

SYNTHESIS AND INVESTIGATION OF BENZIDINE ANILINE AND BENZIDINE O-ANISIDINE COPOLYMERS WITH PANi LIKE STRUCTURE

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Conductive polymers are considered an important and innovative class of materials due to their significant impact on the field of polymers. These materials are characterized by extensive conjugation along their backbone, featuring alternating single and double bonds [1]. PANi and polymers synthesized from aromatic diamines are particularly notable among electroactive conjugated polymers. This distinction stems from their excellent environmental stability, simple and cost-effective synthesis methods, unique characteristics, and wide-ranging applications [2-4].

The studies show that conductive polymers can be obtained by using the method of oxidative polymerisation of aromatic diamines. However, the synthesized polymers were largely insoluble and displayed low electrical conductivities. In such cases copolymerization offers a facile route to the preparation of polymers with specifically desired properties [5,6]. The simple and inexpensive one-pot oxidative polycondensation of benzidine with aniline and o-anisidine has been done, to have PANi-like structured polymer with precise control over the ratio of quinonedimine and aryleneimine units [7].

The composition of the resulting copolymers was analyzed by proton magnetic resonance (PMR) spectroscopy for initial benzidine-to-o-anisidine molar ratios of 1:0.5, 1:1, and 1:2. The study demonstrates that the physico-chemical properties of the copolymers—including ultraviolet-visible (UV-Vis) absorption characteristics, solubility, thermal stability, electrical conductivity, and morphology—can be tuned by adjusting the ratio of quinonedimine to substituted structural units within the polyaniline (PANi)-like chains. The copolymers exhibited high thermal stability, retaining 66–72 % of their weight up to 600 °C. When doped with hydrochloric acid (HCl), their electrical conductivity was comparable to that of the parent homopolymers, polyaniline and polyanisidine. These findings suggest the potential of structural modulation to enhance the functional performance of PANi-based copolymers for advanced materials applications.

Keywords: Conductive polymer, aniline, o-anisidine, benzidine, copolymerisation

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- [1] J. Huang, R.B. Kaner *Conjugated polymers: Theory, synthesis, properties, and characterization* (3rd ed.), CRC Press, Boca Raton (FL) (2006)
- [2] A. Janošević, B. Marjanović, A. Rakić, G. Ćirić-Marjanović *Progress in conducting/semiconducting and redox-active oligomers and polymers of arylamines* J Serb Chem Soc., 78 (11) (2013), pp. 1809-1836
- [3] A.G. MacDiarmid, A. Epstein *Polyanilines: The new class of conducting polymers* Faraday Discuss Chem Soc., 88 (1989), pp. 317-332
- [4] X.G. Li, M.R. Huang, W. Duan, Y.L. Yang *Novel multifunctional polymers from aromatic diamines by oxidative polymerizations* Chem Rev., 102 (9) (2002), pp. 2925-3030
- [5] Y. Wei, R. Hariharan, S.A. Patel *Chemical and electrochemical copolymerization of aniline with alkyl ring-substituted anilines* Macromolecules., 23 (3) (1990), pp. 758-764
- [6] U.S. Waware, R. Arukula, A.M.S. Hamouda, et al. *Cyclic voltammetry and XPS studies of poly (aniline-co-3-aminophenol)* Polym. Bull., 80 (2023), pp. 3897-3910.
- [7] P. Minasyan, Sh. Vardanyan, N. Durgaryan, G. Grigoryan, *Synthesis and investigation of benzidine – aniline and benzidine – o-anisidine copolymers with PANi like structure*, European Polymer Journal, Volume 239, 2025, 114249, ISSN 0014-3057,