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Synthesis and application of novel hyper branched polymers via catalytic chain transfer polymerization

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Hyperbranched polymers are a relatively new class of macromolecule that exhibit a wide range of possible applications due to their unique structures and properties [1]. Polymers made from di-functional acrylates and methacrylates, including tricyclo[5.2.1.02,6]decanedimethanol diacrylate, (tCDDdA) have found application in the realm of highly Bacterial Attachment Resistant (BAR) materials due to their weakly amphiphilic nature and rigid pendant groups[2].; meanwhile, hyperbranched copolymers of divinylbenzene and lauryl methacrylate have been shown to deliver higher levels of wear reduction and film-formation in mechanical parts than their linear counterparts. There has also been interesting in utilizing the three-dimensional structure and inherently low viscosity of the hyperbranched poly (ethylene glycol) (PEG) polymers as additives to ink for additive manufacturing, to reduce curing times and improve interlayer adhesion. Through the use of catalytic chain transfer polymerization (CCTP) with a cobalt chain transfer agent (CTA), the synthesis of high BAR materials, high performance lubricants and hyperbranched ink additives are scaled up, with the aim of proving the industrial and commercial viability of these polymers and to allow further investigation and testing of the bulk properties of these materials. Additionally, dielectric property measurements are used to follow a CCTP polymerization, to help ensure the hyperbranched architecture remains constant batch-to-batch, and to maximize the possible yield while minimizing the risk of gelation.

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