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SYNTHESIS AND CHARACTERIZATION OF POLYCARBAZOL - POLYANILINE COPOLYMER IN DICHLOROMETHANE SOLUTION

POLİKARBAZOL – POLİANİLİN KOPOLİMERİNİN DİKLOROMETAN ORTAMINDA SENTEZİ VE KARAKTERİZASYONU

Muammer KAVANOZ[1*], Gözde KILIÇ[1]

[1] Recep Tayyip Erdogan University, Faculty of Art & Sciences, Department of Chemistry, Rize, Türkiye.

*Corresponding author. E-mail: muammer.kavanoz@erdogan.edu.tr

ABSTRACT

Conductive polymers can be synthesized in solution or on the electrode surface by oxidation of aromatic heterocyclic organic molecules. Polypyrrole, polythiophene, polyaniline, polyfuran, polyphenylenevinylene, polytionaphtene, polycarbazole, polyindole and polyazulene are the most well-known conductive polymers. Although less studied among the conductive polymers, carbazole polymers have many advantages such as cheap, environmental and chemically stable because of aromatic structure, optic with nitrogen atom in structure, electrical properties, can give polymers having a lower band gap than p-phenylene polymers because occur from biphenyl group. During the polymerization, poly (2,7-carbazole) derivatives can be obtained by binding from 2- and 7- positions while poly (3,6-carbazole) polymers obtained by binding from 3- and 6- positions. Features and applications area of these polymers are different [1,2]. In previous studies, electrochemical synthesis of Polyaniline was carried out in dichloromethane medium and it was used as modified surface for determination of some phenolic compounds [3,4].

In this study, electropolymerization of polycarbazole- polyaniline (PC - PANI) copolymer was firstly studied using polymerization solution containing dichloromethane / 100 mM tetrabutylammonium perchlorate (TBAP) / 1.0 mM carbazole / 50.0 - 200 mM aniline and optimum polymerization conditions were determined. Aqueous and non-aqueous medium behaviors of prepared PC –PANI modified electrode were investigated. The best electroactive film was determined. Characterization of the synthesized copolymer film was carried out by UV-vis, FT-IR, Raman, SEM and EDS techniques. Electrochemical behavior of hydroquinone was investigated in $NaHSO_4$ / Na_2SO_4 medium over obtained modified electrode and it was compared with its homopolymers.

Keywords

Copolymer, polyaniline, polycarbazole.

ÖZET

Aromatik heterohalkalı organik molekülün yükseltgenmesi ile elektrot yüzeyinde veya çözeltide iletken polimerler sentezlenebilmektedir. Polipirol, politiyofen, polianilin, polifuran, polifenilenvinilen, politiyanaften, polikarbazol, polindol ve poliazulen en çok bilinen iletken polimerlerdir. İletken polimerler arasında daha az incelenmesine rağmen karbazol polimerleri; başlangıç maddesinin ucuz, aramotik yapısından dolayı çevresel ve kimyasal açıdan kararlı, yapısındaki azot atomu sayesinde optik, elektriksel özelliklere sahip olması ve bifenil grubundan oluştuğu için poli(p-fenilen) polimerlerinden daha düşük band aralığına sahip polimerler verebilmesi gibi bir çok üstünlüklere sahiptir. Polimerizasyonu sırasında, genelde 3- ve 6-pozisyonlarından bağlanmalarla poli(3,6-karbazol) polimerleri elde edilirken 2- ve 7-pozisyonlarından bağlanarak poli(2,7- karbazol) türevleri de elde edilebilir. Bu polimerlerin özellikleri ve uygulama alanları farklıdır [1,2]. Daha önce yapılan çalışmalarda, polianilinin elektrokimyasal sentezi diklorometan ortamında gerçekleştirildi ve bazı fenolik bileşiklerin tayini için modifiye yüzey olarak kullanıldı[3,4].

Bu çalışmada, diklorometan / 100 mM tetrabutilamonyumperklorat(TBAP) / 1.0 mM karbazol / 50.0 – 200 mM anilin içeren polimerizasyon çözeltisi kullanılarak polikarbazol – polianilin (PC – PANI) kopolimerinin elektropolimerizasyonu ayrıntılı olarak ilk kez çalışıldı ve optimum polimerizasyon şartları belirlendi. Hazırlanan PC – PANI modifiye elektrodunun sulu ve susuz ortamlardaki davranışları incelendi. Elektroaktivitesi en iyi olan film belirlendi. Sentezlenen kopolimer filminin karakterizasyonu UV-vis, FT-IR, Raman, SEM ve EDS yöntemleri ile gerçekleştirildi. Elde edilen modifiye elektrot üzerinden, hidrokinonun $NaHSO_4$ / Na_2SO_4 ortamda elektrokimyasal davranışı incelendi ve homopolimerleri ile karşılaştırıldı.

Anahtar Kelimeler: Kopolimer, Polianilin, Polikarbazol.

FIGURES/ŞEKİLLER

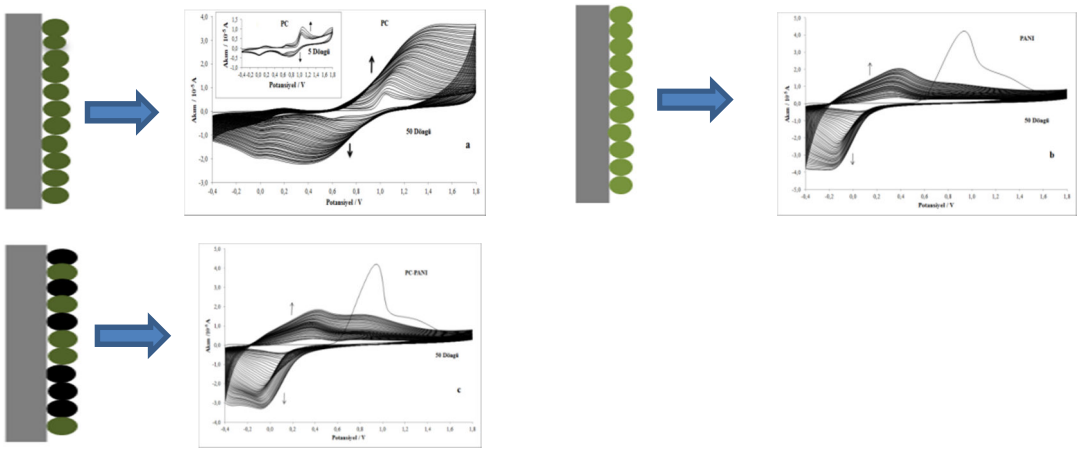


Figure.1. Cyclic voltmmograms of a) Polycarbazole (PC), b) Polyaniline (PANI), c) Polycarbazole- Polyaniline (PC-PANI) on Pt electrode using CH_2Cl_2 polymerization solution containing 100 mM tetrabutylammonium perchlorate (TBAP) /1.0 mM carbazole/ 33 mM $HClO_4$; 100mM TBAP / 50 mM aniline / 33 mM $HClO_4$; 100 mM TBAP 1.0 mM carbazole/ 50 mM aniline / 33 mM $HClO_4$, respectively.

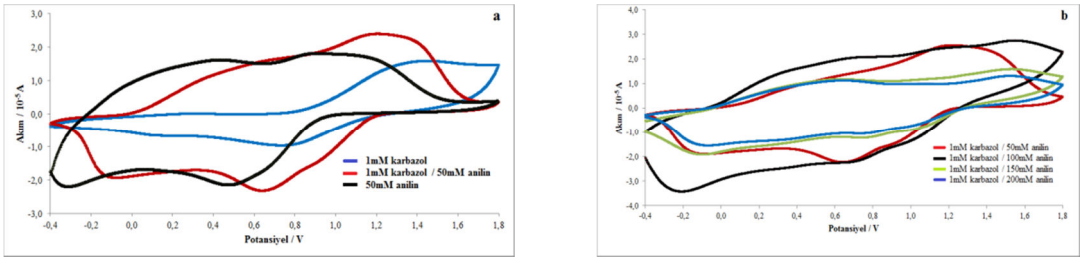


Figure 2. Blank solution voltammograms of a) PC, PANI, PC-PANI b) PC – PANI films obtained depending on the increased aniline concentration.

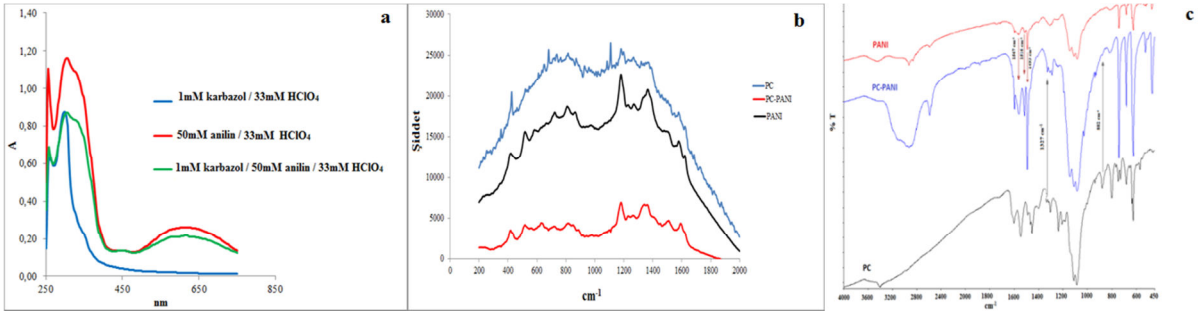
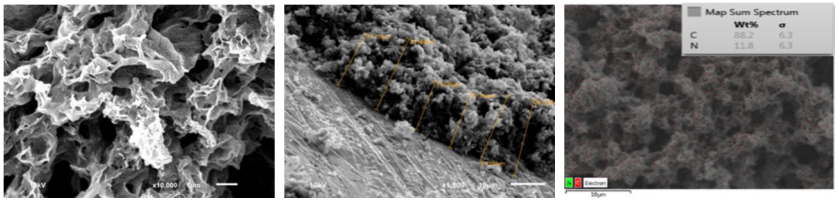
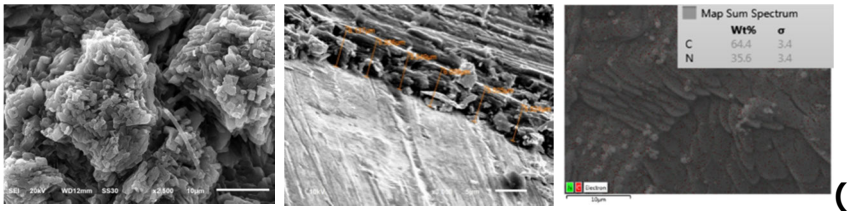


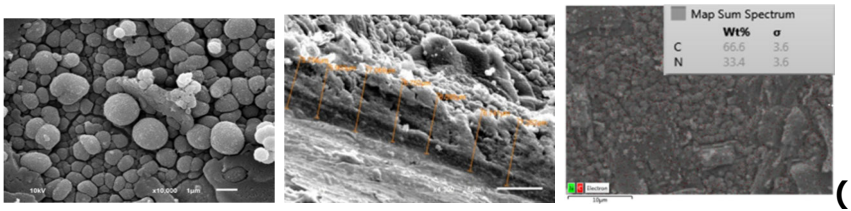
Figure 3. a) UV-vis, b) Raman and c) FT-IR spectrums of PC, PANI and PC –PANI films.



(PC)



(PANI)



(PC-PANI)

Şekil 4. SEM images and EDS spectrums of PC, PANI and PC –PANI films.

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