate giving (I) in ratio 2:1
- 1,2-diamino ethane giving (II) in ratio 2:1
- Thioacetamide giving (III) in ratio 1:1

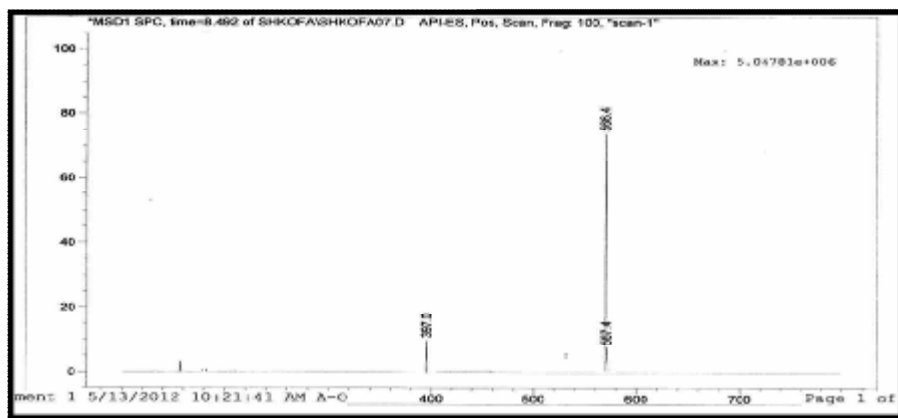
Benzyl chloride reacted with (I, II, III) compounds gave (A, B, C) compounds respectively.

The structures of all prepared compounds were determined by spectral FTIR, $^1\text{H-NMR}$ and MS methods.

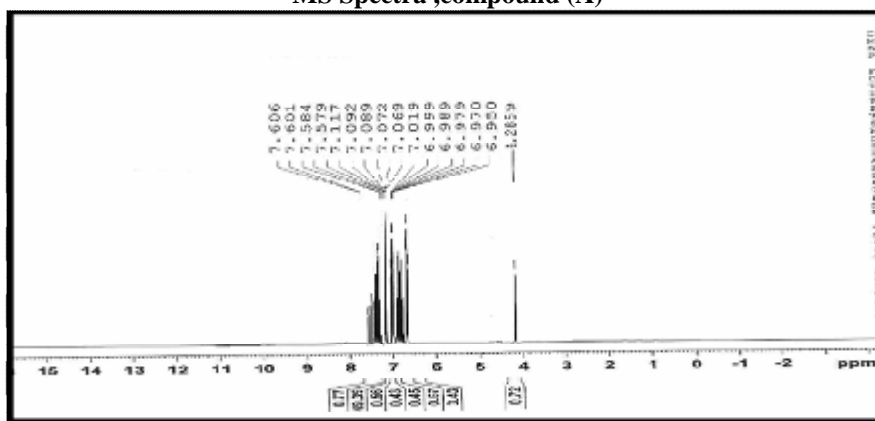
Acknowledgments

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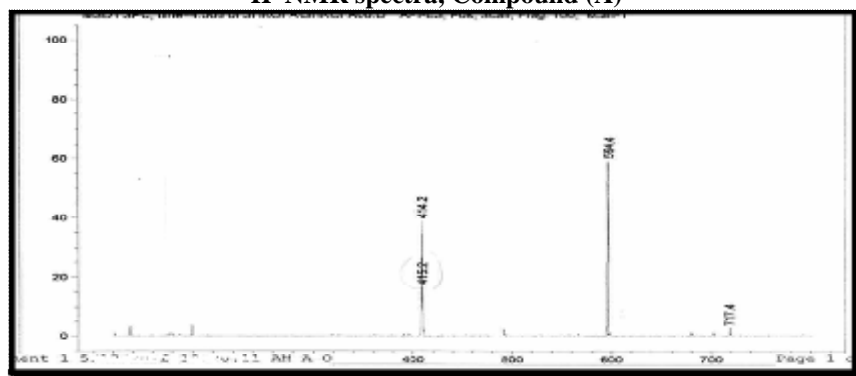




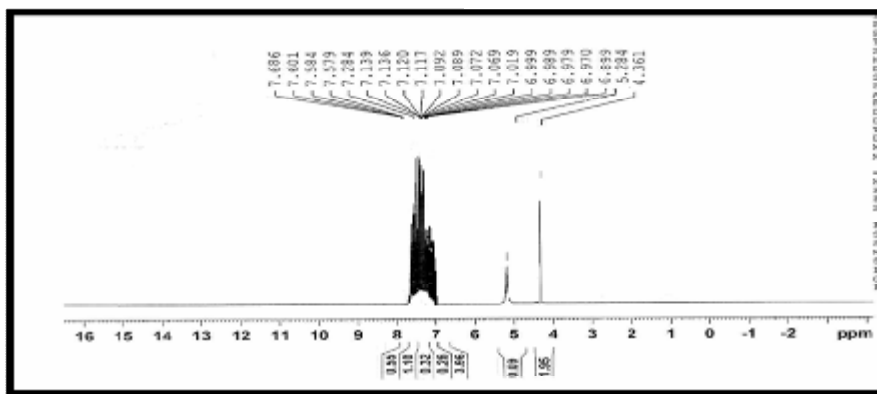
MS Spectra ,compound (A)



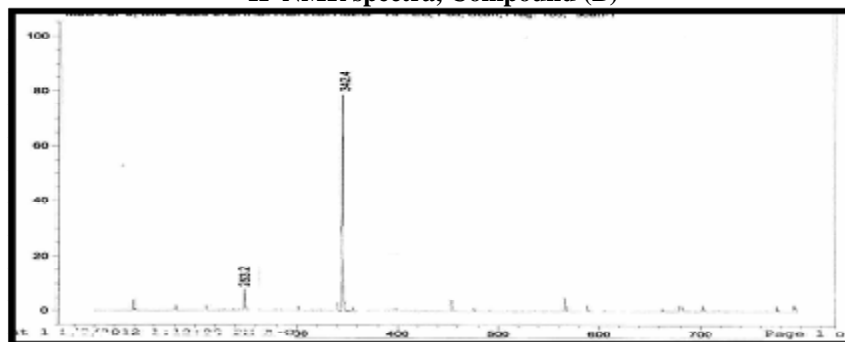
H^1 NMR spectra, Compound (A)



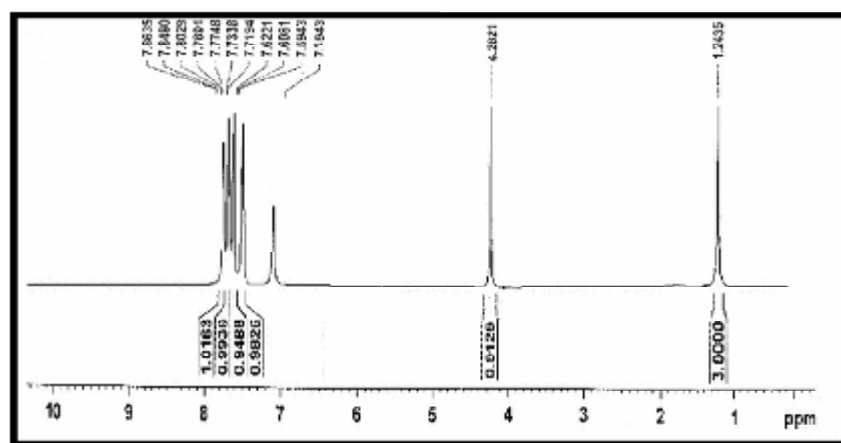
MS Spectra Compound (B)



¹H NMR spectra, Compound (B)



MS Spectra, Product (C)



¹H NMR spectra, Compound (C)

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