

Keynote Presentation

Marc Hillmyer, Director, Center for Sustainable Polymers, University of Minnesota

Biobased polymers are a very small fraction of the over \$400 billion global polymer market. The goal of the Center for Sustainable Polymers is to develop sustainable alternatives to petroleum-based polymers. A significant requirement is that sustainable polymers have equal or better performance than incumbent polymers, competitive cost, and can be easily and safely recycled or degraded.

He presented the Center's successful program to develop a fully functional, renewable, and degradable ABA triblock copolymer utilizing PLA and menthol. This new block copolymer is a viable alternative to traditional petroleum-based styrene block copolymers that are used for pressure-sensitive adhesives and as TPEs (thermoplastic elastomers) for polymer modification.

Opportunities for safer chemicals & products

- Finite resources will necessitate that sustainable polymers be the economic alternative to macromolecular materials based on fossil fuels.
- There are significant opportunities for conversion of biomass to new monomers. These are then converted to targeted polymers via controlled polymerization which are then used to create hybrid polymers.

Key drivers

- Most polymers are derived from non-renewable fossil resources. Their disposal at end of life presents significant environmental problems. This is driving the public, academics and industry to look for viable sustainable alternatives.

Challenges for implementation

- Need to engage interested and disinterested public
- Need industry participation. Their engagement is critical for funding and insight.
- Need to develop and design new polymers and hybrid polymers that meet/balance the three "E"s. An example is their work to create lower cost alternatives to menthol. Work was done to create a cyclic ester and then further polymerize to arrive at a PLA-PM-PLA block co-polymer. The material is still higher cost, but work continues on beta menthyl and valerolactone to bring the third "E" into the fold.

Helpful actions to advance green chemistry (e.g. policies, education, partnerships)

- The Center for Sustainable Polymers has a very active community outreach and education program to mainstream green chemistry. Examples: Minnesota State Fair Sustainability Eco-exhibit, 4H program, secondary school teacher education program.
- There are also active programs beyond the classroom. They invite local companies to present information about their green chemistry activities and collaborate with industry partners.

Role for the GC3 in advancing green chemistry

- There is a need to mainstream green chemistry at academic institutions. The key is to bring sustainability training and thought processes to the forefront of science programs.
- There is a need for continued visibility and outreach on green chemistry.