Synthetic Studies of α-Glycosidic Sugar Chain Polymer (VI): Comparison of GlcNAc-containing Polymers with Different Structures

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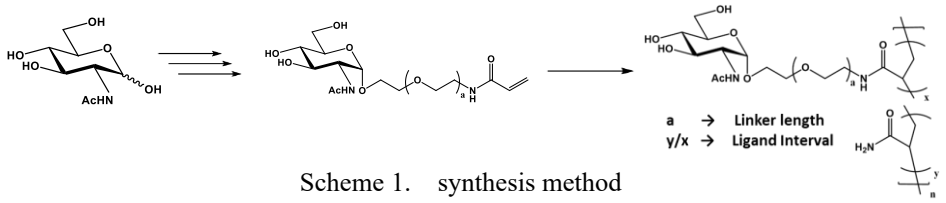
[Introduction]

O-linked oligosaccharides attached to proteins have many functions directly related to diseases and are very attractive targets for drug discovery, diagnosis, and research. However, chemical synthesis and expression are difficult because of the diversity of glycan structures and the three-dimensional structure of proteins.

In this study, we designed an easy-to-synthesize glycopolymer by mimicking the glycan moiety and replacing the protein moiety with a linear polyacrylamide. In addition, we synthesized and functionally evaluated α-glycosidic GlcNAc polymers, which have been rarely reported, targeting N-acetylglucosamine as the sugar chain, and compared them according to their different structures. In this report, we report the results of the comparative study on polymers with different structures.

[Experimental Methods]

Various polymers were synthesized by the method of Scheme 1. The binding affinity of the synthesized polymers to wheat germ agglutinin (WGA) was evaluated by the PL method.



Scheme 1. synthesis method

[Results and Discussion].

A total of 18 α-glycosidic GlcNAc polymers with different structures were systematically synthesized by radical copolymerization of sugar monomers and acrylamide (AAm) in the preparation ratios of 1:0, 1:1, 1:5, 1:10, 1:15, and 1:20, with linker lengths of a = 0, 1, and 2.

The relationship between the composition ratio (AAm/GlcNAc) and binding affinity constant (Ka) is summarized in Fig. 1.

The binding affinity constants of the polymers with long linkers are larger than those of the polymers with short linkers. It was found that there is an optimal ligand spacing.

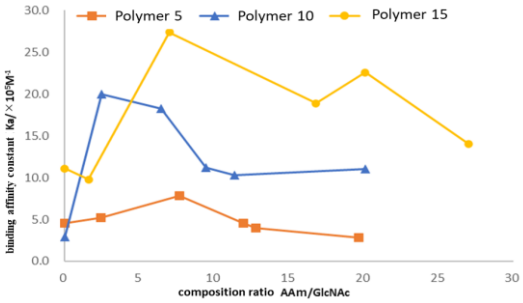


Fig.1. Relationship between polymer composition ratio and binding affinity