Antioxidant Properties of Some new Synthesized Shciff Bases Derived from 1, 2, 4- Triazole Ring

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1. Abstract

Some Schiff' bases were derived from triazole ring which have the name (4-1,2,4-triazole-2-yl-diazenyl)-1-(substituted benzylideneamino) benzene .

They were prepared through the reaction of N-amino triazole, a mixture of (HCl and $NaNO_2$) and aniline . The product was reacted with series aromatic aldehydes to form Schiff' bases, the final products were identified by the available spectroscopic methods and tested their activity as antioxidants by using some chemical indicators.

2. Introduction:

The triazole derivatives related to an important group of heterocyclic compounds that have been subjected to extensive study of the recent past. Diverse biological activities such as antibacterial, antifungal, anti-inflammatory, associated with 1,2,4-triazole derivatives [1–5] .

1,2,4-triazole nucleus shows a wide range of pharmacological activities such as antibacterial [6] , antifungal [7] , anti-inflammatory[8] , and antioxidant[9] . A series of 1,2,4 derivatives have been patented and extensively employed in agriculture [10] . Many workers have reported of organic compounds containing triazole ring [11,12] . As well as A. Hussain et al [13] reported many compounds with triazole ring. Furthermore, Rou'll [14] synthesized and characterized of some new series of compound, polymer containing 1,2,4 triazole unit . Meanwhile, antioxidant effect [15,16] . The aim of the current study is to synthesis new derivatives of those heterocyclic compounds derived from 1,2,4 triazoles with azo group and investigate their antioxidant properties triazoles having azo group have been triazole synthesized and their structures were characterized by 1H-NMR,IR spectroscopy.The potential antioxidant of the synthesized compounds was also investigated .

3. Experimental and Methods:

3.1. Materials:

Most of chemicals used were supplied from Fluka and BDH chemicals co. from Fluka and BDH chemicals co. and used without further purification.

3.2. Techniques:

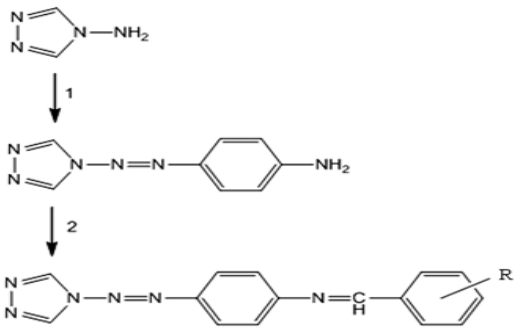
Uncorrected melting points were determined by using an electrothermal melting point apparatus. The F.T.IR spectral data were recorded on F.T.IR-8300 Fourier Transform Infrared Spectrophotometer *SHIMADZU* using potassium bromide disc. Double-beam UV-VISIBLE spectrophotometer (UV 1650 CP),NMR *SHIMADZU* was used to measure the absorbance of the prepared compounds. Melting points(C^o)were recorded on hot stage Gallen kamp melting point apparatus and were uncorrected.

The chemical names follow the IUPAC nomenclature. Some starting materilals were purchased from (Kunshan Yalong trading Co.,LTD),E-mail:sales@yalong china.netand were used without purification.

4.1. Synthesis: 4-(1,2,4-triazol-2-yl-diazenyl) aniline:

The reaction pathway used to prepare compounds (1–11) are show in Scheme (1).

N-Amino triazole (0.02 mole) was dissolved in slightly acidified distilled water, to it a mixture of (HCl and $NaNO_2$) (0.02 mole) was added and the reaction was occupied in ice bath, then aniline (0.01 mole) was added, a bright yellow precipitate was formed and filtered and characterized using H^1-NMR spectroscopy and shows an absorption peak at around (6.6- 6.8) ppm related to proton within the triazole ring, and (8.4-8.9) ppm for the protons of benzene ring and 8.5 for the proton of the (N=CH-) group.



[1] **R= H**
[2] **R= *p*-Cl**
[3] **R= *p*-Br**
[4] **R= *p*-OCH_3**
[5] **R= *p*-NO_2**
[6] **R= *p*-OH**
[7] **R= *m*-Cl**
[8] **R= *m*-Br**
[9] **R= *m*-OCH_3**
[10] **R= *m*-NO_2**
[11] **R= *m*-OH**

Scheme (1)

4.2. 1- (1, 2, 4- triazol- 2- yl- diazenyl) -4- (substituted benzylideneamino) benzene:[2]

4-(1,2,4-triazol-2-yl-diazenyl) aniline (0.02 mole) was dissolved in refluxed absolute ethanol (50 ml), benzaldehyde (0.02 mole) was slowly added to the refluxed mixture, the net mixture was refluxed for (9 hrs.) with stirring, the reflux was completed for another two hours until no more precipitate formed, after cooling to room temperature the mixture was filtered and the precipitate was dried and recrystallized from ethanol, the percentage yield was (72%), the melting point of the target molecule (1) was measured and found to be (198-200 ^{o}C). The same reaction was carried out to different substituted benzaldehydes (R: *p*-Cl, *p*-Br, *p*-OCH_3, *p*-NO_2, *p*-OH, *m*-Cl, *m*-Br, *m*-OCH_3, *m*-NO_2, *m*-OH). The F.T.IR (KBr cm^{-1}) spectral data (stretching vibrations) and the physical properties of the compounds (1 - 11) are shown in Table (2-1) and (2-2) respectively.

Table (2-1): The F.T.IR (KBr cm^{-1}) spectral data (stretching vibrations) for the compounds (1 – 11) .

R	Com.	O-H	C-H aromatic	C-H aliphatic	C=N
H	1	-	3078		1640
p-Cl	2	-	3112		1620
p-Br	3	-	3120		1630
p-OCH_3	4	-	3150	2987-3000	1660
p-NO_2	5	-	3112		1620
p-OH	6	3320	3050		1667
m-Cl	7	-	3035-3070		1620
m-Br	8	-	3100		1612
m-OCH_3	9	-	3130		1615
m-NO_2	10	-	3100		1655
m-OH	11	3350	3150		1640

Table (2-2): The physical properties of the compounds (1 - 11).

G	Com.	M.P.(^{o}C)	% Yield	IUPAC Name
H	1	198-200	72	1-(1,2,4-triazol-2-yl-diazenyl)-4-(benzylideneamino) benzene
p-Cl	2	188	80	1-(1,2,4-triazol-2-yl-diazenyl)-4-(4-chloro benzylideneamino) benzene
p-Br	3	200	66	1-(1,2,4-triazol-2-yl-diazenyl)-4-(4-bromo benzylideneamino) benzene
p-OCH_3	4	194	77	1-(1,2,4-triazol-2-yl-diazenyl)-4-(4-methoxy benzylideneamino) benzene
p-NO_2	5	180	78	1-(1,2,4-triazol-2-yl-diazenyl)-4-(4-nitro benzylideneamino) benzene
p-OH	6	200	76	1-(1,2,4-triazol-2-yl-diazenyl)-4-(4-hydroxy benzylideneamino) benzene

m-Cl	7	198	77	1-(1,2,4-triazol-2-yl-diazenyl)-4-(3-chloro benzylideneamino) benzene
m-Br	8	200	73	1-(1,2,4-triazol-2-yl-diazenyl)-4-(3-bromo benzylideneamino) benzene
m-OCH_3	9	182	70	1-(1,2,4-triazol-2-yl-diazenyl)-4-(3-methoxy benzylideneamino) benzene
m-NO_2	10	200	66	1-(1,2,4-triazol-2-yl-diazenyl)-4-(3-nitro benzylideneamino) benzene
m-OH	11	196	80	1-(1,2,4-triazol-2-yl-diazenyl)-4-(3-hydroxy benzylideneamino) benzene

4.3 reducing activity, Ferric ion (Fe^{+3}) antioxidant properties:

The antioxidant properties of the prepared compounds containing -triazole ring to reduce (Fe^{+3} to Fe^{+2}) were measured by using ferrozine [17]. The reduction of (Fe^{+3}) by tetrazole ring was studied at pH 5.5, due to low solubility of iron at physiological pH, the reaction mixture contained 50 mM sodium acetate buffer (pH 5.5). 1 mM ferrozine, 50, 100 μM of tested compounds and 100 μM of $Fe(NO_3)_3$.

The reaction was started by the addition of $Fe(NO_3)_3$ and the increase of absorbance at 562 nm after 3 minutes was recorded, Fe^{+2} concentration was determined by using an extinction coefficient for $Fe(ferrozine)_3^{+2}$ complex which is equal to 27.9×10^3 M^{-1} $.cm^{-1}$ [18].

4.4. (reducing activity) Copper ion (Cu^{+2}) antioxidant properties:

The antioxidant properties of the prepared compounds containing -triazole ring to reduce (Cu^{+2} to Cu^{+1}) were measured by using 2,9-dimethyl-1,10-phenanthroline (neocuproine) [19], an indicator molecule that binds specifically to the reduced form of copper (Cu^{+1} but no the oxidized form Cu^{+2}) [20]. The reaction mixture contained (20 mM) KH_2PO_4/KOH buffer (pH 7.4), 200μM $Cu(NO_3)_2$, 600 μM 2,9-dimethyl-1,10-phenanthroline, 50, 100μM of the tested compounds.

The mixtures were incubated at room temperature for 120 minutes and then the absorbances were recorded at 455 nm. The copper concentration was determined by using an extinction coefficient for $Cu(neocuproine)_2^{+1}$ complex which is 7.2×10^3 mM^{-1} $.cm^{-1}$ [19].

4. Results and Discussion:

The synthesis of N-(substituted benzylidene)-2-amino -triazole was achieved by the reaction of 2-amino -triazole with benzaldehyde and substituted benzaldehydes to form the target molecules (1-11).

The authenticity of the product was confirmed by spectral data (F.T.IR) shown in Table (2-1). The antioxidant properties of the prepared

compounds are assessed by the extent of conversion of the Fe^{+3} and Cu^{+2} to the reduced form Fe^{+2} and Cu^{+1}).

The antioxidant properties of the compounds were studied at different concentrations. The antioxidant activity of putative antioxidant has been attributed to various mechanisms, among which are prevention chain initiation, binding of transition metal ion catalyst, decomposition of peroxides, prevention of continued hydrogen abstraction, reductive capacity and radical scavenging [21].

triazole (1-11) studied show higher reducing capacity for copper ions than for iron ions, this can be attributed to the standard reduction and oxidation potentials of the metals, the standard reduction potential of the Cu^{+2}/Cu^{+1} (0.15 V) which is much lower than that for Fe^{+3}/Fe^{+2} (0.77 V). Tables (3-1) and (3-2) show the antioxidant properties of compounds (1-11).

Note the standard deviation (SD) referred to (±) of at least three independent experiments was calculated and showed in the results.

Table (3-1): The antioxidant properties of compounds (1-11) against Fe^{+2}.

µmole Fe^{+2}/µmole triazole			
Compd.	**R**	**50 µM**	**100 µM**
1	H	0.0031±0.001	0.0450±0.001
2	*p*-Cl	0.0018±0.002	0.0029±0.001
3	*p*-Br	0.0039±0.001	0.0060±0.001
4	*p*-OCH_3	0.0059±0.001	0.0079±0.000
5	*p*-NO_2	0.0031±0.001	0.0056±0.001
6	*p*-OH	0.0251±0.001	0.0579±0.001
7	*m*-Cl	0.0011±0.002	0.0025±0.001
8	*m*-Br	0.0022±0.001	0.0051±0.001
9	*m*-OCH_3	0.0030±0.001	0.0048±0.002
10	*m*-NO_2	0.0019±0.001	0.0033±0.001
11	*m*-OH	0.0120±0.001	0.0175±0.001

Table (3-2): The antioxidant properties of compounds 1-11) against Cu^{+1}.

µmole Cu^{+1}/µmole triazole			
Compd.	**R**	**50 µM**	**100 µM**
1	H	0.20±0.001	0.42±0.001
2	*p*-Cl	0.30±0.000	0.66±0.001
3	*p*-Br	0.33±0.001	0.53±0.001
4	*p*-OCH_3	0.48±0.002	0.82±0.002
5	*p*-NO_2	0.42±0.001	0.75±0.002

6	*p*-OH	0.78±0.001	0.97±0.001
7	*m*-Cl	0.32±0.001	0.58±0.001
8	*m*-Br	0.39±0.002	0.62±0.001
9	*m*-OCH_3	0.40±0.002	0.71±0.000
10	*m*-NO_2	0.36±0.001	0.46±0.001
11	*m*-OH	0.69±0.001	0.82±0.001

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تحضير مضادات الاكسدة من بعض قواعد شف المشتقة من حلقة الترايوزول ١،٢،٤

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الخلاصة

تم تحضير بعض قواعد شف المشتقة حلقة الترايازول والمركبات المحضرة تحمل الاسم (substituted)-1-(4-1,2,4-triazole-2-yl-diazenyl) benzylideneamino) benzene 2-aminote (حيث تم تحضيرها من خلال مفاعلة triazole) مع حامض الهيدروكلوريك ونتريت الصوديوم ثم مفاعلة الناتج مع الأنلين, المركب الناتج تم تفاعله مع عدة الديهايدات أروماتية لتكوين قواعد شف . والمركبات المحضرة تم تشخيصها واختبار فعاليتها كمضادات للأكسدة باستخدام بعض الكواشف الكيميائية .