

## SYNTHESIS AND CHARACTERIZATION OF A THERMOSTABLE CONDUCTIVE NANO- SIZED OLIGOMER DERIVED FROM P- PHENYLENEDIAMINE AND CATECHOL

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**Abstract.** A *para*-phenylenediamine–catechol-based oligomer was synthesized *via* oxidative polycondensation in an acidic medium under ultrasonic irradiation, employing potassium persulfate as the oxidant to obtain a nanosized product. 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 (XRD), 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. The formation of a trimer composed of two *para*-phenylenediamine units and a catechol moiety in the quinonoid form was identified, along with the formation of poly-1,2-dihydroxybenzene. Notably, no products of the individual polycondensation of *para*-phenylenediamine were detected. UV-Vis spectroscopy indicates optical absorption behaviour characteristic of a semiconductor-like band gap (3.67 eV). Thermogravimetric analysis shows the oligomer is stable up to ~270°C. Scanning electron microscopy (SEM) revealed uniform, spherical nanoparticles 80–150 nm in diameter, characterizing the surface. Electron spin resonance (ESR) confirmed unpaired electrons within the oligomer structure. The main finding is that the material's conductivity increases as temperature decreases, a behaviour characteristic of metals. At room temperature, the measured conductivity is  $1.06 \times 10^{-7}$  S/cm.

**Keywords:** dodecylamine, *poly*-aniline, *p*-phenylenediamine, 1,2-benzenediol (catechol), potassium persulfate, oxidative polymerization.