수용성 공액 고분자의 바이오 컨쥬게이션을 이용한 센싱효과

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Synthesis and Characterization of Water-soluble Conjugated Polymers and Their Sensing Effect for Bioconjugation

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1. Introduction

Conjugated polymers are being extensively investigated for their potential applications in the fields of optoelectronics, microelectronics, and chemical and biological sensors. Especially, water-soluble conjugated polymers have attracted much attention because of their detection ability toward DNA, proteins, and biological agents. The detection of biological analytes can be achieved in high sensitivity using organic conjugated polymers based biosensory materials due to their large signal amplification even more trace amount of analytes. However, the conjugated polymers are not easy to dissolve in aqueous media because they are a hydrophobic in nature with rigid main chain. In this present contribution, we will describe the synthesis and characterization of water-soluble conjugated poly(para-phenylene) with cationic group.

2.Experimental

2.1. Characterization

^{1}H NMR and ^{13}C NMR spectra were collected on a Bruker DRX 300 spectrometer (Korea Basic Science Institute) and a JEOL JNM AL-400 spectrometer. UV-vis absorption spectra were recorded on a Perkin-Elmer Lambda 35 spectrometer. Luminescence spectra were collected on a Perkin-Elmer LS 45 spectrometer with a xenon lamp as a light source.

2.2 Synthesis of polymers

Pol-1 The neutral polymers were prepared by a palladium-catalyzed Suzuki cross-coupling reaction. The purified monomers were mixed in the appropriate ratios with $Pd(PPh_3)_4$ (0.005 equiv) in a mixture of 1 M $NaHCO_3$ (aq) and DMF (1/2, v/v) under nitrogen. The reaction mixture was heated to 85 °C for 48 h. After the reaction, the reaction mixture was cooled and slowly added to 500 ml of methanol/acetone/ether mixture (1/4/5, v/v/v), and precipitates were filtered. The polymer was dissolved in water/methanol and reprecipitated from methanol/acetone/ether twice. Finally, the polymer was dissolved in 150 ml of water, 0.05 g of sodium cyanide was added, and resulting solution was dialyzed against water (Millipore NanopureTM) using a 1 kD MWCO

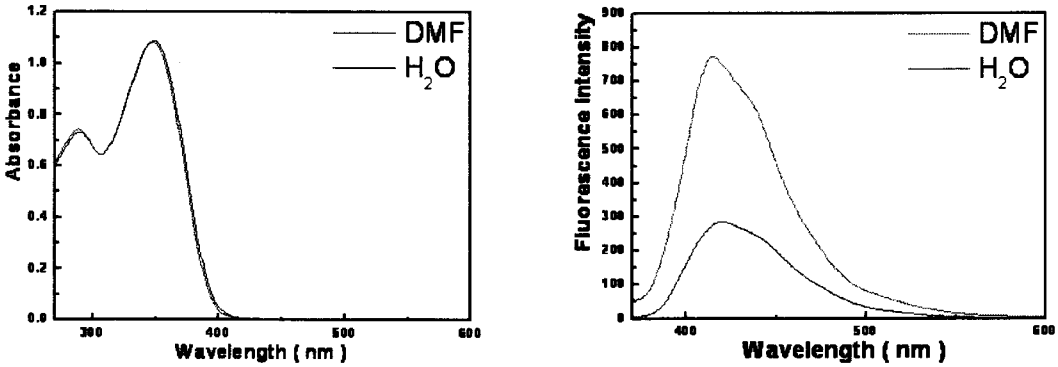
cellulose membrane for 2 days. After the dialysis, the polymer solution was freeze-dried and the bright-brown solid was obtained.

Pol-2 Triethylamine (8 ml) was added dropwise to a solution of the neutral precursor polymer (100 mg) in 20 mL of DMF at 0°C. The mixture was then allowed to heat at room temperature for 48 h. After the reaction, the reaction mixture was slowly added to acetone.

3. Results and discussion

UV and PL Spectra of polymer

The UV-vis absorption and fluorescence spectra in the Pol-2 solution (DMF, H_2O) were show in Figure 1.



(a) (b)

Figure 1. (a) UV-vis absorption of Pol-2 in of DMF and H_2O. Concentration of polymer solution : 5.0 x 10^{-4} M in DMF, 5.0 x 10^{-4} M in H_2O; (b) Fluorescence spectra of Pol-2 in DMF and Water. Concentration of polymer solution : 6.25 x 10^{-7} M in DMF, 6.25 x 10^{-7} M in H_2O.

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