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SYNTHESIS AND CHARACTERIZATION OF A CONJUGATED MULTIFUNCTIONAL OLIGOMER DERIVED FROM PARA-PHENYLENEDIAMINE AND CATECHOL

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Abstract. A *p*-phenylenediamine–catechol-based oligomer was synthesized *via* oxidative polycondensation in an acidic medium under ultrasonic irradiation, employing potassium persulfate as the oxidant to obtain an oligomeric material. The resulting material was characterized by Fourier-transform infrared (FT-IR) spectroscopy, ultraviolet–visible (UV-Vis) spectroscopy, thermogravimetric analysis (TGA), nuclear magnetic resonance (NMR) spectroscopy, scanning electron microscopy (SEM), X-ray diffraction, and electron spin resonance (ESR) spectroscopy. FT-IR and NMR analyses confirm that the reaction conditions (with and without surfactant, in presence of ethanol) significantly affect the composition of the resulting materials. It was established that, depending on the reaction conditions, the formation of a trimer composed of two *para*-phenylenediamine units and one catechol moiety, as well as the formation of poly-1,2-dihydroxybenzene, occurs in different ratios. No products of the individual polycondensation of *p*-phenylenediamine were detected. UV-Vis spectroscopy indicates wide-band-gap semiconducting behavior, with an optical band gap of approximately 4.7 eV estimated from the Tauc plot analysis. TGA shows the oligomer is stable up to ~270°C. SEM revealed an irregular, predominantly flake-like fragmented surface morphology without well-defined individual particles. ESR confirmed unpaired electrons within the oligomer structure. Temperature-dependent conductivity measurements revealed an unusual conductivity trend, where conductivity slightly increased with decreasing temperature within the investigated range. At room temperature, the measured conductivity is 1.06×10^{-7} S/cm.

Keywords: polycatechol, 1,4-diaminobenzol, 1,2-benzenediol, potassium persulfate, oxidative polymerization.

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