폴리아세틸렌 유도체의 색과 스펙트럼 특성(X): 수용성 폴리(술포비테인)의 합성과 특성

The Color and Spectroscopic Properties of Polyacetylene Derivatives (X): Synthesis and Properties of Water-Soluble Conjugated Poly(sulfo betaine)

이원철, 제갈영순, 진성호[1], 윤석한[2], 류원석[3]

경일대학교, [1]부산대학교, [2]한국염색기술연구소, [3]영남대학교

1. Introduction

The driving force on self-doped polymeric materials has been to improve the processibility in aqueous media, to increase the speed of electrochromic switching, and to achieve the increased charge storage performance of polymer-based batteries. The concept of self-doping in conjugated polymers was introduced by Wudl et al [1,2]. In self-n-doped polymers, cationic sites acts as dopant and are incorporated into the polymer, where the monomer contained a covalently attached ionizable, negatively charged, functional group acting as s stable/immobile dopant anion. A new class of ionic polyacetylenes have been prepared through the activated polymerization of ethynylpyridines with alkyl halides [3]. In recent years, we also reported a facile synthesis of new self-dopable ionic conjugated polymer by the activation polymerization of 2-ethynylpyridine with the ring-opening cyclicsultone. Here, we report the color and spectroscopic properties of a new self-dopable conjugated poly(sulfo betaine).

2. Experimental

2-Ethynylpyridine (Aldrich Chemicals, 98%) was vacuum distilled after drying with CaH_2. 1,4-Butane sultone (Aldrich Chemicals., 99+%) was used as received. The analytical grade solvents were dried with an appropriate drying agent and distilled. The polymer was prepared by the direct polymerization of 2-ethynylpyridine with 1,4-butanesultone without any additional initiator or catalyst in high yield.

3. Results and Discussion

The electro-optical and electrochemical properties of a self-dopable conjugated polymer were studied. The polymer was prepared by the polymerization of 2-ethynylpyridine with the ring-opening of 1,4-butanesultone in high yield. The cyclovoltamograms of this polymer exhibited reversible electrochemical behaviors between the doping and undoping peaks. The kinetics of the redox process of this polymer was found that it is almost controlled by the diffusion process from the experiment of the oxidation current density of polymer versus the scan rate. The oxidation current density of polymer versus the scan rate is an approximately linear relationship in the range of 30 mV/sec-120 mV/sec. The exponent of the scan rate, the x value of polymer, is found to be 0.2404. This value means that the kinetics of the redox process is almost entirely controlled by the diffusion process. The photoluminescence (PL) spectra of polymer showed that the photoluminescence peak is located at 511 nm, corresponding to a photon energy of 2.43 eV.

4. Conclusions

The color and electro-optical, electrochemical properties of a new water-soluble polymer were measured and discussed. It was also found that this water-soluble ionic conjugated polymer exhibited good antibacterial activity.

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References

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