# The Development of New DPPZ Dendritic Molecule For Photodynamic Therapy

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ABSTRACT

The dendritic molecule has focused on the target material for photodynamic therapy, and used as the energy harvesting molecule for the application of medicinal field. Those molecules have also researched on the molecule design for the preparation of new dendritic material on PDD and PDT. In this presentation, new dendritic molecules are introduced on the development of DPPZ dendritic molecule for PDT and the efficient synthetic process.

Keywords

dendritic molecule, photodynamic therapy, synthetic process, medicinal field

## I. Introduction

The photobiological active molecular model for photodynamic therapy has been attracted as a research for the development of cancer treatment, and more functionalized molecular models have been developed for the research of smart and stable photobiological active molecule systematically [1]. In addition, these systematical researches have been competed on the clinical and molecular level all over the world. Until now, every developed photosensitizer for photodynamic therapy (PDT) showed photosensitivity and side effect of the skin part for human, and the development of photosensitizer having more smart and less photosensitivity for human has been demanded. Furthermore, the research of the stable photosensitizing molecule showing the longer wavelength and longer life time has been also tried for the development of photodynamic therapy. I have been researched the model molecule for photodynamic therapy having metal complexes and prepared several types of those complexes having Ru(II) complexes [2]. Herein, I will introduce the new dendritic molecule composed of DPPZ relay unit for PDD and PDT and synthetic process

## II. RuOs complex with DPPZ unit

As shown in Fig. 1, RuOs heterodinuclear complex prepared on the energy transfer system with DPPZ relay unit, and this unit has used for the construction of the long ranged energy or electron transfer system [2]. In particular, this unit has also utilized partly for the preparation of dendritic molecule for PDD and PDT.

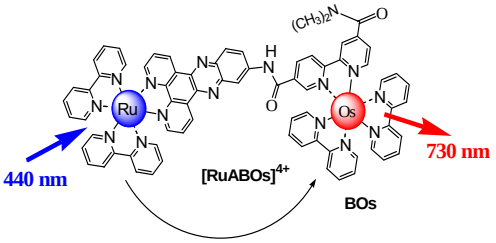


**Fig. 1.** RuOs heterodinuclear complex having DPPZ unit

## III. Porphyrin derivative with terminal phenanthrene

The first target molecule is suggested as porphyrin-based amide type connected to emissive phenanthrene molecule. As shown in Fig. 2 and Fig. 3, the first and second generation molecule are designed by amide bond, which is considered as the synthesis of high yield. In addition, it is considered that these molecules show strong emission, particularly, in the porphyrin-based amide type II.

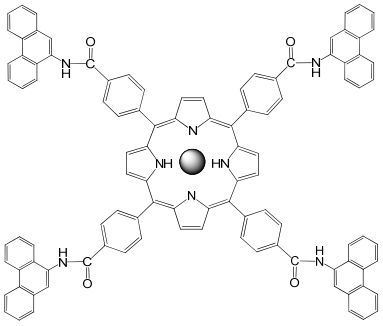

**Fig. 2.** Porphyrin-based amide type I

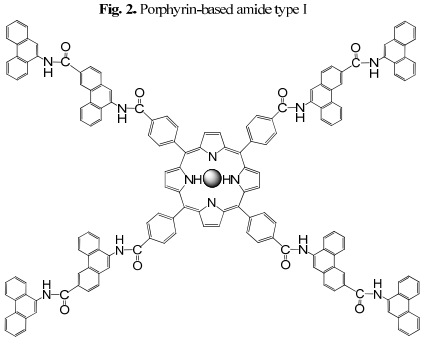

**Fig. 3.** Porphyrin-based amide type II

## IV. Porphyrin derivative with terminal 2-amino-phenazine derivative (DPPZ unit)

As shown in Fig. 4 and Fig. 5, the terminal ligand is introduced to porphyrin-based amide type. The terminal ligand, 2-amino-phenazine derivative, is easily synthesized by condensation reaction. In particular, the longer porphyrin derivative is prepared by amide reaction. The absorption and emission spectra of 2-amino-phenazine derivative is shown in ~430nm and ~520nm, respectively. Moreover, emission of these molrclues will be appeared stronger than that of amide type I and II.

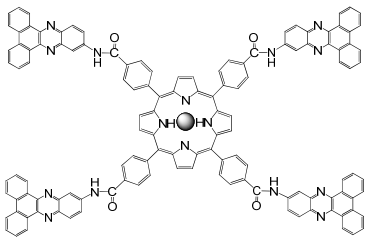

**Fig. 4.** Porphyrin-based amide type III

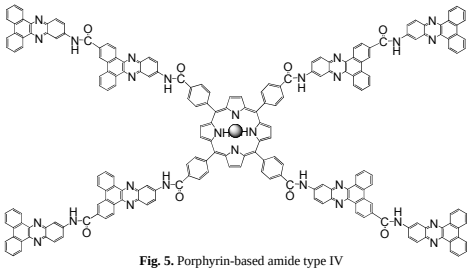

**Fig. 5.** Porphyrin-based amide type IV

## V. Porphyrin derivative with terminal phenanthrene or 2-amino-phenazine derivative(DPPZ unit)

The second generation dendritic molecule is prepared by connection of phenanthrene or 2-amino-phenazine derivative molecule, as shown in Fig. 6 and Fig. 7. these dendritic molecule is easily synthesized by amide reaction, as reported previously [3]. These molecules will be shown stronger emission than previous molecule due to 12 emissive part.

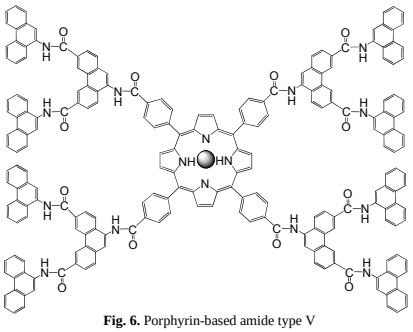

**Fig. 6.** Porphyrin-based amide type V

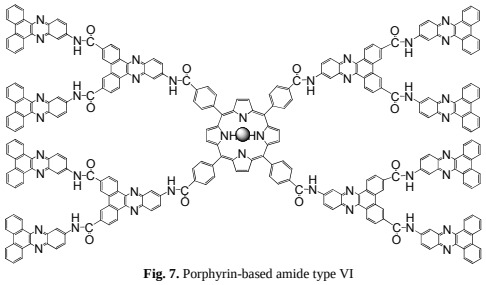

**Fig. 7.** Porphyrin-based amide type VI

## VI. Conclusion

The novel photosensitizing dendritic molecules are easily designed by connection of DPPZ relay unit for the development of photosensitizing material in PDD and PDT. These dendritic molecules will be applicated as the basic standard material in PDD and PDT in the near future.

## References

[1] (a) M. Saleem, A. Ali, C.-S. Choi, B. J. Park, E. H. Choi and K. H. Lee, "The smart 2-(2-fluorobenzoyl)-N-(2-methoxyphenyl)hydrazine carbothioamide functionalized as Ni(II) sensor in micromolar concentration level and its application in live cell imaging," *Journal of Fluorescence*, Vol. 24, pp 995-1001, 2014. (b) J.-J. Chen, L.-J. Gao and T.-J. Liu, "Photodynamic therapy with a novel porphyrin-based photosensitizer against human gastric cancer," *Oncology Letters*, Vol. 11. No. 1, pp 775-781, 2016.

[2] (a) C.-S. Choi, "Photophysical and redox properties of dinuclear Ru(II) complexes prepared from the photosensitizing unit"$[Ru(bpy)_2(dppz\text{-}NH_2)]^{2+}$ complex (dppz-$NH_2$: 7-amino-dipyrido [3,2-*a*:2',3'-*c*]phenazine)," *Bulletin of the Korean Chemical Society*, Vol. 35, No. 2, pp 663-665, 2014. (b) C.-S. Choi, L. Mishra, T. Mutai, and K. Araki, "$[Ru(bpy)_2(dppz\text{-}NH_2)]^{2+}$ complex (dppz-$NH_2$:7-amino-dipyrido [3,2-*a*:2',3'-*c*] phena zine) as a useful photosensitizing unit for the construction of photoinduced energy transfer systems," *Bulletin of the Chemical Society of Japan*, Vol. 73, No. 9, pp 2051-2058, 2000.

[3] C.-S. Choi, "The recent current of fluorescent polypyridine compounds having photo-functionality," *Rapid Communication in Photoscience*, Vo. 5, No. 2, pp 21-26, 2016.