

Title : Synthesis of poly(2,6-dimethyl-1,4-phenylene oxide) by oxidative coupling

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ABSTRACT

In this research project, poly(2,6-dimethyl-1,4-phenylene oxide) (PPO) was synthesized via the oxidative coupling using a Cu(II)-amine catalytic system under oxygen atmosphere in order to study various factors affecting the reaction rate. The factors investigated included different isomer of dimethylphenol monomers, stirrer speed, type of amines, catalyst concentrations and temperatures. The results showed that substitution of dimethyl on the phenolic ring has profound affected on the reaction rate. At room temperature, 2,6-dimethylphenol provided the highest reaction rate of $3.3 \times 10^{-3} \text{ M} \cdot \text{min}^{-1}$. Viscosity-average molecular weight (\bar{M}_v) showed 1.62×10^5 and 90% yield was obtained. In contrast, other isomers exhibited obviously slower reaction rates and lower molecular weights. Increasing both stirrer speed and catalyst concentration significantly enhanced the reaction rate as expected since this oxidative coupling is zero-ordered kinetic reaction. In addition, monodentate amine ligands facilitated the formation of a Cu(II)-amine complex suitable for catalysis at ambient temperature. $^1\text{H-NMR}$ and ATR-FTIR confirmed that this synthesized polymer corresponded to poly(2,6-dimethyl-1,4-phenylene oxide). DSC analysis revealed high melting point in range of 205-235 °C, which is consistent with the thermal properties of PPO and very useful in a high-performance engineering thermoplastic applications. These results demonstrate the various factors affecting the reaction rate and provide guidance for determining optimal conditions for the synthesis of poly(2,6-dimethyl-1,4-phenylene oxide).

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