

Research Proposal for R&E 2016

Research Title	Korean	
	English	Synthesis and Characterization of Organometallic Complexes and their Biological Applications
Field	Field	Engineering () Math () Physics () Chemistry () Biology (○) Earth Science () Computer Science ()
	Sub-field	Biochemistry
Period	2016. 3. 1. ~ 12. 31. (10 months)	

I confirmed that the R&E research proposal is reviewed by me.

2015. 11. 30.

Name of Teacher _____ (Sign)

Office of Planning & Research Affairs

Korea Science Academy

[Research Proposal]

Research keyword
<input type="radio"/> Organometallic complex, Antibacterial, Antifungal, Antitumor
Research abstract
<input type="radio"/> The world is facing numerous problems regarding tumor and their resistance to multi drugs therapeutics, and organometallic complexes can be an alternative as an anti-tumor agent. The organometallic complexes are the active domain in the discovery of antibacterial agent for pathogenic bacteria (or multi drug resistant bacteria), as well as food-related pathogenic and putrefactive bacteria. There are still very few bacterial pathogens that are reported to be susceptible to organometallic complexes and many pathogens remain to be studied. Organometallic complexes will be synthesized as the antibacterial agent, and its novel mechanism of action will be studied. Cisplatin is the best example of platinum-based organometallic complex, which is applied in the treatment of non-small cell lung cancer and in testicular cancer. This study will focus on the synthesis of organometallic complexes based on metals such as Cobalt (Co), Nickel (Ni), Palladium (Pd), and Iron (Fe) and their biological applications.

Research proposal

○ **Purpose and Motive:** Syntheses of organometallic complex are the active domain in the research field of chemistry and biology, due to its variety of complex formation with different biological activities such as antibacterial, antifungal and anti-tumor activity. The world at present is facing many problems related to multidrug resistance by pathogenic bacteria as well as by numerous types of cancers. Metal-based drugs are the standard in therapeutics, an example of which are platinum-based drugs, applied to ovarian cancer, testicular cancer and lung cancer.

○ **Background and objective:** The research field of bio-organometallic chemistry is increasingly drawing much interest due to the development of a new class of organometallic compounds and their ability to play a leading role in the field of biology. The organometallic complexes are the antibacterial agents including gram-positive and gram-negative bacteria (Ref. 1, 2 & 3), antifungal (Ref. 4), anti-tubercular (Ref. 5) and anti-tumor (Ref. 6 and 7). The aim of the research is to identify and quantify the antibacterial, antifungal and antitumor activity of novel organometallic complexes.

○ **Contents and method of research:**

-Synthesis of Organometallic complexes

-Characterization

-Biological activities:

- i) Antibacterial analysis: This includes disc diffusion method or well method for qualitative analysis. 96 well plate methods for micro broth assay are utilized for quantitative analysis and alternatively, macro broth dilution method is also applicable.
- ii) Antifungal analysis: This includes disc diffusion method or well method for qualitative analysis and macro broth dilution method for quantitative analysis.
- iii) Antitumor activity: cell proliferation by WST1 assay in 96 well plates for qualitative and quantitative analysis.

○ **Research Plan:**

1. Synthesis of organometallic complex

- chelated

- non-chelated

2. Characterization

- FT-IR analysis

- UV-Vis analysis

- NMR analysis

- Single X-Ray analysis

3. Biological activities.

- Bacteria growing, preservation, suspension preparation and standardization etc.

- Media preparation (agar or broth form), sterilization, plate preservation etc.

- Antibacterial activity (Qualitative and quantitative).

- Antifungal activity (Qualitative and quantitative).

- Anti-tumor activity (Qualitative and quantitative).

○ **Reference:**

1. SK Patel , V Tirkey, S Mishra, HR Dash, S Das, M Shukla, S Saha , SM Mobin, S Chatterjee. (2014). Synthesis of mono- and bi-metallic dithiocarboxylate-alkyne complexes from sunlight driven insertion reaction and their antibacterial activity. *Journal of Organometallic Chemistry* 749 (2014) 75e82.
2. E A Nyawade, HB Friedrich, B Omondi, HY Chenia, M Singh, S Gorle. (2015). Synthesis and characterization of new α, α' -diaminoalkane-bridged dicarbonyl(η^5 -cyclopentadienyl) ruthenium(II) complex salts: Antibacterial activity tests of η^5 -cyclopentadienyl dicarbonyl ruthenium(II) amine complexes. *Journal of Organometallic Chemistry* 799-800 (2015) 138e146.
3. B Geetaa, K Shravankumar , PM Reddy, E Ravikrishnaa, M Sarangapani , KK Reddy, V Ravinder. (2010). Binuclear cobalt(II), nickel(II), copper(II) and palladium(II) complexes of a new Schiff-base as ligand: Synthesis, structural characterization, and antibacterial activity. *Spectrochimica Acta Part A* 77 (2010) 911-915.
4. A A Abou-Hussein, W Linert. (2014). Synthesis, spectroscopic, coordination and biological activities of some organometallic complexes derived from thio-Schiff base ligands. *Spectrochimica Acta Part A: Molecular and Biomolecular Spectroscopy* 117 (2014) 763-771.
5. R Arancibia , C Quintana , C Biot , ME Medina , SC Kremer , L Kremer , AH Klahn. (2015). Palladium (II) and platinum (II) complexes containing organometallic thiosemicarbazone ligands: Synthesis, characterization, X-ray structures and antitubercular evaluation . *Inorganic Chemistry Communications* 55 (2015) 139-142.
6. JQ Sha , LY Liang , PF Yan , GM Li , C Wang , DY Ma. (2012). Study on ligation of copper complexes of the quinolone antibacterial drugs and octamolybdates POMs. *Polyhedron* 31 (2012) 422-430.
7. NR Palepu , JR Premkumar , AK Verma , K Bhattacharjee, SR Joshi , S Forbes, Y Mozharivskyj, KM Rao. (2015). Antibacterial, in vitro antitumor activity and structural studies of rhodium and iridium complexes featuring the two positional isomers of pyridine carbaldehyde picolinic hydrazone ligand. *Arabian Journal of Chemistry* (2015), <http://dx.doi.org/10.1016/j.arabjc.2015.10.011>.