Solution Properties of Acetylated Dextran Studied by Light Scattering and Optical Beam Deflection Method

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1. Introduction

Dextran, a soluble water polysaccharide consisting predominantly of α-1,6-glucosidic linkages has a long history in biomedical usage. Modified of polysaccharides are an interesting for designing new materials with applications in biomedicine. Hydroxyl groups in glucose repeating units have been replaced with acetylated groups to trigger theirs properties. Altering of thermal and mechanical properties have already shown in the acetylated polysaccharides [1-2]. Initially, the influence of acetylation degree on solution properties have investigated in this study.

2. Experimental Method

Ac-DEXs were synthesized by the reaction of dextran (M_w of 40 kg/mol) with various amounts of acetic anhydride to change the acetylation degree (0 to 26.42%) in the present of pyridine at 50 ºC for 24 hour. Ac-DEXs were dissolved in water to study the solution properties.

Light scattering experiment was performed at 25ºC with sample concentration of 2-10 gL^{-1}

Thermal diffusion property was studied at temperature range of 20-50 ºC with10 gL^{-1} by an optical beam-deflection method.

3. Results and Discussion

The M_w and R_g of dextran increased due to the acetylation process as showed in Table 1. When dissolved in water, Ac-DEXs can self-aggregate due to intra- and/or intermolecular hydrophobic interactions. The positive second virial coefficient (A_2) of modified samples implied that water is a good solvent for the modified dextran.

The Soret coefficient, S_T, of all samples significantly increase with increasing of temperature. Moreover, the increase of S_T, were observed with increase of acetylation degrees. This indicates that the hydrogen bonding between polysaccharide molecules and water are broken by heating and substitution of acetylated functional groups.

Table 1. M_w, R_g, and A_2 of Ac-DEX solutions with different degree of acetylation

% Acetylation	M_w (kg/mol)	R_g (nm)	A_2 (mol×L/g^2)
0	41.8	14.3	0.00064
4.62	58.6	84.0	0.00087
9.62	43.8	82.2	0.00106
17.11	42.0	76.3	0.00079
20.85	45.2	62.6	0.00180
26.43	44.4	44.7	0.00034

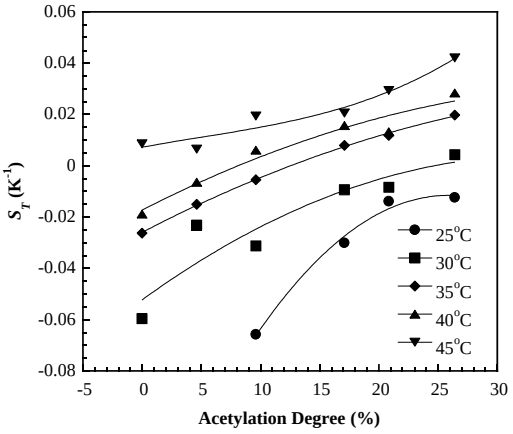

Figure 1. S_T of Ac-DEX solutions with different degree of acetylation

4. Conclusion

Acetylation process can induce the formation of self-aggregate, rendering the increasing of molecular weight and radius of gyration. Hydrogen bonding between polysaccharide molecules and water can be destroyed by substitution of acetylated groups on hydroxyl groups in dextran molecular chains.

Acknowledgement

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References

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