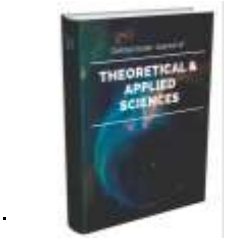

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Article

Synthesis and Characterization of New Some Imidazole's Derivatives as Antioxidants

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Abstract: This research focuses on the synthesis and characterization of two new imidazole derivatives: 2-methoxy-6-[4-(naphthalen-2-yl)-1-phenyl-1H-imidazol-2-yl] and 2-(4-methylphenyl)-4-(naphthalen-2-yl)-1-phenyl-1H-imidazole. The study aimed to explore their antioxidant properties using DPPH radical scavenging assays. The synthesis was achieved by heating a mixture of 2-bromo-2′-acetonaphthone, primary amine, aldehyde, and ammonium acetate in a solvent-free environment at 130°C. The characterization of the compounds was done using FT-IR, 1H-NMR, and mass spectral analysis. The antioxidant activity was evaluated, and both derivatives demonstrated significant radical scavenging properties, with the second compound showing higher inhibition. The results suggest that these imidazole derivatives are potent antioxidants, which could be beneficial for further medicinal applications.

Keywords: Imidazole, Antioxidant, Primary Amine, Aldehyde

1. Introduction

Imidazole ($C_3H_4N_2$) is the name given to cyclic chemical compounds containing N and a 5-membered ring structure (Figure 1).The molecule was classified as aromatic since it had electron pairs from four of the remaining ring atoms and from each of the protonated nitrogen atoms, making a total of five and six atoms (1–5). One of the most fundamental classes of substances with biological significance is the imidazole ring.Antimalarial, anticancer, anticonvulsant, and anti-inflammatory, for instance (6–9). Imidazole compounds have shown antioxidant qualities by their capability to scavenge free radicals using the DPPH technique or by lowering lipid peroxidation. The rich electron imidazole Among the substances that were tested, some showed notable antioxidant activity. These compounds may be primarily antioxidant active due to their ability to both chelate and scavenge free radicals (10–12).

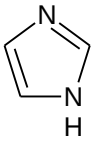

Figure 1 : Imidazole

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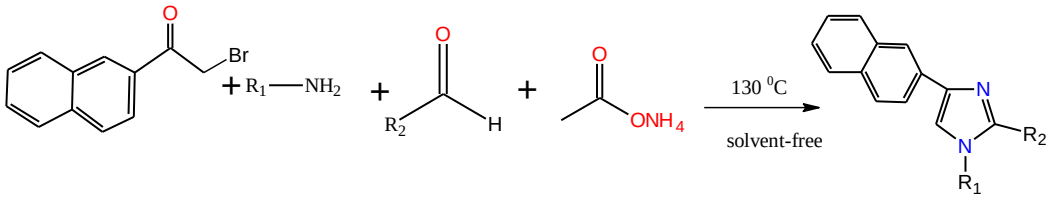
Experimental

Preparation of imidazole's derivatives (a,b) [15]

A new reaction was initiated by heating the mixture of 0.01 mol of 2-Bromo-2′-acetonaphthone, 0.01 mol of primary amine, 0.01 mol of aldehyde, and 0.0015 mol of ammonium acetate at 130 °C while mixing the four components without the use of solvents. in order to create imidazoles (Scheme 1). Reflux temperature is reached when the reaction is finished in ten hours.and by using ethylacetate:hexan (3:7) as an eluent to confirm the reaction, and recrystallized the derivatives of imidazole using an appropriate solvent.



Scheme 1

1-Synthesis of **2-(4-methylphenyl)-4-(naphthalen-2-yl)-1-phenyl-1*H*-imidazole (a)** (2.491gm, 0.01mol) 2-Bromo-2′-acetonaphthone with (1.2gm, 0.01mol) 4-Methylbenzaldehyde and (0.9ml, 0.01mol) anline m.p = (222-224), Rf (0.9) yield (72%.).

2- Synthesis of 2-methoxy-6-[4-(naphthalen-2-yl)2-yl-1H-imidazol-1-phenyl]phenol (b) (0.01mol, 2.491gm) 2-Acetonaphthone-2′-bromodiphenyl (1.52gm,0.01mol) O-vanillin and (0.9ml, 0.01mol) anline produce (75%) with m.p = (219-221) and Rf = (0.7).

2. Materials and Methods

Antioxidant activity

DPPH radical scavenging activity

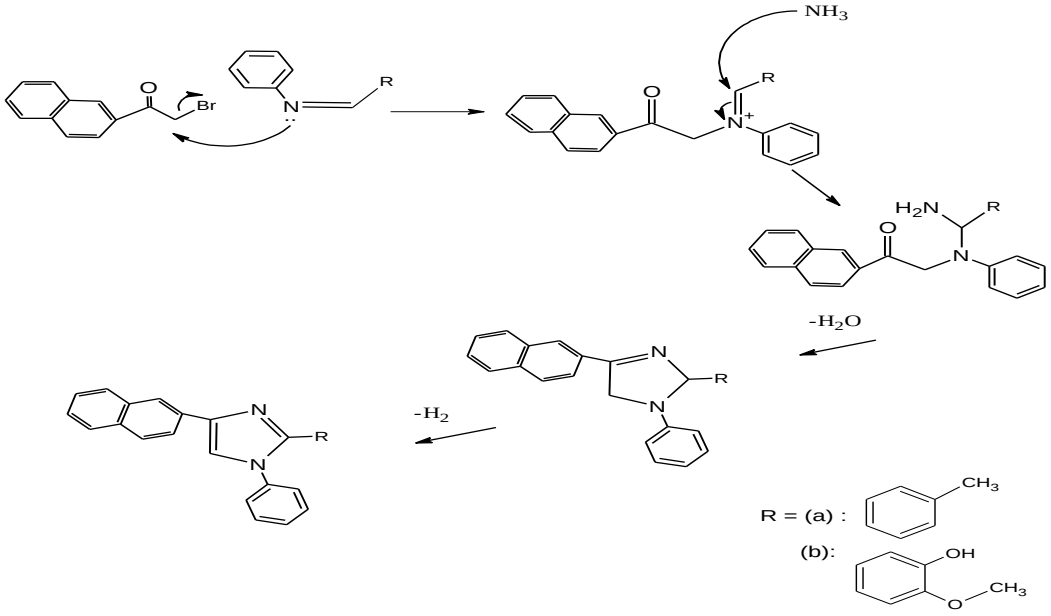
The techniques established by Chen and Ho [16] were used to calculate the scavenging effect on the DPPH radical. Each DHPM derivative and imidazole derivative were produced as ethanol solutions with concentrations of (0.1, 0.2, 0.3, and 0.4 mg/ml). Separate test tubes containing 2.7 ml of 40 ρg ml-1 methanolic solution of DPPH were filled with varying quantities (0.3 ml) of each ethanolic solution of DHPM derivatives. After giving the combinations a good shake, they were left in the dark for two hours, or until stable values were achieved. At 517 nm, the samples' absorbance was measured. The following formula was used to determine each sample's and standard's % DPPH radical scavenging activity:

% DPPH radical scavenging activity = [1-(At /A0)] x 100

where At denotes the sample's absorbance and Ao denotes the control's absorbance. Standards made use of ascorbic acid.

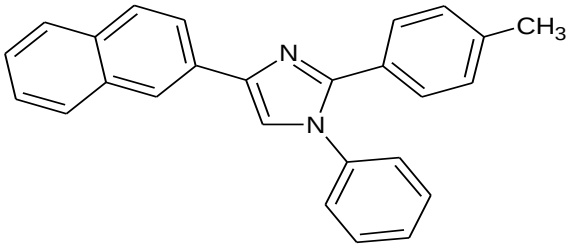
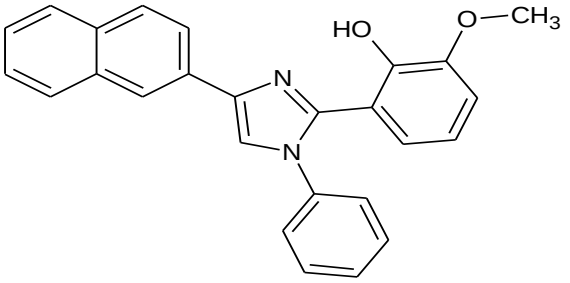
3. Results

Imidazole's derivatives (a,b) are prepared by condensation of the amine and aldehyde in the first step to form the imine intermediate, followed by the formation of the iminium intermediate. Then, the imine is added nucleophilically to 2-bromo-2-acetonaphthone to form the aminal intermediate. The dihydroimidazole intermediate, which may undergo air oxidation under the reaction conditions to create the functionalized imidazole as shown in scheme (1), would be produced by intramolecular condensation of the amine moiety with the neighboring carbonyl.



Secheme 2: Mechanism of synthesis imidazoles (a,b)

Table (1): Compounds' chemical structures

com.	Molecular Formula MW(g/mol)	Structural formula
a	**C26H20N2 360**	
b	**C26H20N2O2 392**	

1. IR data and bonding

The (a.b) infrared spectra of these compounds, which are represented by the representative and KBr disk spectra in Table (2), consist of five bands that are indicative of the aromatic, aliphatic, C=N, and C=C, C-N stretching vibrations. These bands occur in the following ranges, respectively: 3050-3120, 2900-2985, 1550-1650, 1475-1600, and 1000-1350 cm-1.

Table (2): FT-IR spectra of imidazoles

Com.	Aromatic C-H stretching cm-1	Aliphatic C-H stretching cm-1	C=N stretching cm-1	C=C stretching cm-1	C-N stretching cm-1
a	3047	2978	1612	1590	1357
b	3055	2846	1604	1465	1365

2. ^{1}H-NMR spectral analysis

The synthesized imidazoles' 1H-NMR was recorded using a 500 MHz NMR spectrophotometer (Bruker) using TMS (tetramethylsilane) as an internal reference standard in DMSO-d6 and chloroform solvents. The NMR spectra's number of detected protons and their chemical shift (δ ppm) matched the structure of the molecule.

The 1-H-NMR spectra of 2-(4-methylphenyl)-4-(naphthalen-2-yl)-1-phenyl-1H-imidazole (a) showed that the solvents, d6-DMSO and HDO, had singlet peaks at chemical shifts δ (2.50 ppm and δ, respectively (3.38 ppm). It also showed many peaks for aromatic protons at chemical shift δ (7.37-7.91ppm) and a singlet signal for two protons (C5-H imidazole) at chemical shift δ (8.89ppm).

2-methoxy-6-[4-(naphthalen-2-yl)-1-phenyl-1H-imidazol-2-yl]phenol (b) showed two singlet peaks in its 1-H-NMR spectra: one at chemical shift δ (7.25 ppm) for the chloroform solvent and another at chemical shift δ (2.46 ppm) for the methyl group. Furthermore, it showed many peaks for aromatic protons at chemical shift δ(6.89-7.52ppm) and a singlet peak for two protons for (C5-H imidazole) at chemical shift δ (8.66ppm).Moreover, a hydroxyl group singlet signal at chemical shift δ (14.04 ppm) is seen [19].

3. Mass spectral analysis

Schemes (4) and (5) illustrate how the molecular weight of imidazoles and the molecular ion peak agreed with one other.

4. Antioxidant

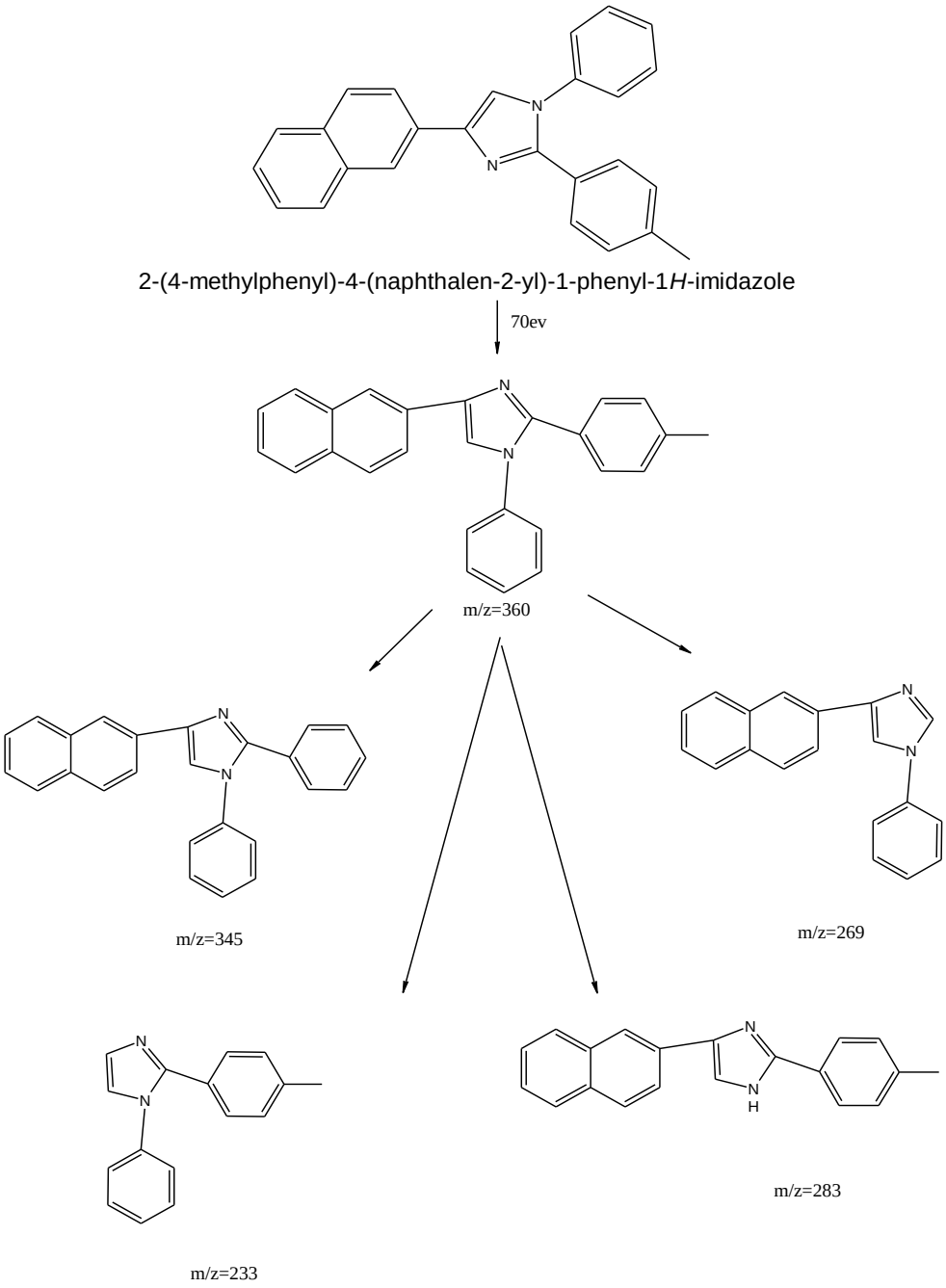
One of the best-known methods for assessing antioxidant activity is free radical scavenging. By giving hydrogen atoms or electrons to the DPPH molecule via a free radical assault, the antioxidant molecules neutralize DPPH-free radicals and transform them into yellow-colored diphenylpicryl hydrazine [17,18], which lowers absorbance at 517 nm. The outcomes are listed in Tables (3). Compound 2 was shown to be the most efficient antioxidant, with the other compounds exhibiting increased activity [20].

Table (3): values of inhibition of compounds

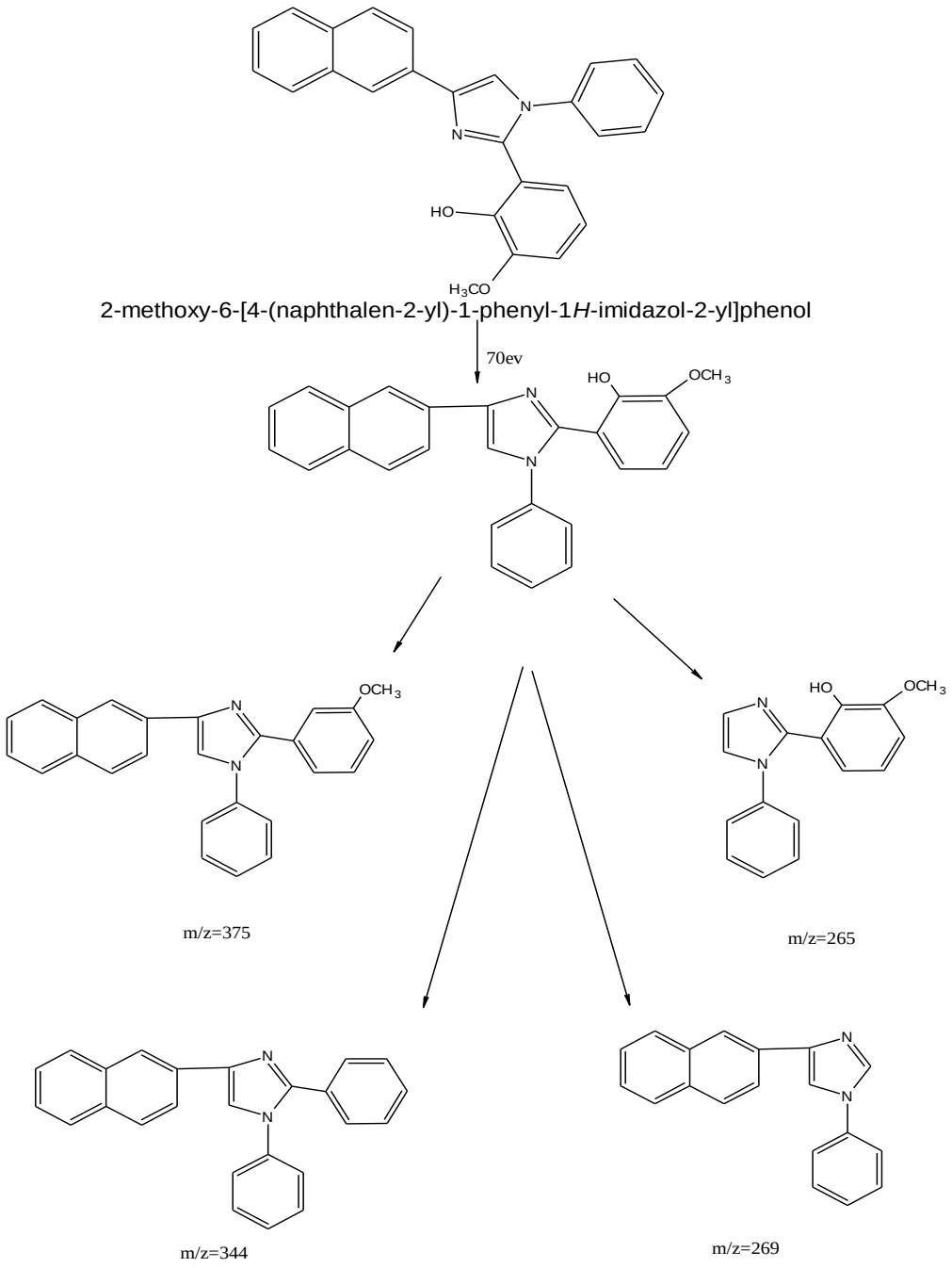
Con.	DPPH inhibition %		Ascorbic acid
	1	2	
0.2	90.31	94.56	54.14
0.3	96.12	95.99	60.02
0.4	97.02	97.26	71.52

4. Conclusion

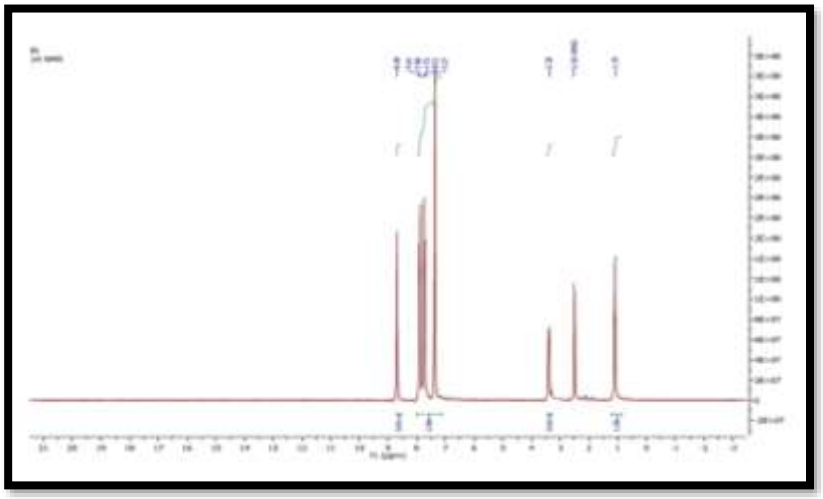
In this study Prepared two **imidazole's** derivatives**(a,b)** and showed that the prepared compounds are highly effective as antioxidants**.**



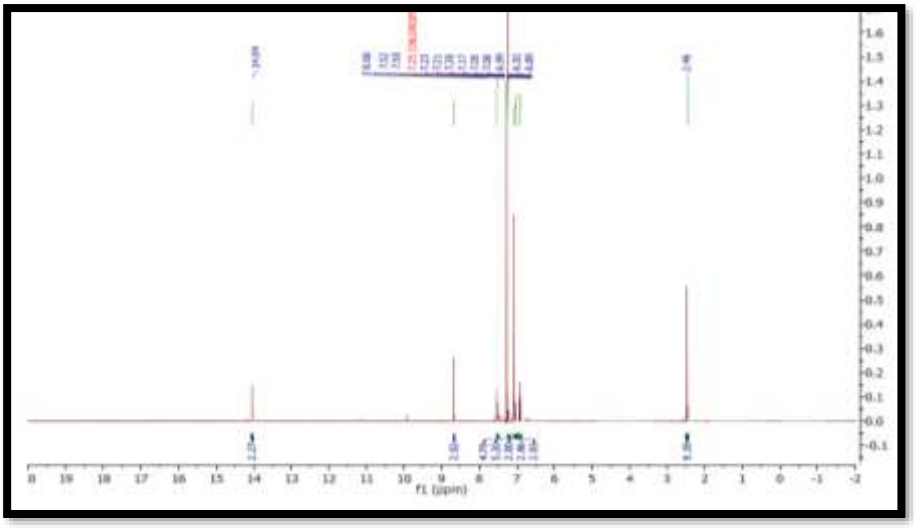
Secheme 3


2-methoxy-6-[4-(naphthalen-2-yl)-1-phenyl-1H-imidazol-2-yl]phenol
70ev
m/z=375
m/z=265
m/z=344
m/z=269

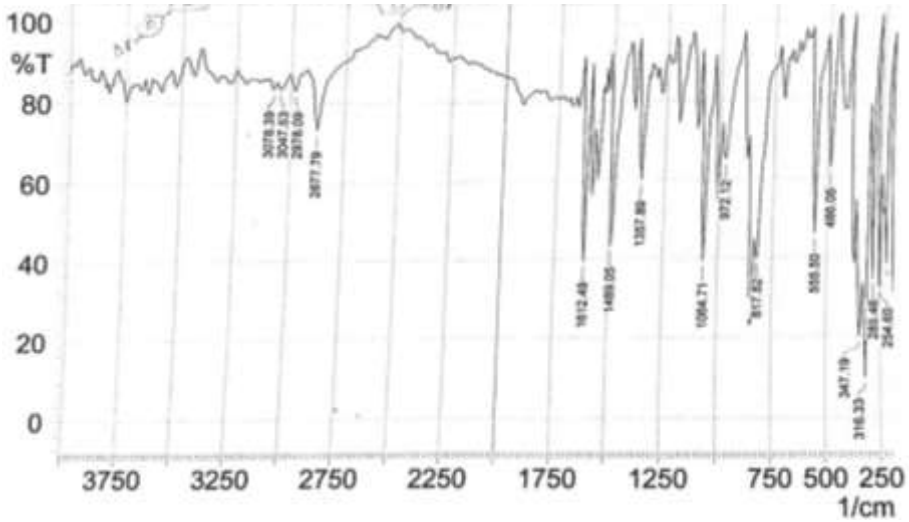
Secheme 4



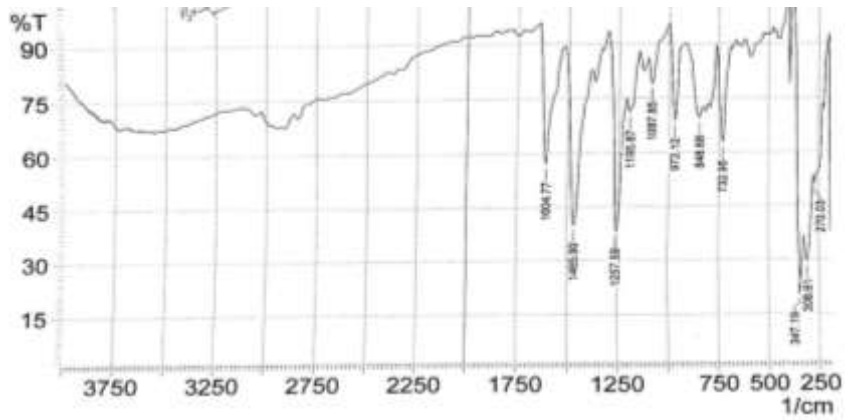
Figure(1): 2-(4-methylphenyl) 1H-NMR spectra1-phenyl-4-(naphthalen-2-yl)-1H-imidazole **(a)**



Figure(2): 2-methoxy-1H-NMR spectra-6-[1-phenyl-1H-imidazol-2-yl]-4-(naphthalen-2-yl)phenol **(b)**



Figure(3): The 2-(4-methylphenyl) IR spectrum1-phenyl-4-(naphthalen-2-yl)-1H-imidazole **(a)**



Figure(4): 2-methoxy-6-[4-(naphthalen-2-yl)] IR spectra2-yl-1H-imidazol-1-phenyl]phenol **(b)**

REFERENCES

1. Poonam G. and Jitendra K. *Inter J M Chem,* **2015,**7(2): 60-80
2. Auhood Kadhim Zaid , Synthesis, Characterization, and Computational Study of Novel Thiazolidinone Derivatives Containing the Indole, *Journal of Medicinal and Chemical Sciences Vol. 6, Issue 2 , 2023, Pages 346-354* http://dx.doi.org/10.26655/JMCHEMSCI.2023.2.15
3. Delia H, Víctor E, Torres H, Oscar G, Elizabeth M , Esmeralda S, *J Chem Bio* , **2014**, 2, 45- 83.
4. Auhood Kadhim Zaid, Synthesis, Characterization, and Computational, Biological Studies of Four-membered Cyclic Amides 2- azetinones, *Journal of Chemical Health Risks* (2022) 12(4), 665-674
5. Rafid Ryyis Arraq; Angham G. Hadi, Synthesis, Identification, and Anti-oxidant Activity of Di-Organotin (IV) Cephalexin Complexes, *Journal of Medicinal and Chemical Sciences,Volume 6, Issue 2 , February 2023, Pages 392-401* http://dx.doi.org/10.26655/JMCHEMSCI.2023.2.19
6. Adhraa Ghazi Abdulrazzaq; Abbas Ali Salih Al-Hamdani, Some Metal Ions Complexes With Azo [4-((8-hydroxyquinolin-7-yl)-N(4-methylisoxazol-3-yl)benzenesulfonamide] Synthesis, Characterization, Thermal Study and Antioxidant Activity, *Journal of Medicinal and Chemical Sciences,Volume 6, Issue 2 , 2023, Pages 236-249,*http://dx.doi.org/10.26655/JMCHEMSCI.2023.2.7
7. Fujioka, H.; Murai, K.; Ohba, Y.; Hiramastu, A.; Kita, Y. *Tetrahedron Lett*, **2005**, 46(13): 2197-2199.
8. Hayal M.Y., Magtoof M.S., Synthesis, Characterization of some New 4-Thiazolidinone of Acenaphthoquinone, *University of Thi-Qar Journal of Science*, 2021, **8**:76
9. Amita V, Sunil J, and Deepika S, *J Chem* , **2013**, 329412, 12 pages.
10. Zainab Amer Salla , *University of Thi-Qar journal of science*, 2020,vol7(2):87-89.
11. Vijesh A.M., Isloor A.M., Telkar S.,.Peethambar S.K, Rai S., and Isloor N., *Euro J Medl Chem*, **2011** ,. 46, no. 8, pp.3531–3536,
12. Singh BK, Mishra M, Saxenaa N, Yadav GP, Maulik PR, Sahoo MK,Gaur
13. RL, Murthy PK, Tripathi RP ,*Eur J Med Chem*,**2008**, 43:2717–2723
14. Sorrenti V., Salerno L., Di Giacomo C., Acquaviva R., Siracusa M.A., Vanella A. , *Nitric Oxide* , **2006**,14: 45–50
15. Ali A. Abbas; Zainab N. Mageed; Olfat A. Nief; Hamid H. Mohammed, Synthesis and Characterization of Schiff Bases Derived from 3-(4-methoxyphenyl) Acrylic Acid and 3-(Benzo[d][1,3]dioxol-5-yl) Acrylic Acid, *Journal of Medicinal and Chemical Sciences,Volume 6, Issue 2 , February 2023, Pages 205-219* http://dx.doi.org/10.26655/JMCHEMSCI.2023.2.4
16. Chen CW, Ho CT ,*J Agric Food Chem,* **1995**, 2:35–46
17. Jain A. K., Ravichandran V., Sisodiya M., and Agrawal R. K. *Asian Pacific J Trop Med*, **2010**, 3, no. 6, pp. 471–474,.
18. Mehdi A. ; Samira A.; , Shahzad F.; Jafar A. D.; Peiman M. *SYNLETT*, **2009**, No. 20, pp 3263–3266
19. A. A. Abdelhamid, "Synthesis of imidazole derivatives: Ester and hydrazide compounds with antioxidant activity using ionic liquid as an efficient catalyst," *J Heterocycl Chem*, vol. 57, no. 2, pp. 676–685, 2020, doi: 10.1002/jhet.3808.
20. E. Noriega-Iribe, "In vitro and in silico screening of 2,4,5-Trisubstituted imidazole derivatives as potential xanthine oxidase and acetylcholinesterase inhibitors, antioxidant, and antiproliferative agents," *Applied Sciences (Switzerland)*, vol. 10, no. 8, 2020, doi: 10.3390/APP10082889.