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Structural Characterization of Fucoidan in Aqueous Solutions by Small Angle X-ray Scattering

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1 Introduction

We find many kinds of electrolyte polysaccharides in seaweeds, as exemplified with carrageenan, alginate, which have sulfate groups and carboxyl groups. They are applied for food additives as increasing viscosity or gelling agent, because their aqueous solution gives high viscosity or gels at various conditions. Their properties are affected with the concentration of metal salts and/or their kind. These behaviors are related with the solution structure of polysaccharide and their assembly structure at molecular level or nano-scale.

Recently the fucoidan, having many sulfate groups, reveals various physiological activities, as antiviral, antitumor, and so on. In order to this kind of mechanism, it is very important to elucidate the structure of association between protein and electrolyte polysaccharide.

In this study structural characterization of marine polysaccharide, fucoidan, is performed by small angle X-ray scattering (SAXS) [1].

2 Experiment

The fucoidan sample, derived from *Turbinaria Ornata* species, was collected along the central coasts of Vietnam. This chemical composition was analyzed as consisting of fluctose and galactose with high content of sulfate.

SAXS experiments were carried out at Photon Factory, Tsukuba, Japan. The X-ray beam from synchrotron radiation was used. An incident X-ray beam was monochromatized to λ = 0.149 nm and focused to the position of the detector with a bent focusing mirror. The scattered X-ray was detected by Imaging Plate (IP) positioned at a distance of about 1 meter from the sample holder. The solutions were injected in a flat cell of 0.2 cm path-length made of glass with quartz windows (20 μm thick).

3 Results and Discussion

Figure 1 shows the Kratky plots ($q^2I(q)$ vs q, where $I(q)$ is scattering intensity and q is the magnitude of scattering defined by $(4\pi/\lambda)\sin(\theta)$ with λ the wavelength of incident beam, 2θ scattering angle) for 1% fucoidan in water and in 0.5M NaCl. The weak peak can be found in 0.4 nm^{-1} of q, due to the repulsive electrostatic interaction. This means that this fucoidan sample contains much amount of sulfate groups. The addition of saline, the effect shielding against that force, made the peak disappear. The maxim in 0.75 nm^{-1} indicates the chain thickness of fucaidan as estimated by about several nm.

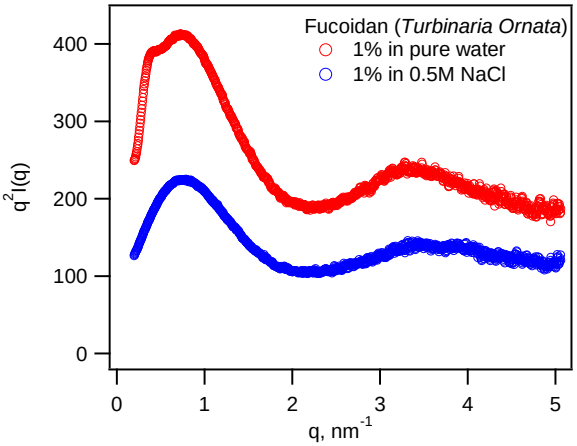

Fig. 1: Kratky plots for SAXS from fucoidan 1% in water and in 0.5M NaCl.

References

[1] Thanh Thi Thu Thuy, Tran Thi Thanh Van, Yoshiaki Yuguchi, Tran Thi Thanh Thuy, Bui Minh Ly and Nguyen Tien Tai, *Marine Drugs*, **11**, 2431-2443 (2013)

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