

ARAŞTIRMA MAKALESİ/RESEARCH ARTICLE

THE SYNTHESIS OF 1-(N-2'-IODO-5'-METHOXYPHENYLIMINOMETHYL)-2-NAPHTOL and (1-N-2',4'-DIİODO-5'-METHOXYPHENYLIMINOMETHYL)-2-NAPHTOL

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ABSTRACT

In this study, Schiff base (1) which was prepared from 2-hydroxy-1-naphtaldehyde aniline and m-(methoxy) substituted aniline were reacted with DMSO, I₂, H₂SO₄ in the hope of preparing Schiff base which was substituted with iodine. The reaction has been carried out with DMSO-I₂-H₂SO₄ at 100°C under atmospheric conditions. Reaction has been followed with TLC and the pH of the reactions medium were approximately at 5. In the experiment was carried out approximately at pH ≈ 2 the azomethine (-CH=N-) bond breaking was found. The reaction of the naphtholic Schiff base (1) with DMSO-I₂-H₂SO₄ was carried out at 100°C for about 10 hours. The structure of product was determined by mass, IR, UV, ¹H-NMR, ¹³C-NMR spectra and with elemental analysis. Under our reaction condition iodine was substituted to the phenyl ring of the naphtholic Schiff base (1).

Key Words: Aromatic, Electrophilic, Halogenation, Iode substitution

1-(N-2'-İYODO-5'-METOKSİFENİLİMİNOMETİL)-2-NAFTOL VE 1-(N-2',4'-DİİYODO-5'- METOKSİFENİLİMİNOMETİL)-2-NAFTOL'ÜN SENTEZİ

ÖZ

Bu çalışmada m-OCH₃ anilinden hazırlanan Schiff bazı (1) ile, iyot süstitüye Schiff bazını sentezlemek amacıyla ; DMSO, I₂, H₂SO₄ ile reaksiyona sokulmuştur. Reaksiyon DMSO, I₂, H₂SO₄'li ortamda 100°C'de, geri soğutucu altında gerçekleştirilmiştir. Reaksiyon ortamının pH'ı yaklaşık 5 olarak belirlenmiştir. pH'ı 2 civarında yapılan deneyde azometin (-CH=N-) bağının kırıldığı tespit edilmiştir. Reaksiyon 100°C'de yaklaşık 10 saatlik sürede gerçekleştirilmiştir. İzole ürünlerin (2,3) yapısı kütle, IR, UV, ¹³C-NMR, ¹H-NMR ve elementel analiz ile tayin edilmiştir. Reaksiyon koşullarında iyot, naftolik Schiff bazının (1) fenil halkasına süstitüye olmuştur.

Anahtar Kelimeler: Aromatik, Elektrofilik, Halojenleme, İyot süstitüsyonu.

1. INTRODUCTION

In aromatic electrophilic halogenizing reactions, iodine is not as active as chlorine or bromine (Bottle, 1986; Olah 1993). The reason for this is that the reaction for the iodide ion occurring in the reaction environment is obtained in a reversible manner. Hence, oxidizing agents such as HIO₂ and H₂O₂ are added to remove the iodide ion, occurring in the electrophilic haloge-

nizing reactions, from the environment (Ogato, 1964; Radner, 1998). And, a procedure of dehydrating aluminum is employed in iodizing aromatic substances. According to the procedure, aromatic substances are caused to react with molecular iodine. The dehydrated surface of aluminum provides an appropriate environment for electrophilic iodizing. The surface reacts with the iodide ion, oxide ion and freed HI, resulting in iodizing (Fessenden, 1992; Gali, 1991).

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Geliş: 27 Nisan 2004; Kabul: 24 Mayıs 2004

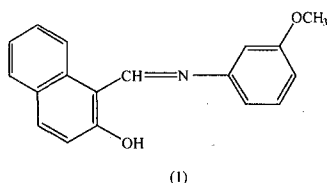
In the literature, many oxidizing agents such as peroxy acetic acid, peroxide sulphate, sulphur trioxide are used to iodize aromatic compounds.

The most common aromatic electrophilic halogenizing reaction is the Craft reaction (Radner, 1998; Solomons, 1996) where Lewis acids are used to electrophiles. The catalyst in the reaction environment is Lewis acids to create halogen electrophiles.

As aromatic iodine derivatives find a wide area of applications in medicine, biochemistry and pharmaceuticals industry, a new and economic iodizing method is suggested in this study.

With this method, *m*-OCH₃, the Schiff base, was put into an iodizing reaction in an environment containing DMSO₂-I₂-HSO₄ and the structure of the resultant product was then clarified.

2. DISCUSSION



m-OCH₃, the Schiff base, was heated under the cooler for 10 hours under the iodizing conditions of the iodizing method in this study and then the raw product was isolated.

a) When the first raw product cooled down, excess iodine in the reaction environment was eliminated with 10%-Na₂S₂O₃ through ice-aided settling and rinsed with pure water. When film chromatography was applied (SiO₂ Toluene), the product being (R_f= 0.75) provided yellow crystals of ethyl alcohol.

The melting point of the substance that was isolated at an efficiency of 22.7% was 185° C with molecules detected at 403.09 in the mass spectrum (Figure 1).

The isolated substance had the OH peak linked with H observed as a low and spreading one at about 3,500 in IR spectrum (Figure 2). Observed were azomethine** at 1624.73 (-CH=N-), an aromatic structure at 1568.8 - 1481.06, C-O at 1284.36, and peaks for aromatic substitution at 1142.62 - 1012.45 - 966.16 - 857.20 - 831.17 - 778.14 - 745.35.

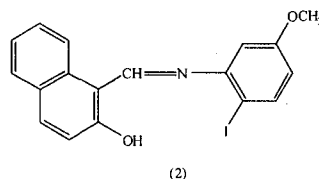
In the UV spectrum (Figure 3), the substance was observed to have maximums at 318.0 - 367.0 -445.0 -

462.0. In the basic UV spectrum, maximums were observed at 279.0 - 289.0 - 316.0 while acidic UV spectrum showed maximums at 279.0 - 289.0 and 316.0.

In the mass spectrum of the isolated substance, peaks of M⁺- C₁₇H₈NOI were observed at *m/e*: 159.24 and T⁺ at 127.35. The closed formula of the substance is C₁₈H₁₄NO₂I.

In the ¹H-NMR mass spectrum of the isolated, purified substance (Figure 4), it is concluded that the 3H singlet at 3.86 ppm belonged to the -OCH₃ group, the low and spreading one at 15.2 ppm to the OH proton and the 1-proton singlet at 9.24 ppm to the azomethine proton while a 9-proton signal was observed in the aromatic area. In the extended NMR spectrum of this area (Figure 5), the highest delta value of the H-4 proton was at 8 ppm (J = 9 Hz), followed by a H-5 signal equal to 1H doublet at 7.64 ppm (J_{5,6} = 8 Hz) while the H-8 signal appeared as a 1H doublet at 7.73 ppm (J_{7,8} = 8 Hz).

And the H-6 and H-7 protons in the naphthalene ring appeared as a 1-proton triplets at 7.27 and 7.45 ppm. The C-H protons in the remaining part of the phenyl ring in the spectrum were marked by theoretic calculations. The H-3' proton turned out to be in a lower area, compared with other phenyl protons. The 1H doublet at 7.72 ppm (J_{4,5} = 8 Hz), which was in agreement with calculated values, was marked as belonging to the H-3' proton while the H-6' proton and H-4' protons were observed as a 1-proton singlet at 6,66 ppm and another 1 proton (dxt, J=2 Hz, J=6 Hz) at 6,67 ppm, respectively. Based on this interpretation, it was realized that the isolated substance was the iodine-substituted Schiff base (2).



In the ¹³C-NMR spectrum of the substance (Figure 6), a total of 7 small peaks and 11 large ones occurred. The signal at 56,91 ppm was marked as belonging to the methoxy carbon. The C-1, C-2, C-4a and C-8a signals in the naphthalene ring were observed at 109.31, 169.86, 127.83 and 133.45 ppm, respectively.

The remaining 10 C-H signals were marked in the light of theoretic calculations. Accordingly, the CH carbons of C-3, C-4, C-5, C-6, C-7, C-8, C-6', C-4', and C-3' appeared at 119.33, 140.40, 137.29, 124.14, 129.83, 128.59, 104.84, 113.00, and 122.197 ppm, respectively. These ^{13}C -NMR results, too supported the idea that the structure was the iodine-substituted Schiff base (2).

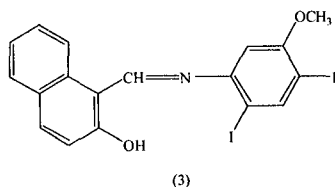
b) As for the second raw product, the product being ($R_f = 0.5$) provided yellow crystals of ethyl alcohol when film chromatography was applied (SiO_2 Toluene). The melting point of the substance that was isolated at an efficiency of 34.2% was 230°C with molecules detected at 403.09 in the mass spectrum (Figure 7).

The isolated substance had the OH peak linked with H observed as a low and spreading one at about $3,500\text{ cm}^{-1}$ in IR spectrum (Figure 8). Observed were azomethine** at 1625 (-CH=N-) , an aromatic structure at $1457.92 - 1323.89$, C-O at 1244.83 , C-O at 1158.04 , and peaks for aromatic substitution at $1047.16 - 986.41 - 887.09 - 819.60 - 742.46$.

In the UV spectrum (Figure 9), the substance was observed to have maximums at $320.0 - 392.0$ and 462.0 . In the basic UV spectrum, maximums were observed at $316.0 - 419.0 - 430.0$ while acidic UV spectrum showed maximums at $311.0 - 350.0$ and 368.0 .

In the mass spectrum of the isolated substance (Figure 7), peaks of (537 M^+) were observed at 403.09, ($\text{M}^+ - \text{C}_7\text{H}_6\text{OI} = \text{M}_1^+$) in 47.62% at 169.21, ($\text{M}_1 - 28$) = ($\text{M}_1^+ - \text{CH}_2\text{NI}$) in 45.54% at 140.40, and (T^+) in 97.62% at 127.33.

The closed formula of the substance is $\text{C}_{18}\text{H}_{13}\text{NO}_{22}\text{I}$. Based on this, I concluded that the compound was a di-iodine-substituted one (3) and no molecular iodine was detected in the mass spectrum.



The ruptures explain that iodine is linked with the ring.

In the ^1H -NMR mass spectrum of the substance (Figure 10), the 3H singlet at 3.90 ppm was marked as belonging to the $-\text{OCH}_3$ group, and the H-containing one at 14.72 ppm to the $-\text{CH}=\text{N}$ proton while a 8-proton signal was observed in the remaining aromatic area. In the extended ^1H - NMR spectrum of this area (Figure 11), the H-3, H-4, H-5 and H-8 protons in the naphthalene ring were marked as four 1-proton doublets ($J = 8$ Hz) at 7.14, 7.82, 7.72 and 8.10, respectively while the

H-6 and H-7 protons were observed as two 1-proton triplets at 7.73 and 7.50 ppm. In agreement with calculated values, the H-3 proton was to the left of the H-6 proton and the singlet at 8,18 ppm was observed as belonging to the H-3' proton and the singlet at 6,64 ppm to the H-6' proton.

Based on the ^1H -NMR spectrum above (Figure 10), it is concluded that the isolated substance was the iodine-substituted Schiff base (3).

The ^{13}C -NMR spectrum, too, supported that the substance, with formula above (Figure 12), was the di-iodine-substituted Schiff base (3).

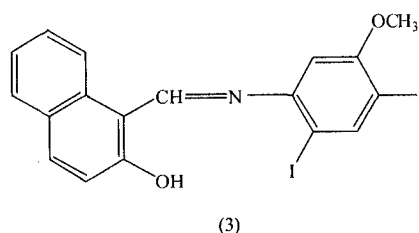
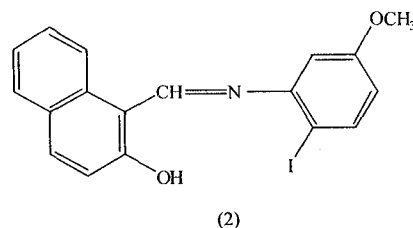
In the ^{13}C -NMR spectrum of the substance (Figure 12), a total of 8 small peaks and 10 large ones occurred. The signal at 57,1 ppm was realized as belonging to the $-\text{OCH}_3$ carbon while two small signals at 84.18 and 85.30 ppm were concluded to be belonging to the C-4' and C-2' carbons, respectively.

The C-1, C-2, C-4a and C-8a signals in the naphthalene ring were observed at 109.54, 165.48, 128.23 and 133.23 ppm, respectively while the signals C-1' and C-5', being carbons with no phenyl aromatic H, were observed at 151.15, and 160.06 ppm.

The carbons of C-3, C-4, C-5, C-6, C-7, and C-8 in the naphthalene ring were observed at 119.54, 148.40, 136.75, 124.90, 129.90, 128.58 ppm, respectively while the carbons of C-6' and C-3' in the phenyl ring were observed at 103.76 and 121.03 ppm, respectively.

The ^{13}C -NMR spectrum and ^1H -NMR mass spectrum of the substance were in agreement. Based on chemical analyses and other spectroscopic analyses, it was concluded that the structure was the iodine-substituted Schiff base (2).

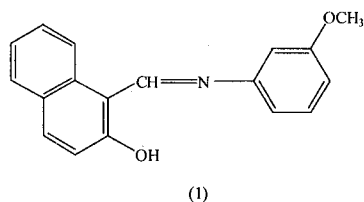
Two products (2, 3) were obtained from the iodizing reaction of $m\text{-OCH}_3$, the Schiff base, in an environment containing $\text{DMSO}_2\text{-I}_2\text{-H}^+$.



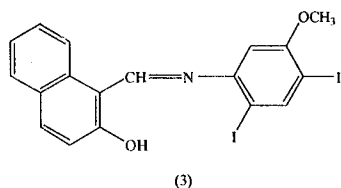
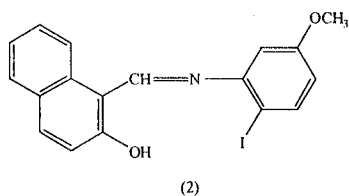
3. EXPERIMENTAL SECTION

The reaction of *m*-OCH₃, the Schiff base (1) with DMSO₂-I₂-HSO₄ was carried out at 100°C in a period of 10 hours. The reaction was monitored with ITK controls. pH of the reaction environment was set at about 5. Excess iodine in the reaction environment was eliminated with 10%-Na₂S₂O₃.

The product of the reaction was purified and crystallized in ethanol alcohol. A series of analyses yielded the realization that the two products obtained from the reaction were of structures 2 and 3.



The structures (2 and 3) of the resultant products were clarified by the elemental analyses of IR, UV, ¹H-NMR and ¹³H-NMR.

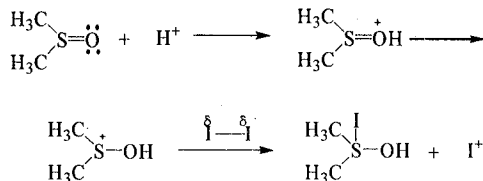


4. CONCLUSION

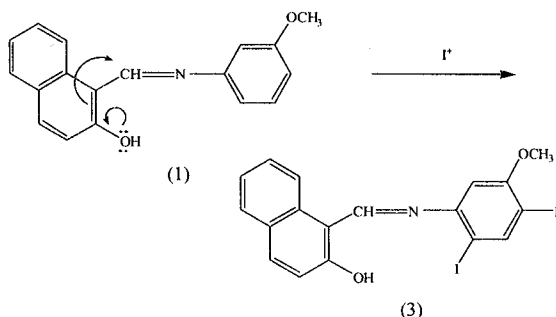
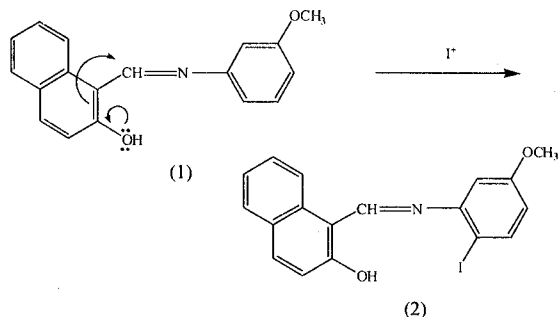
The reaction of *m*-OCH₃, the naphtholic Schiff base (1) with DMSO₂-I₂-HSO₄ was carried out at 100°C in a period of 10 hours, isolating two products (2, 3) in result.

In the iodizing reaction, the iodine in the iodine phenyl ring was substituted in the ortho position according to the azomethine** nitrogen (-CH=N-). The group facilitating direction here was the hydroxy group in the naphthalene ring. As for the second product, one of the iodines in the iodine phenyl ring was substituted in the ortho position according to the azomethine** nitrogen (-CH=N-) and the other in the para position.

The following mechanism is recommended for the iodizing reaction:



The resultant iodine ion (I⁺) was put into reaction with the meta methoxy Schiff base (1) as follows:



This iodine-based product so synthesized find a wide area of applications in medicine, and biochemistry. Our further works concerning activities of these substances so obtained are in progress.

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Nimet KARAKOÇ, born at Sivrihisar in 1962, received her degree from the Chemistry Department of the Engineering-Architecture Faculty at the Anadolu University, becoming the most successful among graduates. In 1987, she completed postgraduate study to receive the title of

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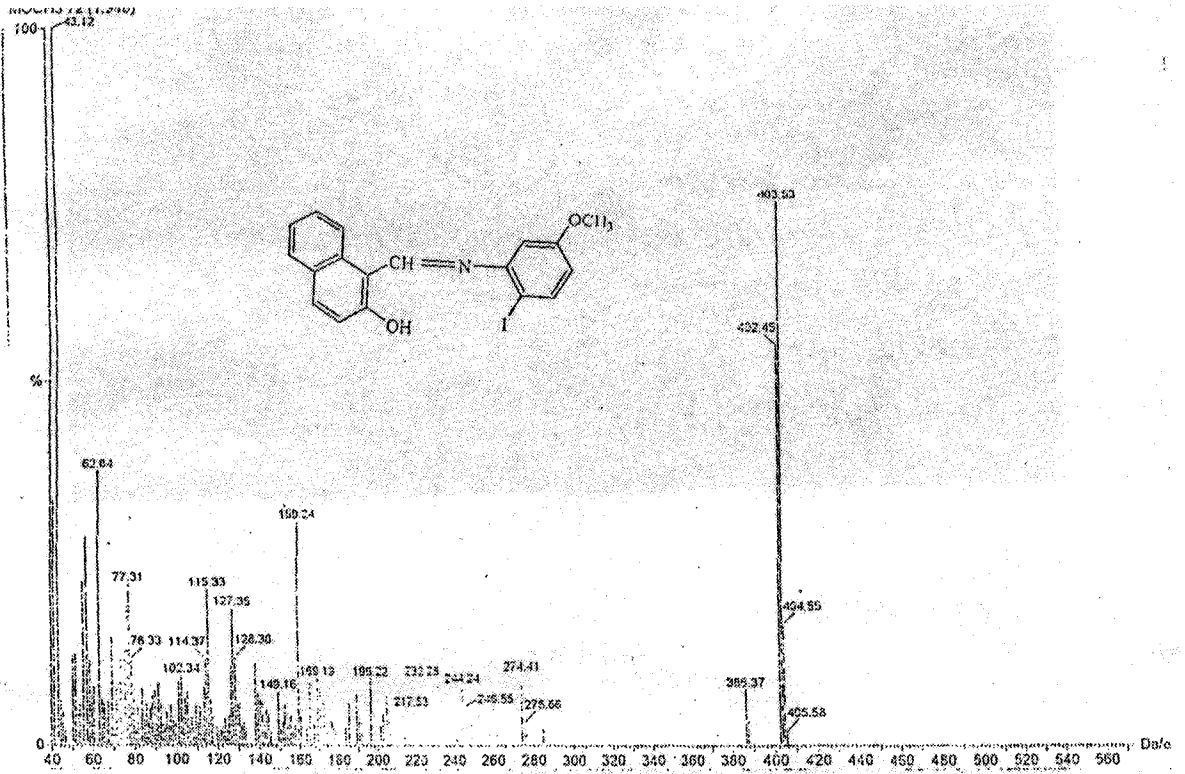


Figure 1 Mass Spectrum of 1-(N-2'-iodo-meta-methoxyphenyliminomethyl)-2-Naphtol (2)

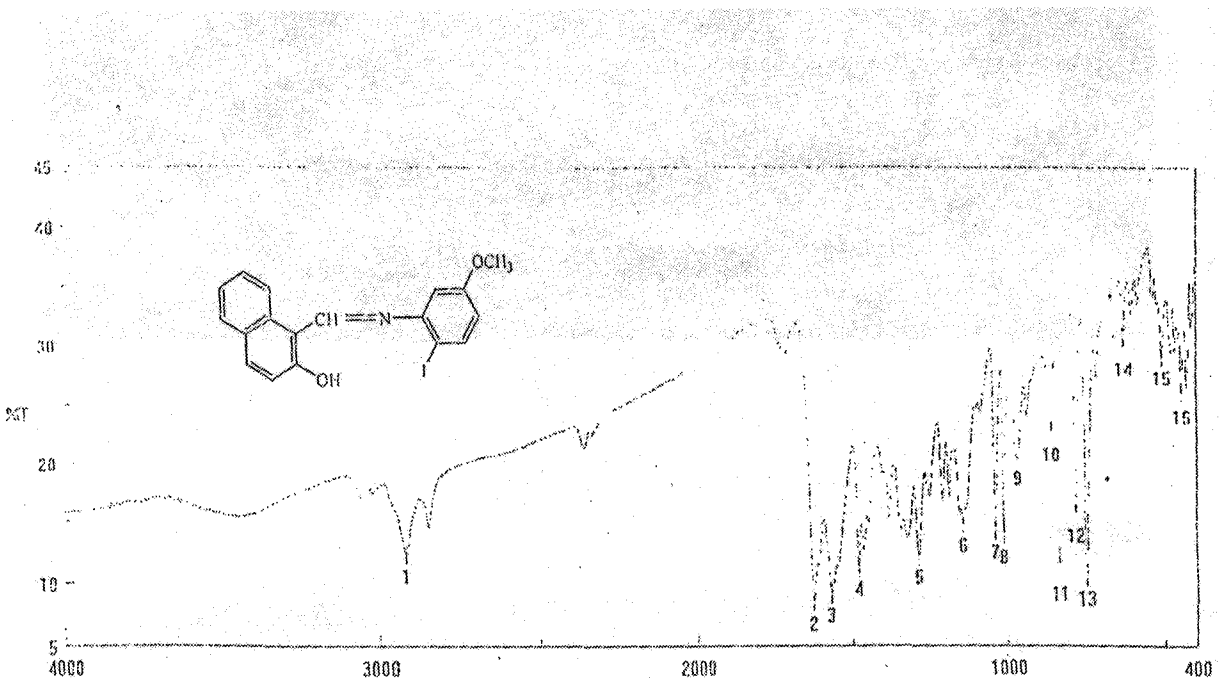


Figure 2 IR (KBr) Spectrum of 1-(N-2'-iodo-meta-methoxyphenyliminomethyl)-2-Naphtol (2)

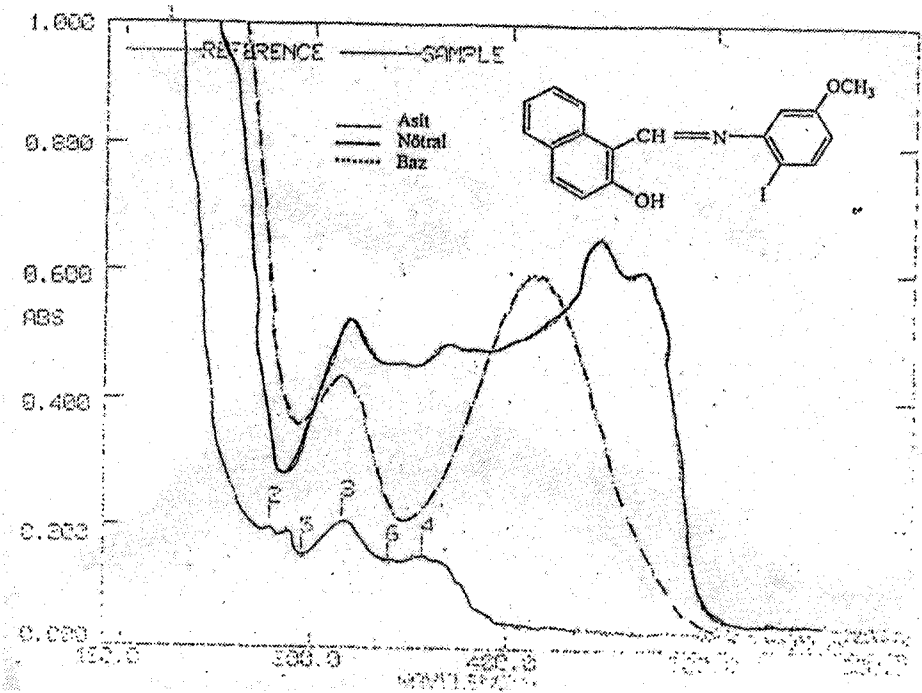


Figure 3 UV Spectrum (MeOH) of 1-(N-2'-iodo-meta-methoxyphenyliminomethyl)-2-Naphtol (2)

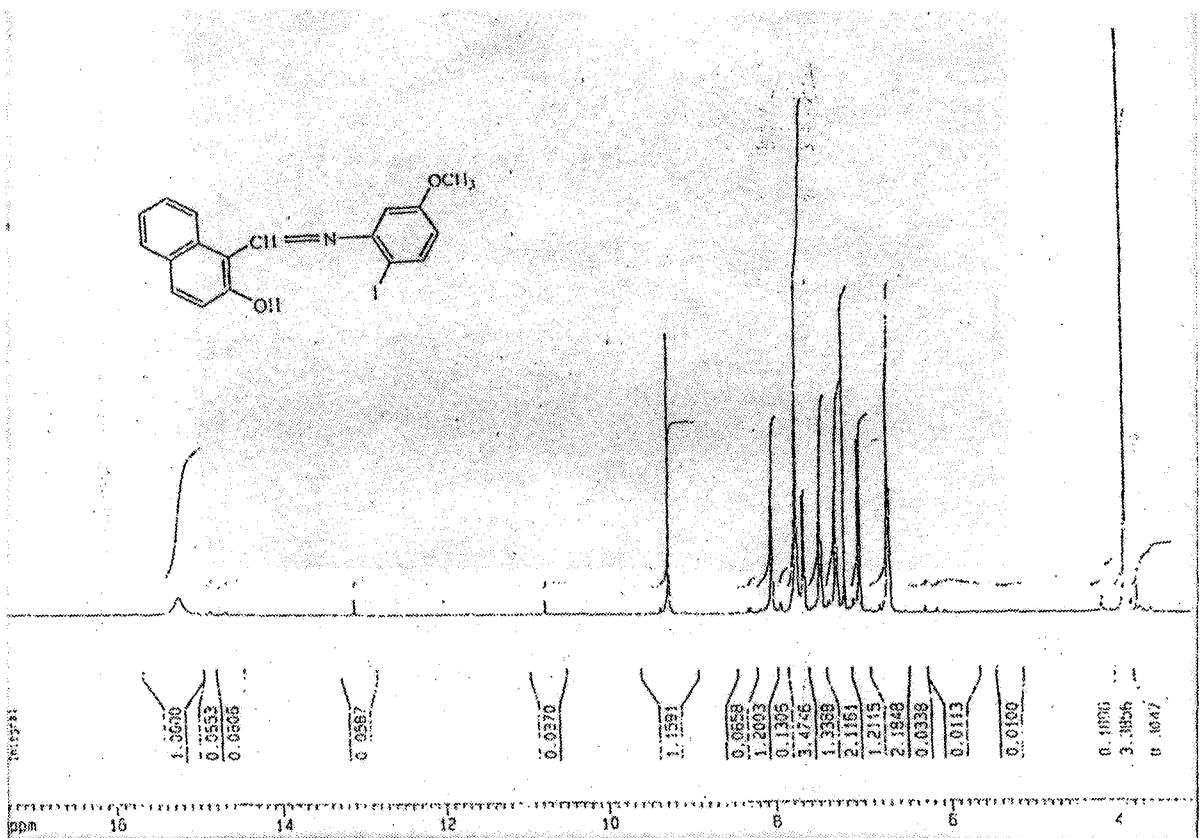


Figure 4 ¹H-NMR of 1-(N-2'-iodo-meta-methoxyphenyliminomethyl)-2-Naphtol (2)

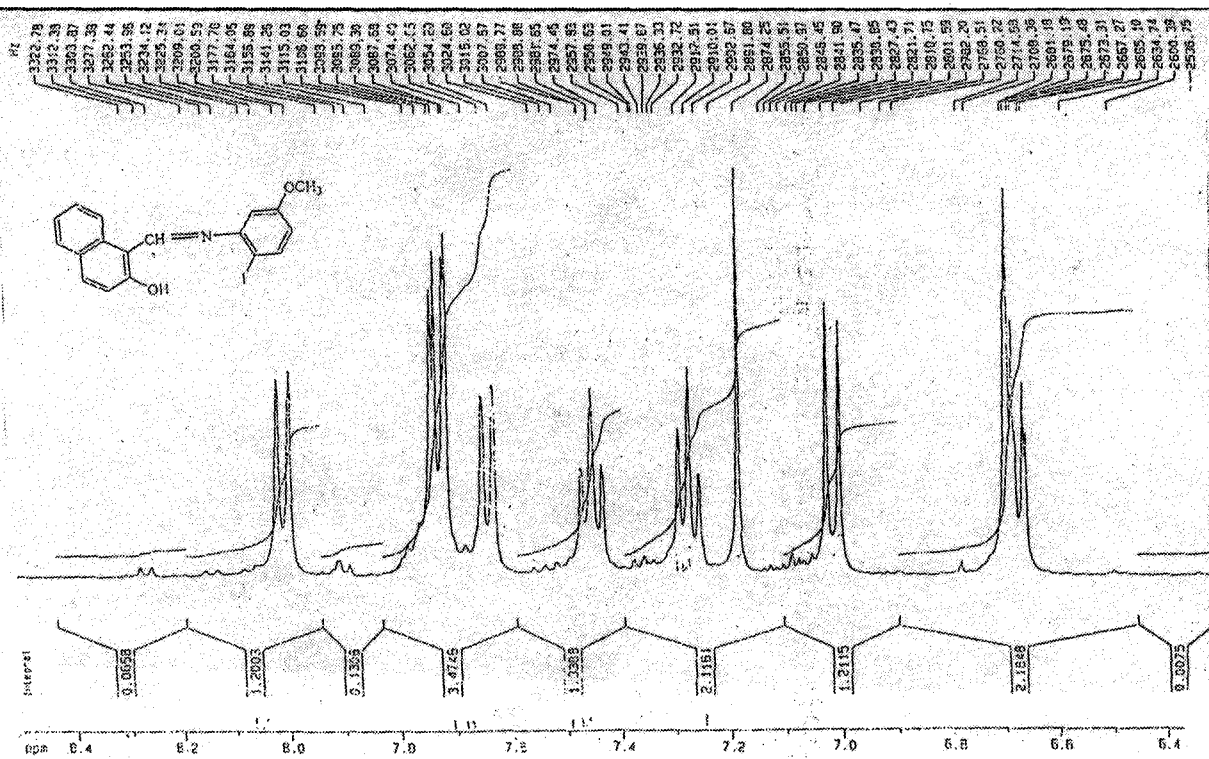


Figure 5 1H-NMR of 1-(N-2'-iodo-meta-methoxyphenyliminomethyl)-2-Naphtol (2) (In the extended NMR spectrum of this area)

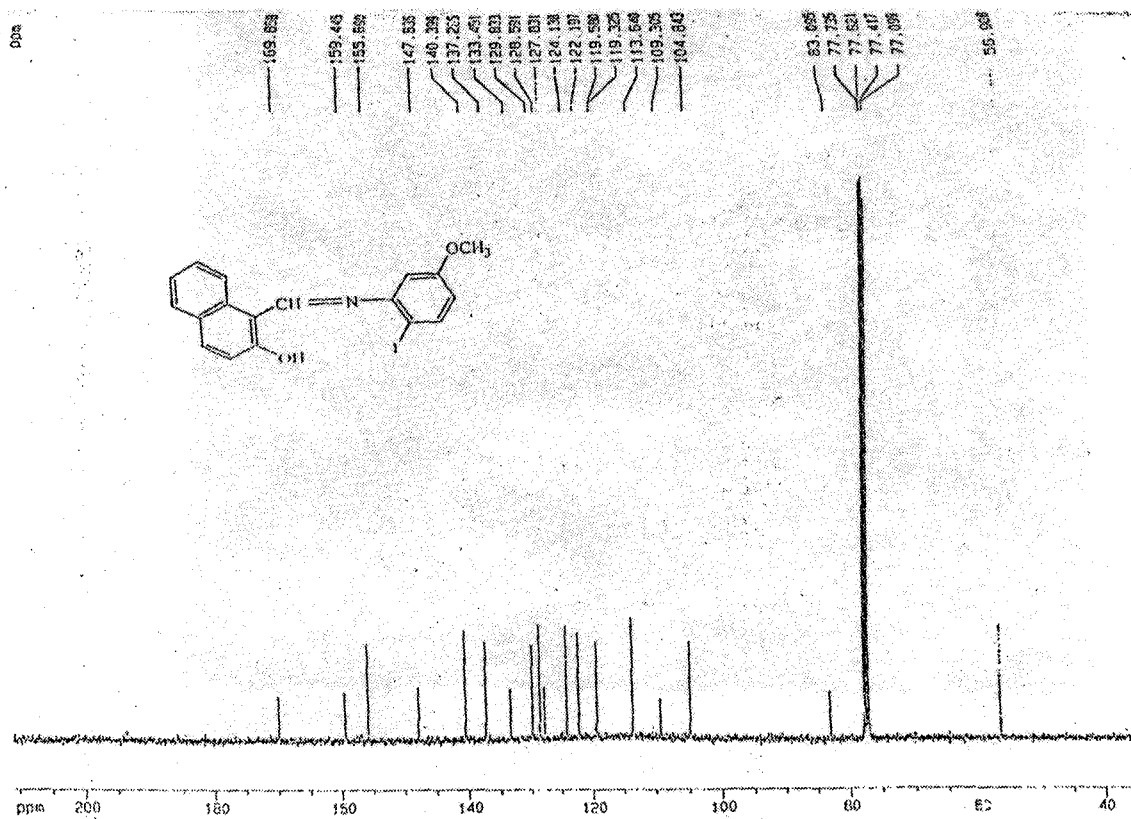


Figure 6 13C-NMR of 1-(N-2'-iodo-meta-methoxyphenyliminomethyl)-2-Naphtol (2)

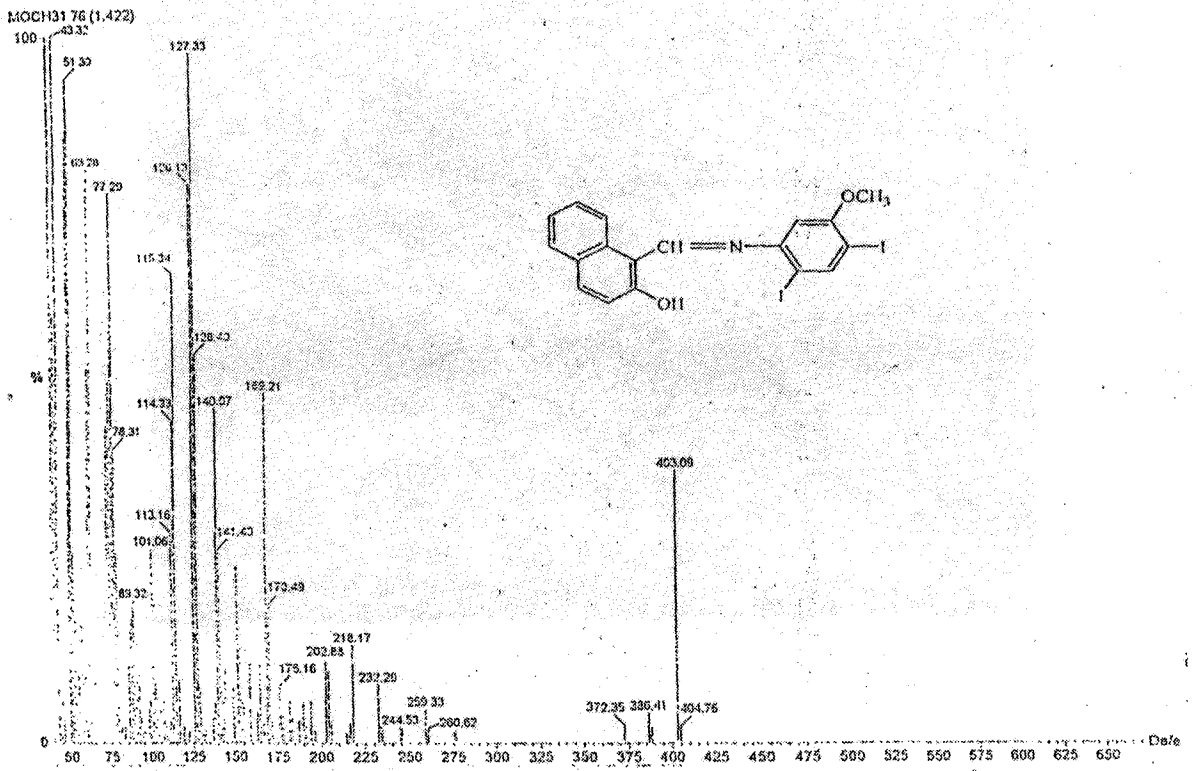


Figure 7 Mass Spectrum of 1-(N-2', 4'-diiodo-meta-methoxyphenyliminomethyl)-2-Naphtol (3)

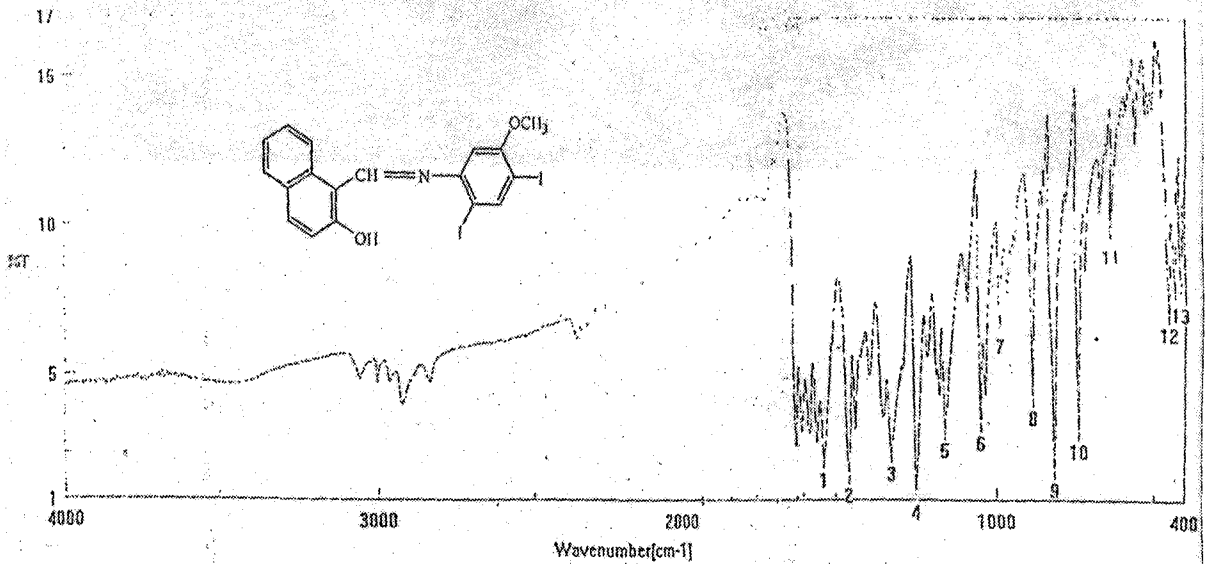


Figure 8 IR (KBr) Spectrum of 1-(N-2', 4'-diiodo-meta-methoxyphenyliminomethyl)-2-Naphtol (3)

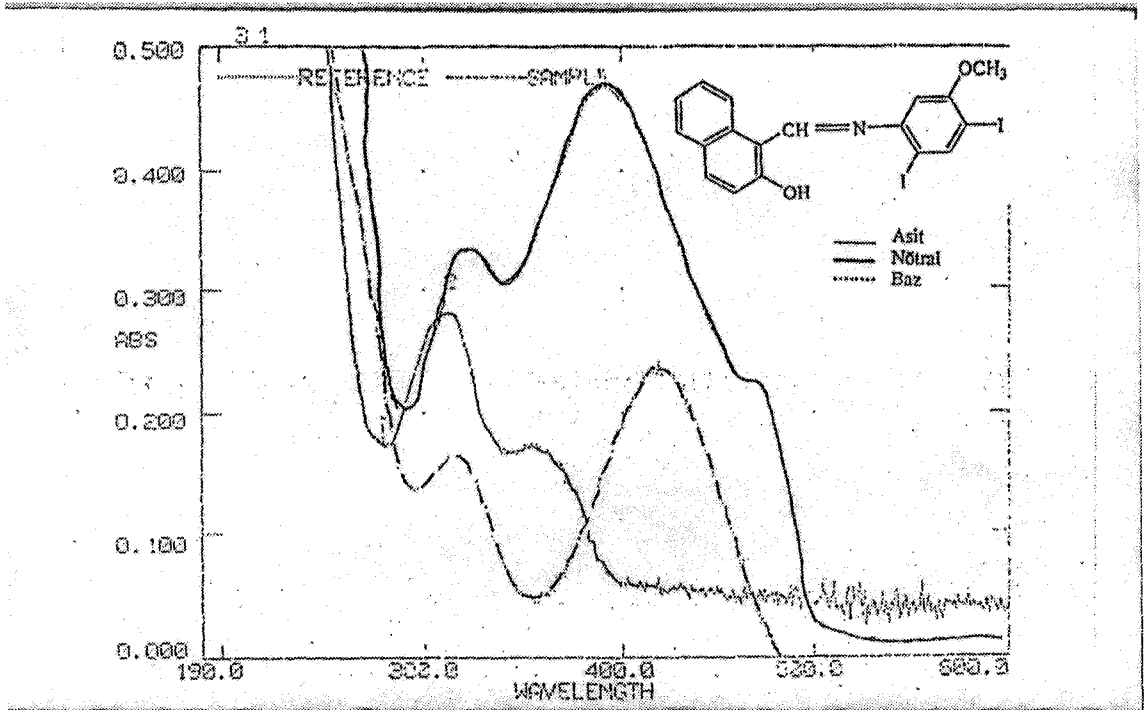


Figure 9 UV Spectrum (MeOH) of 1-(N-2', 4'-diiodo-meta-methoxyphenyliminomethyl)-2-Naphtol (3)

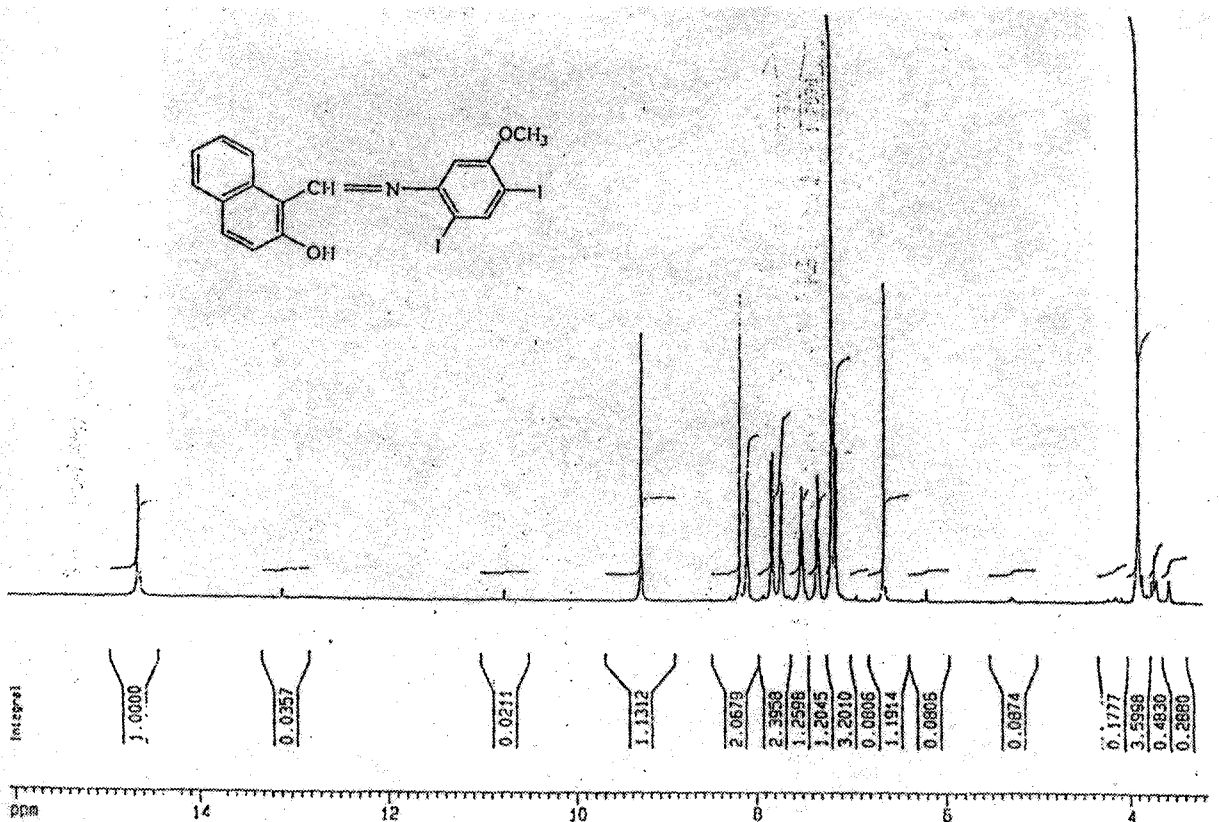


Figure 10 ¹H-NMR of 1-(N-2', 4'-diiodo-meta-methoxyphenyliminomethyl)-2-Naphtol (3)

