High Performance Bio-based Polymers Synthesized from Natural and *In vitro* Polymerized Polysaccharides

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Recently, our group succeeded to synthesize new thermoplastics from polysaccharides by linear and branched esterification and found interesting thermal and mechanical properties. Curdlan and paramylon are linear polysaccharides with β-1,3 linked glucose synthesized by *Alcaligenes faecalis* and photosynthesized by *Euglena*, respectively. A series of their ester derivatives with a degree of substitution of three were synthesized and their physical properties and structures were compared with those of linear ester derivatives. Branched ester derivatives had higher Tm than those of the corresponding linear esters. Highly transparent films, injection molding, and melt-spun fibers were prepared from linear and branched ester derivatives and their molecular and crystal structures were investigated by using wide-angle X-ray diffraction.

Furthermore, we succeeded the one-pot synthesis and development of unnatural-type bio-based polysaccharide, α-1,3-glucan. The synthesis can be achieved by *in vitro* enzymatic polymerization with GtfJ enzyme, one type of glucosyltransferase, cloned from *Streptococcus salivarius* ATCC 25975 utilizing sucrose, a renewable feedstock, as a glucose monomer source, via environmentally friendly one-pot water-based reaction. High thermal atabilized polymers were synthesized from α-1,3-glucan by esterification. A new type graft copolymer (α-1,3-glucan-*graft*-α-1,6-glucan) was further enzymatically synthesized and characterized.

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