MSE-3: Star Polymer Synthesis *via* Robust Living Polymerizations for Potential Hydrogel Applications

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Problem Statement:

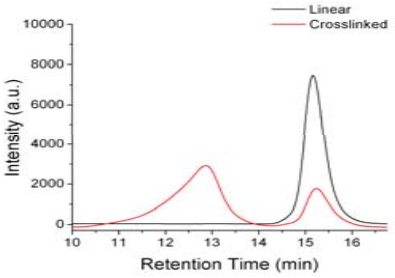
What are the effects of reaction time, air, concentration and crosslinker structures on the yield and architectures of star polymers synthesized through PET-RAFT polymerizations?

Approach:

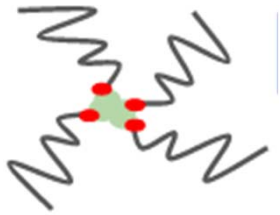
Correlated reaction yields and characterization data with synthesis conditions:

- Synthesized & crosslinked poly(tBA) using PET-RAFT system.
- Determined polymer yields, dispersities, molecular weights and sizes with NMR, SEC and DLS analysis.
- Compared yields, dispersities, and molecular weights of all samples to find optimal synthesis conditions.

Results:



Comparison of linear and crosslinked (star) poly(tBA)



Structure of star polymer. Green represents the crosslinker, red the CTA

- SEC – Used to determine polymer yields, polydispersities and average molecular weights; narrow dispersities of star polymers (1.1-1.2) achieved.
- NMR – Confirmed reaction yields; high yields (>70% conversion) possible with PET-RAFT.

Discussion & Conclusions:

- Each set of synthesis conditions resulted in different molecular weight distributions and yields.
- Small molecule, high functionality, acrylic crosslinkers found to be most efficient in PET-RAFT system. Allylic crosslinkers were least effective.
- Anaerobic reactions gave high yields with narrower PDIs compared to reactions run in the presence of air.
- Gelling of reactions dependent on concentration of reaction mixture. High monomer concentration increased tendency of gelling.

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