Journal of Chemical, Biological and Physical Sciences

An International Peer Review E-3 Journal of Sciences

*Available online at*www.jcbsc.org

Section A: Chemical Sciences

CODEN (USA): JCBPAT Research Note

Antioxidant activity of 3-2- (1-(2, 4-dihydroxyphenyl) ethyldeneamino) phenyl)-2-methylquinazoline-4(3H)-one Schiff base and its Cu (II), Ni (II) and Co (II) complexes

Sunil Kumar, B. Mane and K. Siddappa*

Department of Postgraduate Studies and Research in Chemistry, Gulbarga University, Gulbarga -585106, Karnataka, INDIA

Received: 10 July 2015; **Revised:** 23 July 2015; **Accepted:** 30 July 2015;

Abstract: The numeral life-threatening communicable diseases and harmful cellular damage caused by free radicals on lipids, proteins or DNA oxidation has reached an alarming level in various countries around the world. Hence, the present work was focused to find out the solution for the capacity of synthesized compounds to act as an antioxidant agent in order to prevent the damaged caused by free radicals. The synthesized Schiff base alone and in combination with the metal complexes screen for their antioxidant activity by DPPH radical scavenging method. The antioxidant activity of Schiff base found to be enhanced upon complex formation with Cu (II), Ni (II) and Co (II) metal ions.

Key words: Schiff base, Quinazoline-4(3H)-one, antioxidant activity.

INTRODUCTION

Oxygen reactive free radicals, more known as reactive oxygen species (ROS) have a dual nature. On the one hand, they are necessary for normal function of the cell, but on the other side when ROS is in excess can be mediators of damage to cell structures and this harmful effect is termed oxidative stress [1].

Reactive oxygen species (ROS) such as superoxide anions, hydrogen peroxide, hydroxyl and nitric oxide radicals, play an significant role in oxidative stress related to the pathogenesis of various important diseases [2]. Therefore, scientists in various disciplines have become more interested in new

compounds, either synthesized or obtained from natural sources that could provide active components to prevent or reduce the impact of oxidative stress on cells [3].

In this regards, Antioxidants are extensively studied for their capacity to protect organisms and cells from damage induced by oxidative stress and slow down the progress of many chronic diseases, namely vascular diseases, some forms of cancer and oxidative stress responsible for DNA, protein and membrane damage. In the literature it was clearly documented that due to chelation of organic molecule to the metal ions scavenging activity of ligand was enhanced upon complexation. Not only that the metal ions also exert differential and discriminating effects on scavenging radicals of the biological system which are served as potent antioxidant than the ligand[4].

Among various heterocyclic analogs quinazoline-4(3H)–one in coordination with metal ions used as a versatile molecule for designing potential bioactive agents having diverse pharmacological activities such as an anti-bacterial, anti-fungal, anti-inflammatory, analgesic, anti-cancer, anti-convulsant, anti-oxidant, anti-tubercular and anti-HIV[5, 6].

Hence, keeping in view the varied analytical and biological activities of the quinazoline-4(3H)-one Schiff base, the present paper deals with the antioxidant activity of synthesized compounds in order to check their biological potency.

The synthesis and characterization of 3-2-(1- (2, 4-dihydroxyphenyl) ethyldeneamino) phenyl)-2-methylquinazoline-4(3H)-one Schiff base and its complexes were already reported in our earlier protocol [7].

MATERIALS AND METHODS

All the chemicals and solvents were procured from Hi-media Mumbai. Melting points of the newly synthesized compounds were determined by electro-thermal apparatus using an open capillary tube. The metal chlorides used were in hydrated form. Organic chemicals such as 1, 1-diphenyl-2-picrylhydrazyl (DPPH), butylated hydroxyl anisole (BHA) and tertiary butylated hydroxyl quinolone (TBHQ) were procured from Sigma Aldrich Co. and Merck chemical companies. The purity of the compounds was checked by TLC using silica gel-G coated aluminum plates (Merck) and spots were visualized by exposing the dry plates to iodine vapors.

Determination of DPPH radical scavenging activity

The DPPH radical scavenging activity of the Schiff's base and its complexes was measured according to the literature protocol [8].

A stock solution of the Schiff base ligand (DHPEAPMQ) and its complexes (1 mg/mL) was diluted to final concentrations of 25, 50, 75 and 100 µg/mL by adding DMSO. A methanol solution of DPPH (1 mL, 0.3 mmol) was added to DMSO (3 mL) at various concentrations (25-100 µg/mL). The mixture was shaken vigorously and incubated at 25 °C. After 30 min the absorbance was measured at 517 nm by UV-visible spectrophotometer. The control was prepared without any extract. A graph was plotted with concentration (µg/mL) of the compounds on the x-axis and percentage scavenging effects on the y-axis respectively. Radical scavenging activity was expressed as a percentage of scavenging effect and was calculated using the following formula.

$$\textbf{R}\text{adical Scavenging Effect (\%)} = \frac{\text{Absorbance of control} - \text{Absorbance of sample}}{\text{Absorbance of control}} \text{ X } 100$$

RESULTS AND DISCUSSION

DPPH radical scavenging activity: Schiff's base ligand (DHPEAPMQ) and its complexes showed significant scavenging effects with increasing concentration in the range of 25-100 µg/mL as shown in Fig. 1.

The IC_{50} values for methanol solutions of the Schiff's base ligand (DHPEAPMQ) was (44 µg/mL) while for Cu (II), Ni (II) and Co (II) complexes was (32 µg/mL), (38 µg/mL) and (37 µg/mL) respectively which clearly shows superior antioxidant activity all complexes over the Schiff's base ligand (DHPEAPMQ).

Since the incorporation of metal ions into the Schiff's base ligand (DHPEAPMQ) demonstrated a broad spectrum of results. Furthermore, the synthesized compounds scavenged the DPPH radical in a concentration dependent manner. The average suppression ration (IC_{50}) of standards BHA and TBHQ were found to be 20 and 24 µg/mL respectively.

The reason for the enhanced scavenging activity of all the metal complexes over the Schiff's base can be clearly explained based on the following remarks.

1. Due to the chelation and synergistic effect of the organic molecules with the various metal ions scavenging activities of metal complexes increases. Thus the results obtained were correlated with previously reported studies on metal complexes in which the ligand has antioxidant activity and it was anticipated that the metal ion will increase its activity predominantly thereby indicating the stronger free radical scavengers and excellent antioxidant properties of these complexes [9, 10].
2. It was marked that the hydroxyl radical scavenging effects of transition metal complexes are much higher than those of their ligand due to their redox coupling reaction [11].

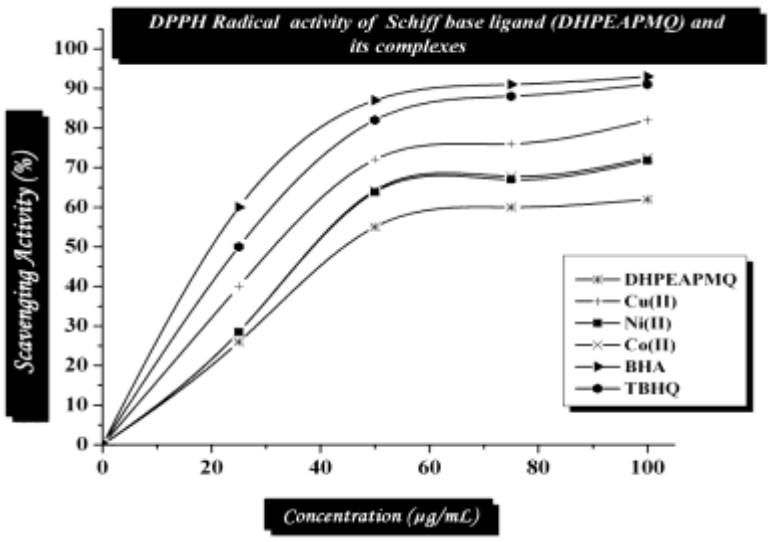

Fig. 1: DPPH radical scavenging activity of Schiff base and its complexes as well as the standards.

CONCLUSION

In the present study we demonstrated the antioxidant activity of Schiff base (DHPEAPMQ) and it's Cu (II), Ni (II) and Co (II) complexes by using DPPH radical scavenging method and the results were compared with standard drugs.

All the metal complexes show higher activity than the parent Schiff's base ligand, in other word the antioxidant activity of the Schiff's base ligand (DHPEAPMQ) enhanced upon chelation with transition metal ions.

The potent antioxidant activities of synthesized compounds are due to the presence of the hydroxyl group, explained on the basis of chelation and synergistic effect.

ACKNOWLEDGEMENT

The authors are thankful to the Chairman, Department of Chemistry, Gulbarga University, Gulbarga, for providing laboratory facilities, Chairman.

REFERENCES

1. B. Grigorov, *Trakia J. Sci.* 2012, 10, 83.
2. M. Alkan, H. Yuksek, O. Gursoy-Kol and M. Calapoglu, *Molecules*, 2008, 13, 107.
3. A. Al-Amiery, A. A. H. Kadhum and A. B. Mohamad, *Bioiorg. Chem. Appl*. 2012, 1.
4. L. Yong, Z. Y. Yang and M. F. Wang, *J. Fluoresc*. 2010, 20, 891.
5. G. Naganagowda and A. Petsom, *J. Sulfur Chem.*, 2011, 32, 223.
6. K. Hemalatha and K. Girija, *Int. J. Pharma. Pharma Sci*, 2012, 4, 99.
7. K. Siddappa, S. lkumar, B Mane and D. Manikprabhu, *Bioinorg. Chem. Appl*, 2014, 2014, 1.
8. J. R. Soares, T. C. P. Dinis, A. P. Cunha and L. M. Almeida. *Free Radical Res*, 1997, 26, 469.
9. S. B. Bukhari, S. Memon, M. Mahroof-Tahir and M. I. Bhanger, *Spectrochim. Acta Part A* 2009, 71, 1901.
10. L. Yong, Z. Y. Yang and M. F. Wang, *J. Fluoresc*, 2010, 20, 891.
11. J. Lei, S. Jie, S. Zhi-hong, L. Fei-fei, W. Yuan, W. Wei-na and W. Qin, *Inorg. Chim. Acta*, 2012, 391, 121.

Corresponding author: K. Siddappa;

Department of Postgraduate Studies and Research in Chemistry, Gulbarga University,

Gulbarga -585106, Karnataka, INDIA