End functional polymers and miktoarm copolymers
by controlled polymerization methods

Dr. Prakash P. WADGAONKAR

Polymers and Advanced Materials Laboratory, Polymer Science and Engineering Division,
National Chemical Laboratory, Dr. Homi Bhabha Road, Pune 11008, India.
e-mail: pp.wadgaonkar@ncl.res.in – tel: +91-20-25902306 – fax: +91-20-25902615

End-functional polymers and miktoarm copolymers are of great interest as they find applications as precursors to block copolymers and as rheology modifiers, respectively. End-functional polymers and miktoarm copolymers could be prepared using different techniques such as anionic and cationic polymerizations but due to stringent reaction conditions and some limitations associated with these techniques, polymer chemists have shifted their interest in recent times to controlled radical polymerization methods such as RAFT, NMP and ATRP. Of these techniques, ATRP is a robust and versatile synthetic technique which allows preparation of molecular brushes, stars, block copolymers, and end functional polymers with high chain end fidelity and precisely controlled structures.

We have designed and synthesized several new functional group containing ATRP and ROP initiators and multifunctional initiator cores possessing different types and specific number of initiating site for preparation of miktoarm copolymers. Commercially available 4,4’-bis(4-hydroxyphenyl) pentanoic acid, which in turn is derived from levulenic acid – a platform chemical obtained from biomass- and 5-hydroxy isophthalic acid were used as the starting materials. Both 4,4’-bis(4-hydroxyphenyl) pentanoic acid and 5-hydroxy isophthalic acid contain phenolic and acid groups which were effectively utilized in various aspects of chemical transformations for synthesis of the desired initiators. New initiators for ROP and ATRP containing various functional groups such as allyloxy, aldehyde, propargyloxy, and azido were designed and synthesized. These functionalized initiators were utilized for synthesis of end-functional polymers. The MFI-cores were designed and synthesized using simple organic transformations and utilized to obtain miktoarm copolymers (A2B, AB2, A2B2, and A3B) via combination of suitable polymerization techniques.\textsuperscript{[1-4]}

References