EFFECTS OF ELECTROLYTE ON GELLAN, MONITORED BY DIFFERENTIAL SCANNING CALORIMETRY

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The extracellular polysaccharide, gella gum is obtained from the aerobic fermentation of *Pseudomonas elodea*. It has a tetrasaccharide repeating unit that consists of the monosaccharide building units L-rhamnose, D-glucose, and D-glucuronic acid in the molar ratios 1:2:1. The gellan molecule exists in aqueous solution as a disordered coil at high temperature and it converts reversibly to an ordered helix on cooling. The conformational transition established from different techniques (optical rotation, light scattering, viscosity, conductivity) is in agreement with a two coil to one double helix reversible transition. The conformational state of gellan gum is a sensitive function of the ionic strength, the nature of the added counter ions and temperature. By use of the differential scanning calorimetry (DSC), the conformational change of deacetylated gellan has been investigated. The introduction of cations increases the number and strength of the junction zones in the helical conformation, thus, controlling the amount of aggregation upon gelation.

From the DSC data the enthalpy ΔH and the peak temperature T_m of melting were obtained. The values of T_m usually vary for biopolymers as a function of the total ionic counter ion concentration C_T. C_T was calculated for each salt concentration and ln C_T plotted againt T_m^{-1}. The Manning polyelectrolyte theory (Manning, 1970) predicts that the slope is directly related to the enthalpy of melting by the equation

$$\Delta H = -R(\Phi_c - \Phi_h)\, \mathrm{d}\ln C_T / \mathrm{d}(1/T_m)$$

(Φ_c and Φ_h are the osmotic coefficients).

Using this relationship, ΔH was found to be 20·21 kJ/equiv. This value corresponds to the enthalpy of melting at infinite electrolyte dilution in the absence of any aggregation. The experimental exothermic enthalpies, ΔH of gellan gum solutions have been monitored as a function of external salt concentration C_s. The experimental value of 4·58 kJ/equiv. obtained in the absence of electrolyte is significantly less than the theoretical value predicted by the Manning polyelectrolyte theory. This discrepancy may be due to polymer aggregation.

Reference

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CHARACTERISATION OF COLLOIDAL GAS APHRONS (CGA-s) FOR PROTEIN RECOVERY

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Colloidal gas aphrons are microbubbles composed of a gaseous inner core surrounded by a thin soapy shell and are created by intense stirring of a solution containing surfactant. Owing to their size (from 10 to 100 μm) and structure they show colloidal behaviour, thus the main interaction forces governing this type of dispersion are caused by surface forces and electrostatic interactions.

Downstream processing, which involves the recovery, purification, separation and concentration of the products, is one of the more difficult and troublesome stages of the overall production system in biotechnological industries. Conversely, recovery steps generally represent a large part of the total capital investment in a fermentation plant. Often proteins are the target in the recovery process, especially enzymes for their use as industrial catalysts. The use of CGA-s for the separation of proteins is thought to be an attractive method for application in industry, where low cost and high efficiency, within the safest environmental conditions, are the main concerns. Other applications of the CGA-s that have been reported are:

- Removal of heavy metals from aqueous solutions (Ciriello *et al.*, 1982)
- Separation of ogranic dyes from waste water (Roy *et al.*, 1992)
- Harvesting of *Saccharomyces cerivisiae* (Save & Pangarkar, 1993).

The aim of this presentation is to show some preliminary studies undertaken for the characterisation and optimisation of the stability of the CGA-s for their further application for the separation of proteins.

Statistically designed experiments were developed in order to study the effect of different factors upon the stability of the aphrons. At the same time power consumption measurements were performed during the formation of CGA-s.

References

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MONOCOMPONENT ENZYMES/PECTIN METHYL ESTERASE

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Several enzymes have been cloned from *A. aculatus* by the expression cloning technique (Dalboege & Heldt-Hansen, 1994) and expressed in a host organism, either *A. niger* or *A. oryzae*. The monocomponent enzymes obtained are substantially free from interfering activities and are likely to be useful for modification purposes of for example, cell wall materials in order to obtain improved functionality. Several types of experimental enzymes are available for application trials on a small scale basis including pectin methyl esterase (PME). The kinetic and mode of action of PME has been further characterised. Pectins are widely used in the food industry — they are often modified from the natural, high methoxylated pectins to a lower level of methylation of the galacturonic acids to obtain new functionalities. PME hydrolyzes the methyl-esterified galacturonic acid residues in pectin. The enzymatically catalyzed process is a useful alternative to the chemically based modification of extracted pectin.