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Introduction

Gellan gum is a microbial polysaccharide derived from *Pseudomonas elodea*. It consists of a tetrasaccharide unit, β-D-glucose, β-D-glucuronic acid, β-D-glucose and α-L-rhamnose. It has been used as a texture modifier to control viscoelasticity in the food industry and as a culture medium in biotechnology because it forms a transparent gel which is resistant to heat and acid in the presence of calcium chloride. It is believed that gellan molecules take double helical conformations in solutions at lower temperatures, and above a certain critical concentration, they form aggregates which play the role of junction zones, resulting in a three-dimensional network.

In spite of previous extensive studies, the gelation mechanism of gellan gum solutions has not been clarified too well. As is often the case with biopolymers, the results obtained for different samples cannot be compared directly. Therefore, it is important to compare experimental results obtained from the same samples, because even a subtle difference in the position of the electrolytic groups or in molecular weight leads to a significant difference in physicochemical properties. It is well known in the history of the development of rheology that the distribution of NBS (National Bureau of Standards, USA) polyisobutylene has played an important role. Using the same sample, various groups participating in collaboration could compare their results, and thus made a great contribution to the establishment of a time–temperature superposition principle or a reduced variable method.

Based on the same idea, the research group on gellan gum has been organised by the Research Group on Polymer Gels affiliated to the Society of Polymer Science, Japan. Its aim is to elucidate the conformation of gellan gum in solution, gelation mechanism, and develop further industrial applications. The several laboratories involved have tried to conduct collaborative studies on gellan gum using a common sample, and the results were published in a special issue of *Food Hydrocolloids* (Vol. 7, No. 5, pp. 361–456, 1993). As is well known for polyelectrolytes, the metal content and type are decisive in determining solution and gel properties. Unfortunately, the metal contents in the gellan sample used in the above-mentioned collaborative studies were not low enough. Therefore, I asked Dr G.R. Sanderson of Kelco Ltd to prepare a great amount of purified sodium-type gellan in order to conduct collaborative studies. Quite a good sample of sodium form gellan gum with high purity was prepared and was distributed to 17 different laboratories. The contents of the inorganic ions Na^+, K^+, Ca^{2+}, and Mg^{2+}, were determined as Na^+: 3.03%; K^+: 0.19%; Ca^{2+}: 0.11%; and Mg^{2+}: 0.02%. The International Workshop on Gellan and Related Polysaccharides (IWGRP) was held on 14–15 November 1994 in Osaka, Japan, the aim being to bring about active communication about the newest topics of gellan gum or related polysaccharides between scientists, industrialists, and food technologists.

Although the works presented by foreign researchers did not use the common sample which Japanese researchers had used, active discussions occurred among participants. I believe that this special issue consisting of papers presented at IWGRP will be interesting for all our readers.

The paper of Nishi's group (1) demonstrates clearly the structure of junction zones in gellan gum by STM. They found that the length of gellan molecules was increased by adding cations. Kajiwara *et al.* (2) have studied the conformation of gellan gum in aqueous solutions by X-ray small angle scattering, and found that the thickness of junction zones formed in the presence of cations increased by adding cations. Whether the length of the molecules or the thickness of junction zones increases should be explored in the near future based on better characterised common samples.

The papers of Ogino's group (3), Nakamura's group (4) and Nishinari's group (5) report on the viscoelasticity of gellan aqueous solutions. Izumi's group (6) estimated the thickness of the aggregates of cylindrical molecules from X-ray small angle scattering using Oster–Riley theory. The paper of Tsutsumi's group (7) reports on the interaction of Mn(II) ion with gellan and with water molecules, studied by ESR and NMR.

The paper of Watanabe's group (8) reports the structural parameters determined from a pulse field gradient stimulated echo NMR method, and proposes a gelation mechanism.

The paper of Mashimo's group (9) reports a dielectric property of gellan aqueous solution by time domain reflectometry, and concludes that most water molecules in gellan gum aqueous solutions and gels are free water molecules. This is in quite good agreement with the conclusion of Watanabe's group. It seems that most water molecules in polysaccharide solutions and gels are in a state of free water and do not depend on the specificity of polysaccharide. For example, Ablett *et al.* (*J. Colloid Interface Sci.* Vol. 67, pp. 355–377, 1978), have observed a similar situation for agarose. All these papers used the common sample sodium-type gellan as distributed.

However, to determine the molecular weight and conformation, the common sample was not converted completely to sodium form. Ogawa (10) has performed the ion exchange and obtained the tetramethylammonium-type gellan. She determined the number average molecular weight of tetramethylammonium-type gellan by osmometry. Using the same sample of tetramethylammonium-type gellan, Kubota's group (11) determined the weight average molecular weight by laser light scattering, and discussed the conformational change of gellan gum in the solution.

Hatakeyama *et al.* (12) have studied the changes in freezing bound water in gellan aqueous system by differential scanning calorimetry (DSC) using a potassium-type gellan sample in which was used in the first collaborative works published in the special issue of *Food Hydrocolloids* mentioned above. Miyamoto *et al.* (13) have prepared a carboxymethyl gellan and tried to control the solubility of gellan.

Morris *et al.* (14) examined the effect of acyl substituents on the gelation behavior of gellan gum, and suggested that acetyl groups located on the periphery of the helix prevent the aggregation. Rinaudo *et al.* (15) studied the molecular weight and conformation by viscometry and light scattering. Nussinovitch (16) developed coating methods for fruits and vegetables using gellan films based on the function of partial barriers to moisture and gas exchange. Nishinari's group (17) studied the interaction between gellan gum and konjac-glucomannan by rheology and DSC.

I cannot fully transmit the atmosphere of IWGRP where the enthusiastic face-to-face discussions were done, but I hope that all these 17 papers based on the presentation at IWGRP will be interesting to the readers of this journal.

Katsuyoshi Nishinari
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