Synopsis of Original Research Paper

# Controlled Radical Polymerization of Polyphenol-Inspired Polymers with High Antioxidant and Antibacterial Properties

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Polyphenols are plant-derived chemicals with more than or equal to two phenolic hydroxy groups by the Quideau definition. These molecules usually have both catechol and gallol groups in their chemical structures, that play key roles in their antioxidant and antibacterial activities. Inspired by this, I synthesized gallol-functionalized polymers via controlled radical polymerization for the first time. The reversible addition–fragmentation chain transfer (RAFT) polymerization of 3,4,5-trimethoxystyrene was carried out using cyanomethyl dodecyl trithiocarbonate as the chain transfer agent. This method produces well-defined polymers with a wide range of molecular weight (from 5.4 to 53.4 kg $mol^{-1}$) and low polydispersity index ($Mw/Mn < 1.3$). Subsequent demethylation of poly(3,4,5-trimethoxystyrene) yields poly(3,4,5-trihydroxystyrene) (polyvinylgallol, PVGal). These newly synthesized polymers exhibit greater antioxidant activities than widely used catechol-functionalized polymers based on the 2,2-diphenyl-1-picrylhydrazyl radical (DPPH), 2,2'-azinobis(3-ethylbenzothiazoline-6-sulfonic acid) (ABTS), and oxygen radical absorbance capacity (ORAC) methods. Given this high antioxidant property, the effective use of gallol-functionalized polymers in biomaterials is expected.