Development of Multi-Lock Biopolymers Degradable in Ocean From Non-Food Biomasses

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Implementing organizations : The University of Tokyo, Mitsubishi Chemical Corporation, Bridgestone Corporation, Teijin Limited, Kureha Corporation, Kyushu University, Nagoya University, Yamagata University, Research Institute of Innovative Technology for the Earth (RITE), National Institute of Advanced Industrial Science and Technology (AIST), Ehime University, Tokyo Institute of Technology

Nagoya University
Development of Degradable Polymers Based on Plant-Derived Renewable Resources

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We are developing novel biobased polymers with excellent properties from plant-derived renewable resources and multi-lock polymers having degradable units in the polymer chains by precision polymerization.

(1) Novel Biopolymers from Non-Food Biomasses

The synthesis of vinyl and cyclic compounds from non-food biomasses and their precision polymerizations will provide novel biopolymers with unique properties.

(2) Degradable Vinyl Polymers

Precision copolymerization of vinyl and cyclic monomers will enable the synthesis of vinyl polymers with degradable units in the main chains.

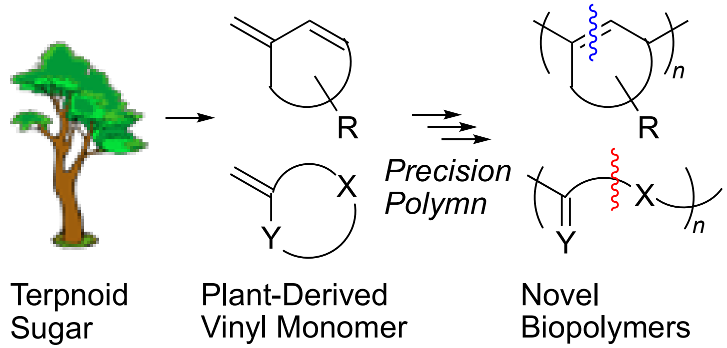
(3) Multi-Lock Biopolymers

Multi-lock biopolymers with multi-degradable units will be prepared by precision copolymerization of plant-derived monomers with different cleavable bonds.

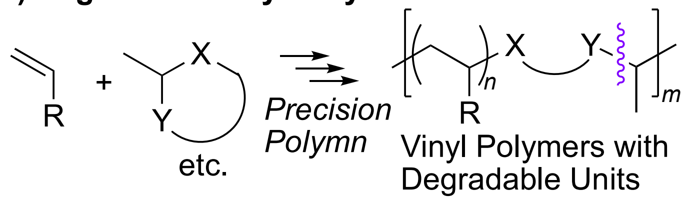
Final Goals in FY 2029

We aim to establish synthetic technology for degradable biopolymers from plant-derived renewable resources by developing original multi-lock mechanisms.

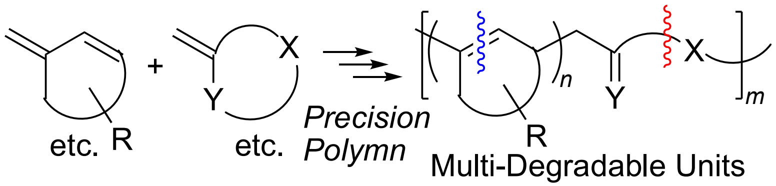
(1) Novel Biopolymers from Non-Food Biomasses



(2) Degradable Vinyl Polymers



(3) Multi-Lock Biolymers



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(1) Novel Biopolymers from Non-Food Biomasses

Highly Reactive Monomers from Plant-Derived Terpenoids and High Heat-Resistant Polymers by Living Cationic Polymerization

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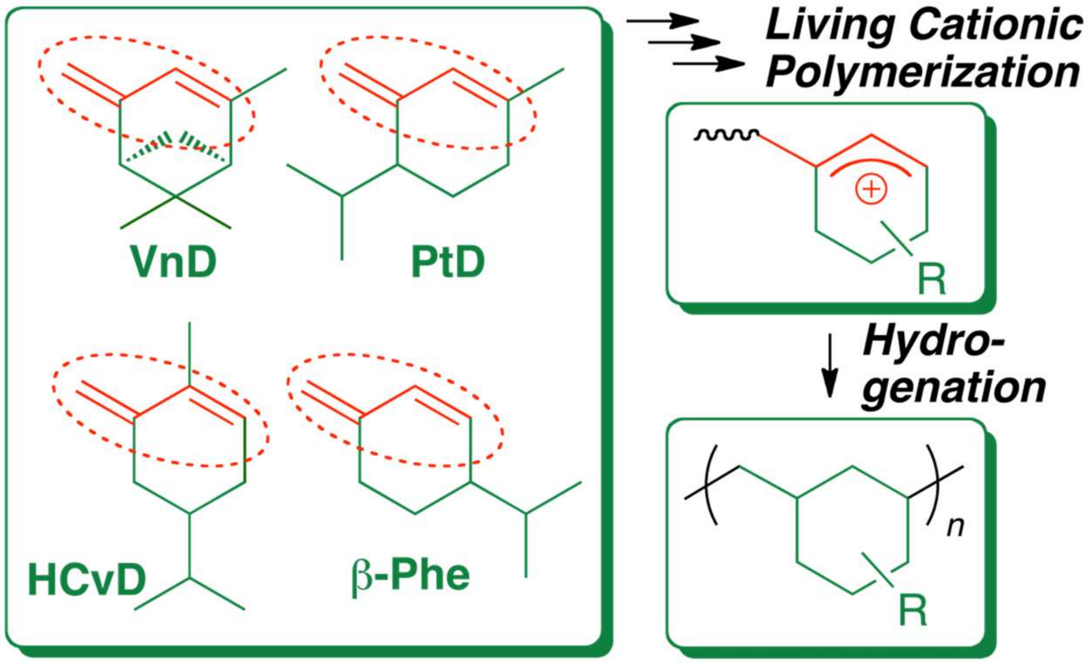
Verbena → VnD   Eucalyptus → PtD

Spearmint → HCvD   Angelica → β-Phe



Biobased exo-Methylene Conjugated Diene

Biobased Cycloolefin Polymer

- Synthesis of *exo*-methylene conjugated dienes from main constituents of plant oils
- Novel biobased alicyclic unsaturated polymers by living cationic polymerization
- High heat-resistant biobased cycloolefin polymers by hydrogenation

Nishida, T.; Satoh, K.; Kamigaito, M. et al.
Polym. Chem. **2021**, *12*, 1186-1198. (**Front Cover**, **Hot Paper**)

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(2) Degradable Vinyl Polymers

Cationic Copolymerization of Cyclic Thioacetals and Vinyl Ethers and Degradable Vinyl Polymers Based on Main-Chain Thioacetal Linkages

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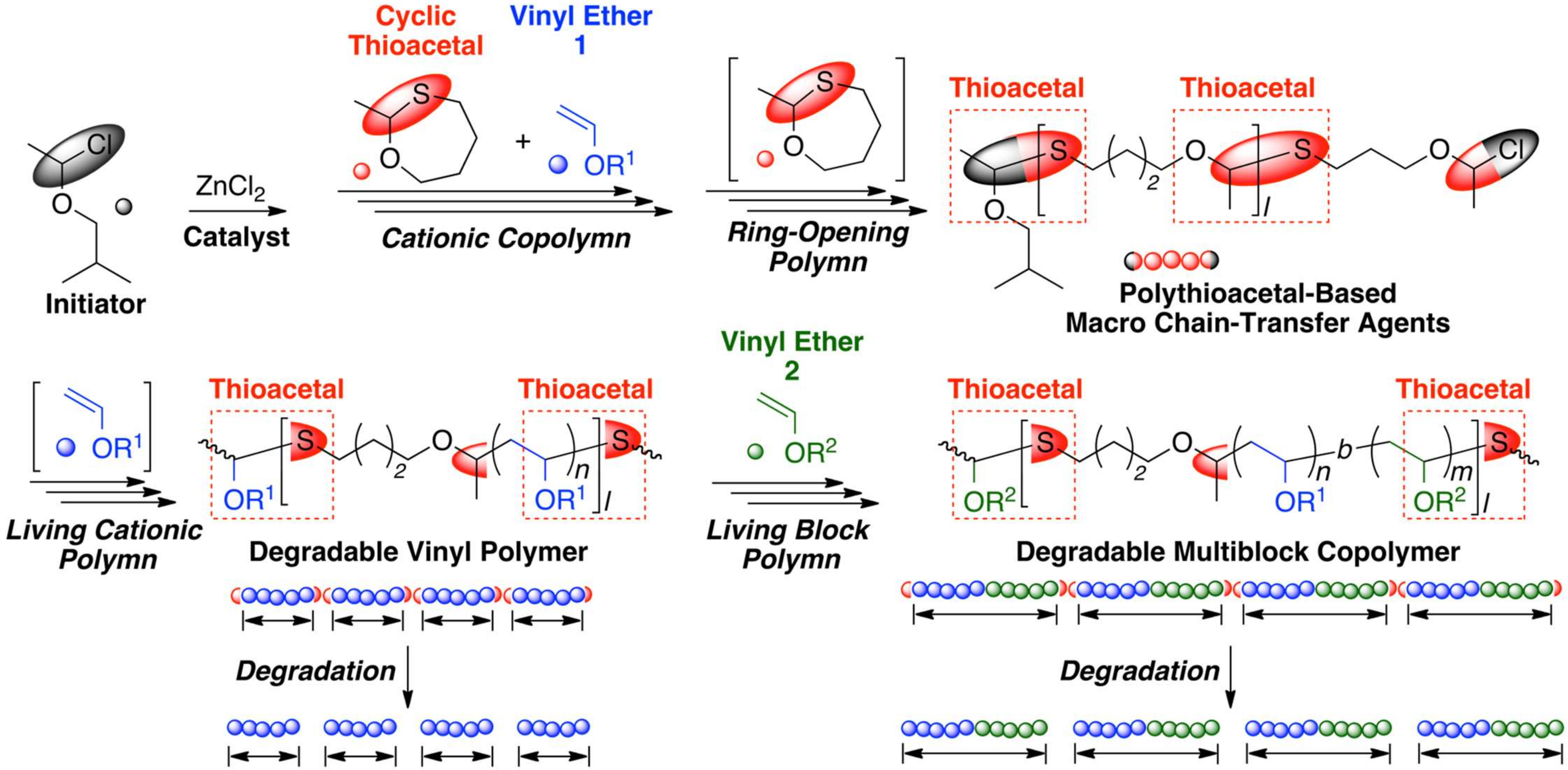

·Main-chain thioacetal linkages by living cationic copolymerization of cyclic thioacetals and vinyl ethers
·Degradable multiblock polymers by block polymerization of different vinyl ethers
·Degradation of vinyl polymers via cleavage of main-chain thioacetal linkages

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(3) Multi-Lock Biopolymers

Biobased Hydroxy-Protected Copolyesters Derived from Glycerol and Deprotection-Triggered Degradation of Polymer Main Chains

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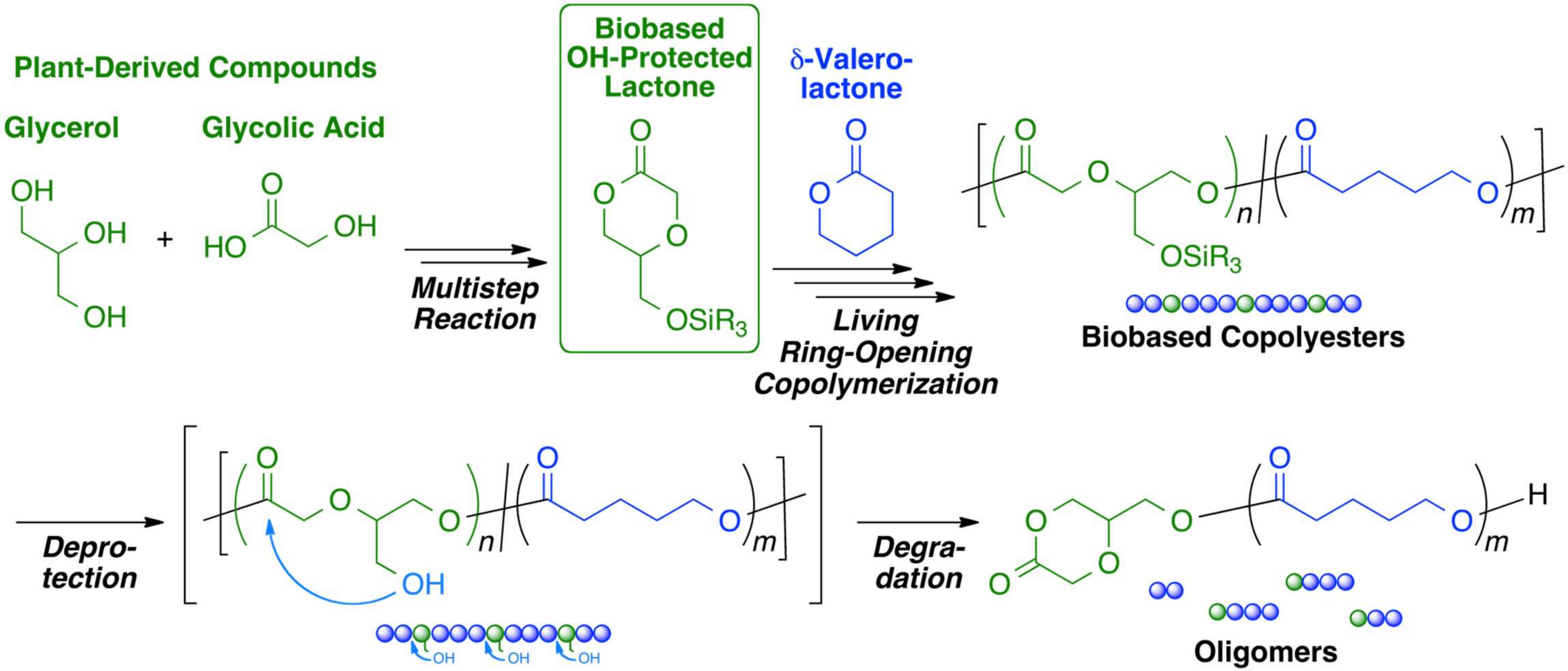

·Synthesis of hydroxy-protected lactone monomer from plant-derived compounds
·Biobased copolyesters with hydroxy-protected pendants by living ring-opening copolymerization of lactones
·Degradation of polymer main-chains triggered by formation of hydroxy pendants via deprotection

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