Conformational studies on arabinogalactan by SAXS

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Arabinogalactan (AG) is a variety of polysaccharides commonly found in plants or microorganisms. It is rich in galactose and arabinose residues but with high structural complexity because of multiple linkages on the galactan backbone, high possibility of branch substitution, and diversity of residues on the branches, etc. Many AGs from several plant materials have been studied over years in terms of their primary structures and functionalities. However, its conformation-related studies did not receive much attention probably because of obstacle to scattering technique choices since the molecular size of AGs is relatively small due to its low molar mass and high branching degree. This makes small-angle X-ray scattering (SAXS) become a suitable choice for studying the conformation of AGs in dilute solutions.

In recent years, we isolated a 1,6-linked galactose-dominant AG from jasmine tea post-treatment waste (JSP-1a) [1]. Meanwhile, a larch tree arabinogalactan with a 1,3-linked galactan backbone (LAG60) and a linear 1,4-linked galactan with few arabinose residues (LG) were chosen for comparative analysis. The form factor $P(q)$ was evalualted as a function of the magnitude q of the scattering vector with the aid of the Berry plots. The resulting $P(q)$ data were analyzed with the Kratky plot (Figure 1) to estimate their conformations in different solvents, including 0.1 M NaCl aqueous, HBSS(-), and dimethylacetamide/0.1 M LiCl. Furthermore, the corresponding triphenylcarbamates (LAGTPC and LGTPC) in tetrahydrofuran were also studied.

Each polysaccharide could maintain similar conformation in different solvents or after derivatization, which was indicated by using the same fitting model but different parameters. JSP-1a, LAG60, and LAGTPC could be fitted by the perturbed hyperbranched chain model, showing high flexibility of backbones and highly branched features. LG and LGTPC showed obvious linear flexible chain features, which could be fitted by the touched-bead worm-like chain model. Besides, the Flory viscosity factor in 0.1M NaCl aq of three polysaccharides proved their branched degree (LAG60: 6.42×10^{23} mol^{-1}; JSP-1a: 4.42×10^{23} mol^{-1}; LG: 1.70×10^{23} mol^{-1}).

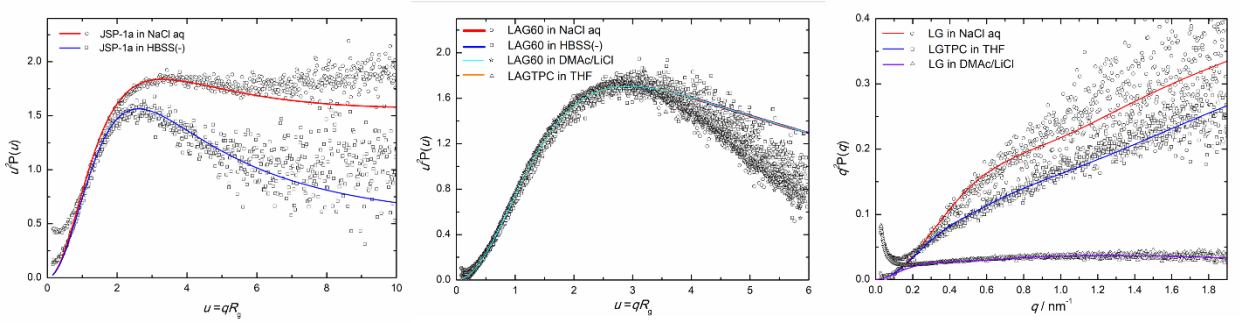

Figure 1: Kratky plots of JSP-1a, LAG60, LG, and corresponding triphenylcarbamates in solutions

References

[1] H. Huang, W. Zhang, *et al*., *Int. J. Biol. Macromol.*, **235**, 123816 (2023).

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