CHAPTER I

INTRODUCTION

Polydiacetylene (PDA) vesicles are spherical particles which constitute of bilayer structure [1-4]. Fig. 1 illustrates the preparation of PDA vesicles in aqueous suspension. The dispersion of diacetylene (DA) monomer in water results in the formation of vesicles. Each layer of the vesicle consists of well organized DA monomers which have hydrophilic and hydrophobic parts. The DA assembly can undergo polymerization to form PDA vesicles after UV light irradiation. The structure of PDA conjugated polymer consists of an ene-yne alternating main chain with long side chains of alkyl group and carboxylic group. The backbone in this structure has conjugation of π-electron. The polydiacetylene vesicles exhibit a dark blue color which can be observed by naked-eyes.

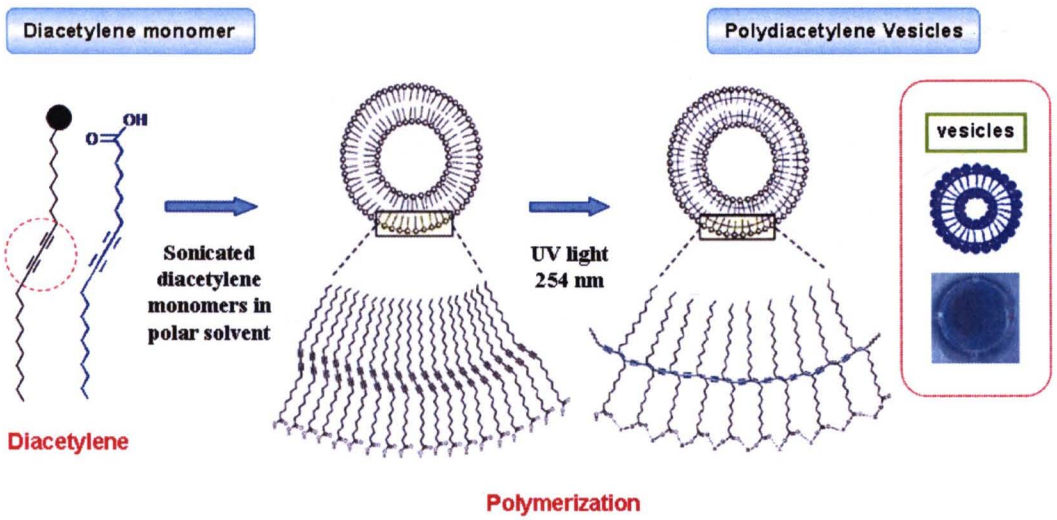

Figure 1 Process for the synthesis of PDA vesicles in water

The property of PDA vesicles that has received considerable attention is a color transition from blue to red upon addition of some stimuli such as pH, temperature and ligand binding [5-8]. The perturbation can weaken or break the hydrogen bonding between the head groups, resulting in HOMO-LUMO energy gap widening. Therefore, the absorption spectrum exhibits a blue shift, corresponding to color transition from blue to red as shown in Fig. 2. From this property, PDA vesicles have a potential for being utilized as sensor materials such as biosensor, thermosensor and chemosensor.

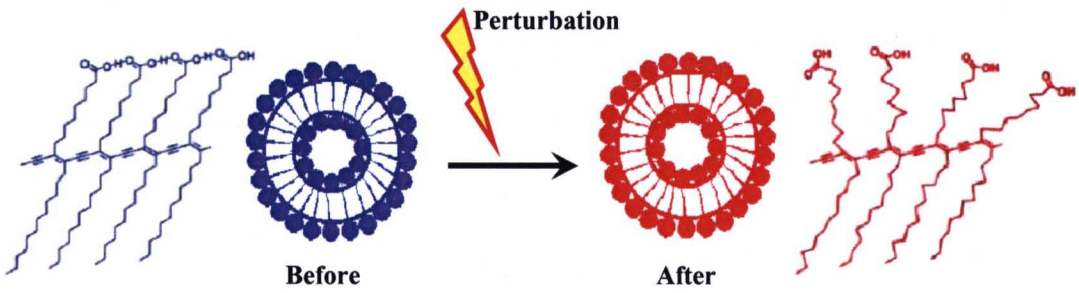

Figure 2 Color transition of PDA vesicles upon exposure to external stimuli

One of DA monomer that has been extensively investigated is 10,12-pentacosadiynoic acid (PCDA) (see Fig. 3). The maximum absorption of blue and red forms of poly(PCDA) vesicles in water is generally observed near 635 and 540 nm, respectively. The color transition from blue to red, which is an irreversible process, normally takes place at about 80 ^{o}C [9].

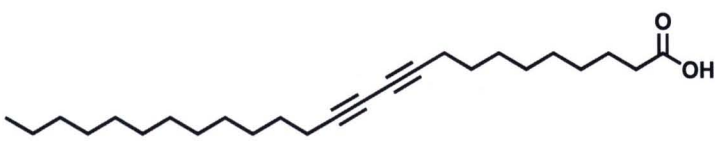

Figure 3 Chemical structure of 10,12-pentacosadiynoic acid monomer

The thermochromism of PDA vesicles has been extensively investigated [5,10]. The strength of interaction at PDA vesicle surface strongly dictates the color-transition temperature. In the extreme cases where the interaction between head group are very strong, the color transition of PDA vesicle, usually an irreversible process, changes to the reversible one. The structural modification by bonding the head groups together also yields PDA vesicle with reversible thermochromism. Many research groups have demonstrated that structural modification is a very effective approach for tuning the colorimetric response and also reversible properties of PDA vesicle.

In this study, we investigate the effect of structural modification on photophysical properties of PDA assemblies prepared from various types of diamidodiacetylene monomers in difference environments. The structures of DA monomers are modified by varying of linkers as shown in Fig. 4.

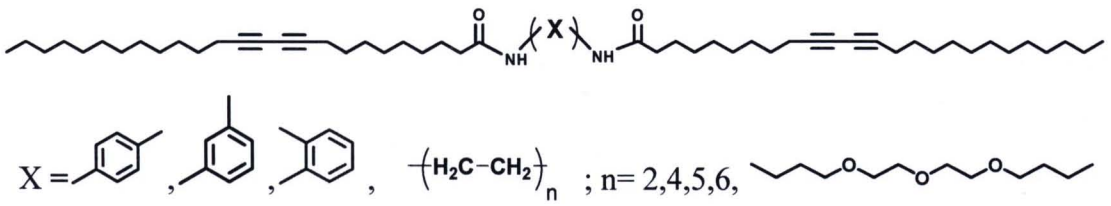

Figure 4 Structures of diamidodiacetylene monomers