

IMMUNOMODULATORY FRUCTAN LEVAN: CHEMICAL MODIFICATION FOR ANALYSIS OF SPATIAL STRUCTURE

Ilmara Vina, Aerna Karsakevich, Svetlana Gonta

Institute of Microbiology and Biotechnology, University of Latvia.
Kronvalda blvd. 4, LV-1586, Riga, Latvia.

The biological activity of biopolymers in solution is generally determined by the spatial structure of the polymer molecule. Very little information exists on the structural basis of the immunomodulatory activity of the bacterial fructose polymer levan. Oxidation with periodate ions is a successful method for structural investigations of the polysaccharides. Using this chemical method of modification, we studied the spatial structure of levan from the original *Zymomonas mobilis* strain 113S. It is known that some high molmass bacterial levans can be completely oxidized almost within 70 to 100 h [1]. However, we established that oxidation of high molmass levan synthesised by *Zymomonas mobilis* in sucrose medium [2], yielded dialdehyde derivatives with a maximum oxidation degree of 19-23 %. The absence of formation of hemialdals and hemiacetals, which can retard complete oxidation of levan, was shown by repeated re-oxidation cycles after corresponding reduction of oxidation products to polyalcohol with NaBH_4 . Therefore, we suggest that the low oxidation degree of levans is due to their highly branched structures (>1000 branches), which retard or prevent the approach of oxidant KIO_4 to the interior of the levan molecules. Moreover, such structures may be stabilized by hydrogen bonds between arranged carbohydrate chains, preventing levan oxidation. Based on these considerations, it is conceivable that fructosyl residues on the surface of levan molecule were preferably modified, and that hydrolysis of the glucosidic bonds during the entire period of oxidation did not occur. We found that the viscosity of slightly acidic levan solutions (pH 3.8-4.0) did not decrease within 120 h. The observed effect of the unusually low maximal oxidation degree of bacterial levan has an important role in our research, as only the reducing ends of the chain, which are arranged on the surface of the levan molecule, have a predominant significance for the immunological activity of bacterial levans [3]. It seems therefore reasonable to suggest that high molmass fructans from *Zymomonas mobilis* 113S with branched morphology exist as compact globular-shaped molecules in aqueous solutions, and that such spatial structures may be responsible for their immunomodulatory activity.

References

- [1]. Gonta, S., Karsakevich, A., Vina, I. Proc. Latvian Acad. Sci., B, 53 (3), 1999, 290-294.
- [2]. Vina, I., Bekers, M., Karsakevich, A., Linde, R., Gonta, S., Toma, M. In: Proceedings of the International Conference, Biomass for Energy and Industry, Würzburg, Germany, June, 460-463, 1998.
- [3]. Vina, I., Karsakevich, A., Bekers, M., Gonta, S., Neilands, O., Utinans, M. In: Book of Abstracts, XVth EFMC International Symposium on Medicinal Chemistry, Edinburgh, September, 170, 1998.