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PRECISION SYNTHESIS OF FUNCTIONAL Polysaccharides by Enzymatic Polymerization

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Natural polysaccharides such as cellulose, starch, and chitin are widely distributed in nature and thus considered as the very important biomass resources. They can also be expected as biomedical materials comparable to proteins, but researches on their practical applications have been still devoted even in recent years. Therefore, the efficient methods for synthesis of functional polysaccharides have attracted much attention to provide new environmentally benign materials. Enzymatic polymerization approach has been identified as a powerful tool to provide polysaccharides with well-defied structure because it is progressed with highly controlled manner in regio and stereo-specificities. Phosphorylase-catalyzed enzymatic polymerization is one of the practically used approaches to synthesize well-defined polysaccharides, which is performed using α -D-glucose 1-phosphate (Glc-1-P) as a monomer and maltooligosaccharide as a primer to produce $\alpha(1 \rightarrow 4)$ -glucan, that is amylose. The author has reported the synthesis of amylose-grafted polymeric materials by chemoenzymatic approach, which is a combined method of the phosphorylase-catalyzed enzymatic polymerization with appropriate chemical reactions. The author has also found that by means of the phosphorylase-catalyzed enzymatic polymerization using analog substrates as monomers, well-defined polysaccharides with functional groups, such as amino group, are efficiently synthesized. Furthermore, amphoteric polysaccharides have been synthesized by the phosphorylase-catalyzed enzymatic polymerization. The products showed specific inherent isoelectric points (pls) and formed large aggregates in water at pH = pI, whereas disassembled at pH shifted from pl. These properties of the present materials are similar as those of proteins.



Biography

Jun-Ichi Kadokawa has completed his PhD in 1992. He then joined Yamagata University as a Research Associate. From 1996 to 1997, he worked as a Visiting Scientist at the Max-Planck-Institute for Polymer Research in Germany. In 1999, he became an Associate Professor at Yamagata University and moved to Tohoku University in 2002. He was appointed as a Professor of Kagoshima University in 2004. His research interests focus on polysaccharide materials. He received the Award for Encouragement of Research in Polymer Science in 1997 and the Cellulose Society of Japan Award in 2009. He has published more than 200 papers in academic journals.

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