OS 3 - Molecular Characterization of Chitin and Chitosan by SEC-MALS

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The SEC-MALS (size-exclusion chromatography equipped with a multi-angle light scattering detector) method was applied to chitin and chitosan samples from various sources, and their molecular characteristics (e.g. molecular mass, molecular mass distribution, molecular conformation, chain stiffness) were investigated along with their concomitant intermolecular structures such as aggregates. Lithium chloride/N,N-dimethylacetamide (LiCl/DMAc) and aqueous acetic acid containing sodium nitrate were used as solvents for chitin and chitosan, respectively. First, the influence of degrees of N-acetylation (DNAc) on dispersion state of the samples in each medium was preliminarily examined. It was shown that heterogeneity of chemical structure of the sample definitely caused heterogeneity of the solution system for both cases, that is, even a slight amount of residual N-acetyl groups (as low as 2% DNAc) caused the presence of aggregates or insufficiently dispersed residues of chitosan in the solutions, and similar results were obtained for chitin/LiCl/DMAc system, where residual amino groups are the cause for aggregates. Then, chemically homogenous chitin/chitosan samples were prepared, and their molecular conformation and chain stiffness in each solvent were evaluated. The Benoit-Doty theory for wormlike polymer chains was applied to the data, and the persistence lengths qBD of around 10 nm were commonly obtained. These results were in good accordance with those from other cellulosic polysaccharides in various solvents, leading to an important conclusion that the characteristic of cellulosic main chain consisting of the β-1,4-glycoside linkage is the primary factor dominating their molecular conformations in solution state, and thus is expected to be an important factor also in the formation/property of higher structures.