A Polydiacetylene Supramolecular System That Emits Red, Green, and Blue Fluorescence

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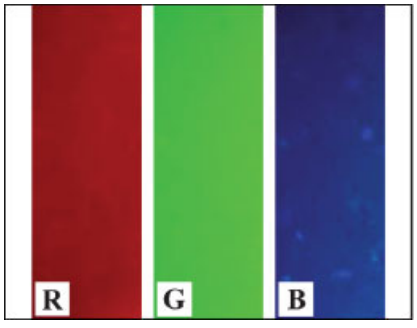
A polymer system based on polydiacetylene (PDA) supramolecules that emits red, green, and blue fluorescence has been constructed. The three-color emitting system is comprised of red-fluorescent PDA vesicles in which green-fluorescent fluorescein molecules are encapsulated. Finally, the blue-fluorescence component is introduced by reacting terminal amine groups on the PDA vesicle surfaces with fluorescamine. Thin PDA-polymer-containing poly(vinyl alcohol) films formed by using this strategy display red, green, and blue fluorescence upon excitation with light at specific wavelengths.



Introduction

Great interest exists in polydiacetylene (PDA) supramolecules owing to their facile preparation and the output signals that are associated with their unique alternating ene-yne conjugated structures.[1] Unlike most conjugated polymers, PDAs are readily prepared by irradiation (UV or gamma ray) of closely packed diacetylene supramolecules. Since no chemical initiators or catalysts are required for the polymerization process, the polymers are generally not contaminated with impurities and, consequently, additional purification steps are not required. Owing to their intriguing stress-induced chromic transition (blue-to-red) and non-linear optical properties, PDAs have been extensively investigated as potential chemosensors and photonic materials.[1–8]

Another important feature of PDAs that has not gained as much attention as their colorimetric properties is their *fluorescence* properties. PDAs are non-fluorescent in a 'blue-phase' and fluorescent in a 'red-phase'.[9] Only recently was the observation of stress-induced fluorescence changes of PDA reported by our group[10] and others.[11] We believe that fluorescence properties of PDAs and their ability to readily form liposome-like structures could serve as the foundation of novel strategies for constructing multiple color-emitting systems. In one plausible design, a multiple color-emitting system would be constructed by encapsulating one type of fluorescent molecule inside the vesicles and covalently attaching another type of fluorescent molecule to the vesicles' outside surface.

In Figure 1 is shown a schematic representation of a PDA vesicle of this type. It contains three components that emit in the red, green, and blue regions. The PDA backbone would be responsible for red fluorescence and fluorescein encapsulated inside the PDA vesicle would emit green

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