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ANTIOXIDANT AND FREE RADICALS SCAVENGING ACTIVITY OF BIOMOLECULES: HYDROXAMIC ACIDS

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INTRODUCTION

Antioxidant and Free Radical Scavenger

A free radical scavenger is a molecule that is able to destroy free radicals. These are capable of engaging in rapid chain reaction that destabilize other molecules and generate many more radicals like Reactive Oxygen Species (ROS). The free radical scavenger is often referred to as an antioxidant.

Why Antioxidant and free radical scavengers are important ?

Oxidation reactions can produce free radicals. In turns, these radicals can start chain reactions which causes oxidative stress. When the chain reaction occurs in a cell, it can cause damage or it might lead to death of the cell. Oxidative stress has been implicated in a number of human diseases. Antioxidants terminate these chain reactions by removing free radical intermediates, and inhibit other oxidation reactions. Free radical scavengers are effective because they can donate their own electrons to ROS and thereby neutralizing the adverse effects of the free radicals.

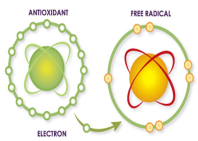


Fig .1: Donate electron to stabilize harmful free

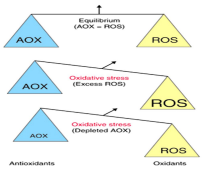


Fig. 2: Oxidative Stress

Mechanism of Antioxidation

$$R^{\cdot} + AH \longrightarrow RH + A^{\cdot}$$

$$RO^{\cdot} + AH \longrightarrow ROH + A^{\cdot}$$

$$ROO^{\cdot} + AH \longrightarrow ROOH + A^{\cdot}$$

$$R^{\cdot} + A^{\cdot} \longrightarrow RA$$

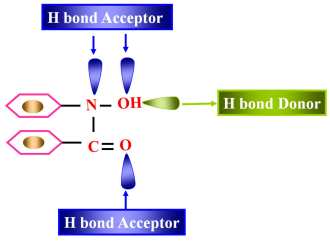
$$RO^{\cdot} + A^{\cdot} \longrightarrow ROA$$

$$ROO^{\cdot} + A^{\cdot} \longrightarrow ROOA$$

$$\text{Antioxidant} + O_2 \longrightarrow \text{Oxidized Antioxidant}$$

Hydroxamic Acids

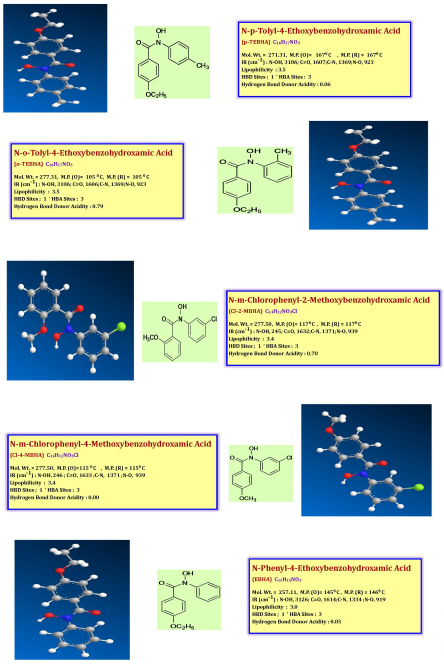
- Hydroxamic acids with functional group was introduced by H. Lossen in 1869.
- First member of N-Aryl series synthesized by Bamberger 1919 was N-phenylbenzohydroxamic acid (PBHA).



- The pharmacophoric part (-NOH.C=O) is responsible for their medicinal properties.
- This follow the "Lipinski rule of five".

PARAMETERS	VALUES
Molecular Weight	≤ 500
Lipophilicity, LogP	≤ 5
Hydrogen Bond Donor Sites (HBD)	≤ 5
Hydrogen Bond Acceptor Sites (HBA)	≤ 10

Structure of hydroxamic acid derivatives



EXPERIMENTAL SECTION

- Ethanolic solution of DPPH (1mM) was incubated with varying concentration of hydroxamic acids (10-50mM) solution for 30 minutes.
- Mixture was vertex for 1 minute, stand at room temperature in dark.
- Absorbance measured at 517 nm in UV spectrophotometer.
- The scavenging activity of compound was calculated by,

$$\% \text{ Scavenging Activity} = [(A_0 - A_s)/A_0) * 100]$$

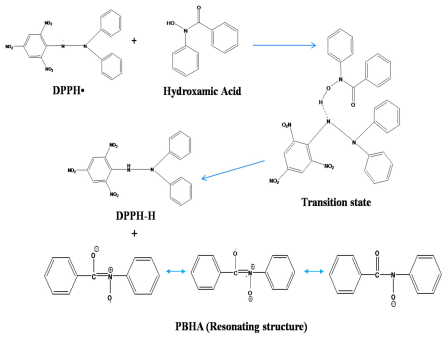
Where,

A_0 = Absorbance of the blank solution

A_s = Absorbance of the solution

EC_{50} = Effective concentration of substrate that causes 50 % loss of the DPPH activity.

Reaction Mechanism



RESULT AND DISCUSSION

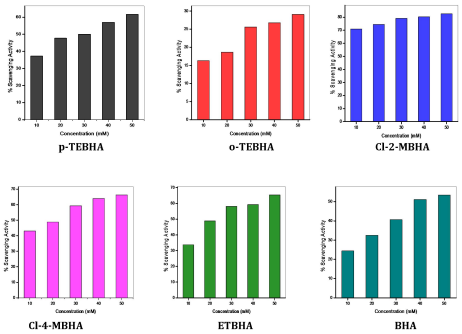


Fig. 3 : Graph plotted between % Scavenging Activity and Concentration of hydroxamic Acids

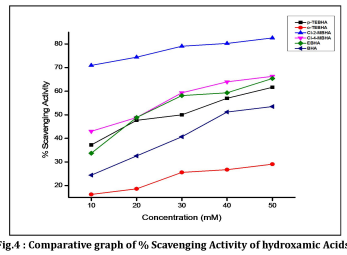


Fig.4 : Comparative graph of % Scavenging Activity of hydroxamic Acids

S. No.	Compound Name	EC_{50} (mM)	% Scavenging Activity
1	N-p-Tolyl-4-EthoxyBHA	30	61.62 %
2	N-o- Tolyl-4-EthoxyBHA	85.99	86 %
3	N-p-EthoxyBHA	21	65.38 %
4	N-m- Chloro-4-MethoxyBHA	20.45	66.27 %
5	N-m-Chloro-2-MethoxyBHA	14	82.55 %
6	Butylated hydroxyanisole	39.09	53.49 %

CONCLUSION

1. Decreases in absorbance in DPPH as due to change in DPPH radical to its neutralized from shown free radical scavenging properties of hydroxamic acids.
2. The increase in % Scavenging activity in presence of hydroxamic acids derivatives has shows its antioxidant properties with activity similar to that of Butylated hydroxyanisole.
3. Halogenations increases free radical scavenging activity of hydroxamic acids.

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