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One-Pot Four-Component Synthesis, Spectral Characterization and Free Radical Scavenging Ability Evaluation of Napthyl - Aryl Substituted Imidazole

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***Abstract*: Free radical scavenging is one of the best known mechanisms and offer rapid techniques for screening the radical scavenging activity of specific compounds. Antioxidant activity is governed by the following method such as DPPH, TBA, superoxide radical scavenging, hydroxyl radical scavenging, nitric oxide radical scavenging, etc. It is revealed from the literature that a very little attention has been given to the antioxidant activity of hetero-aromatic imidazole compound. In view of this observation synthesis and evaluation of antioxidant activity of variously substituted imidazoles are considered relevant. Therefore, the present study is focused on the synthesis of napthyl- aryl substituted imidazole and its evaluation for the ability to scavenge free radicals. Equimolar solutions of benzil, dimethyl aniline and napthaldehyde are refluxed in the presence of ammonium chloride for 2 hours and the product formed was spectrally analyzed. The free radical scavenging ability of the synthesized compound was evaluated against nitric oxide free radical as well hydroxyl free radical.**

***Keywords*: Spectral Characterization, Free Radical Scavenging Napthyl - Aryl**

1. Introduction

Free radical scavenging is one of the best known mechanisms and offer rapid techniques for screening the radical scavenging activity of specific compounds. Antioxidant activity is governed by the following method such as DPPH, ABTS, superoxide radical scavenging, hydroxyl radical scavenging, nitric oxide radical scavenging, etc. It is revealed from the literature that a very little attention has been given to the antioxidant activity of hetero-aromatic imidazole compound. The free radicals and reactive oxygen species cause an phenomena called oxidative stress and that plays a decisive role in the development of various diseases, chronicle and degenerative cancer atherosclerosis, arthritis, viral infection stroke, myocardial infarction, pulmonary condition, inflammatory bowel disease, neurogenerative disease

Development of new multi-component reactions, in particular for the synthesis of polysubstituted imidazoles is an important area of research in medicinal chemistry. The imidazoles exhibit a wide spectrum of biological activities The substituted imidazoles are present in many biological systems and drug molecules such as olmesartan, medoxomil, losartan, eprosartan and trifenagre In view of this observation synthesis and evaluation of antioxidant activity of variously substituted imidazoles are considered relevant. Such imidazoles are generally synthesized by a four-component condensation of aldehyde, 1,2-diketone, amine and ammonium acetate. This paper describes the synthesis of substituted imidazole derivatives and evaluating its anti-oxidant characteristics.

2. Experimental

A. Synthesis of compound

A mixture of benzil (1 mmol), substituted amine (1 mmol), aryl aldehyde (1 mmol), ammonium acetate (1 mmol) in glacial acetic acid was heated at 60°C under stirring for 2 h. The progress of the reaction was monitored by thin-layer chromatography (TLC). After the completion of the reaction, the mixture was cooled to room temperature, poured into cold water and the resultant precipitate was filtered by suction. An analytically pure compound was obtained by crystallization from ethanol/water.

3. Results and discussion

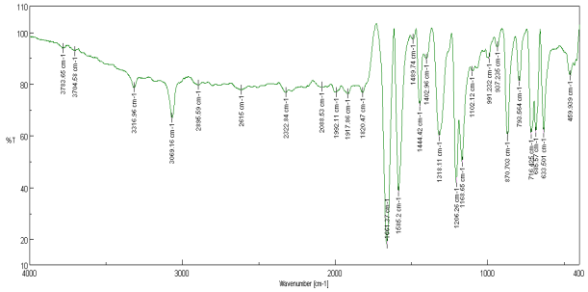
Substituted imidazoles are synthesized by three component reaction between benzil, dimethyl aniline and napthaldehyde are refluxed in the presence of ammonium chloride for 2 hourswithout a catalyst, in solvent free condition.

2-(4-methyl phenyl)-1-(3- napthyl)-4,5-diphenyl-1H-imidazole

Yield 89%; mp >350°C; 1H NMR (400 MHz, CDCl3): δ 7.08–7.60 (m, 17H), 1.90 (s, 3H); ^{13}C NMR (100 MHz, CDCl3): δ 145.7, 138.8, 137.4, 135.8, 135.0, 134.1, 131.5, 131.2, 130.7, 130.2, 130.1, 129.5, 129.3, 128.5, 128.4, 128.2, 127.9, 127.3, 127.0, 126.9, 122.9, 15.3; FT-IR: 3064, 1366, 742, 694 cm^{-1}.

The free radical scavenging activity of the synthesized

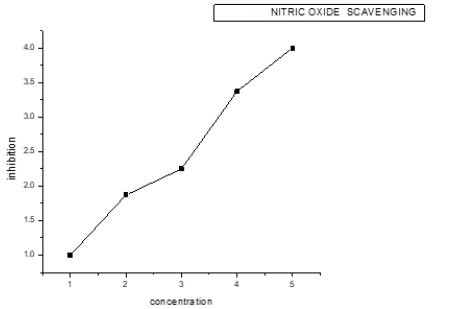
substituted imidazole derivatives arise either from phenolic hydroxyl groups or from the imine unit of the imidazole moiety The antioxidant experiments testify that these compounds exhibit very good antioxidant activity in comparison to standard α-Tocopherol.

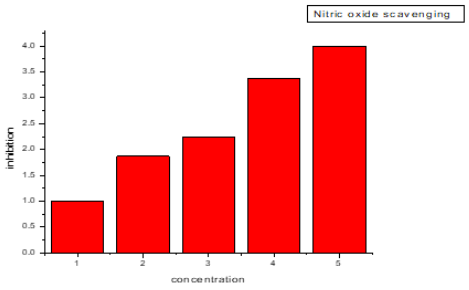


A. *Nitric oxide radical scavenging assay*

The nitric oxide scavenging assay and hydroxyl radical scavenging assay was studied and the results obtained are tabulated below.

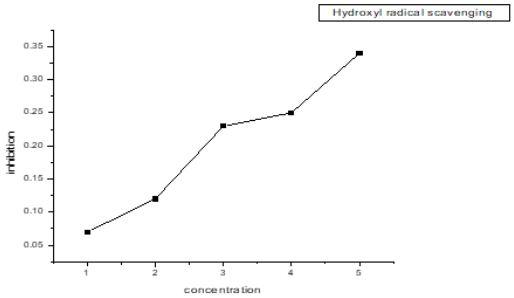
S. No.	Concentration ml of solution	Blanc A_0	A_1	A_0-A_1	inhibition $\frac{A_0-A_1}{A_0}$
1	1	0.08	0.16	0.08	1.00
2	2	0.08	0.23	0.15	1.87
3	3	0.08	0.26	0.18	2.25
4	4	0.08	0.35	0.27	3.37
5	5	0.08	0.40	0.32	4.00

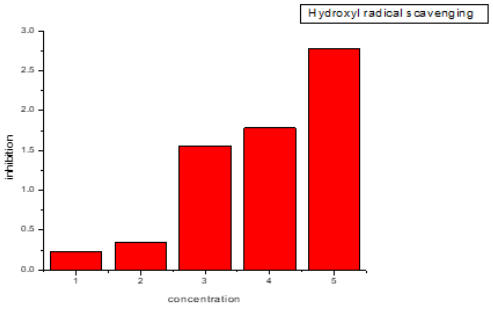




B. *Hydroxyl radical scavenging assay*

S. No.	Concentration of solution (ml)	Blanc A_0	A_1	A_0-A_1	Inhibition $\frac{A_0-A_1}{A_0}$
1	1	0.09	0.07	0.02	0.23
2	2	0.09	0.12	0.03	0.34
3	3	0.09	0.23	0.14	1.56
4	4	0.09	0.25	0.16	1.78
5	5	0.09	0.34	0.25	2.78





The anti-oxidant study of the drug was carried out by in vitro trialas. Nitric oxide free radical scavenging and hydroxyl radical scavenging characteristics of the drug was determined. Its inhibition towards the free radical produced were determined using optical density measurements. The values obtained were compared with the standard natural anti-oxidant ascorbic acid. Concentration versus inhibition graphs were drawn. The graph obtained reveals the fact that the anti-oxidant property is concentration dependent. The bar diagram shows the quantitative inhibition. The reason for higher radical scavenging capacity of the compound can be explained by the mechanism of radical scavenging by imidazoles. It has been reported that the presence of indole, pyrazole group adjacent to imidazole ring that can stabilize an unpaired electron in general boost up the antioxidant capacity of the molecule.

4. Conclusion

From the results of in vitro antioxidant activity, it is concluded that these molecules can be designed as potential drugs with a slight modification in the structure of the molecules.

The NO radical scavenging activity was undertaken to evaluate the effect of substituent on the antioxidant activities of the synthesized compounds and shows promising activity.

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