PROBLEMS AND SOLUTIONS OF MEASURING THE MOLECULAR WEIGHT OF RICE STARCHES

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Molecular weight is one of the most important physical properties underpinning amylose and amylopectin polysaccharide behaviour. A requirement of most methodologies for determining molecular weight is the complete solubilisation of both amylose and amylopectin. A combination of solvents and the use of enzymes facilitate this for rice starches. Debranching enzymes have been used as a first step in determining the amylopectin structure of three rice starches. The solubilised material was separated by size exclusion chromatography and detected by light scattering and concentration detectors (SEC/MALLS). The absolute molecular weight of amylose ($4.8x10^5$ - $5.1x10^5$ g/mol) and the relative M_w (weight average molecular weight) of the chains of amylopectin from three rice starches were estimated.

If the samples were not debranched but dissolved in dimethysulphoxide (DMSO), it was difficult to obtain sufficient separation using SEC/MALLS. This was even more difficult if processed starches were investigated using this technique. The same solvation technique was used for samples studied by analytical ultracentrifugation (AUC). The results with high rotor speed showed very good separation of starch components. The sedimentation coefficient ($s^\circ_{20,w}$), for amylose, which is related to its molecular weight, was 5.3 - 5.7 Svedberg. The sedimentation coefficient of amylopectin was found to be time dependent. The sedimentation coefficient ($s_{T,b}$) (at a particular concentration) obtained from the extrapolation at time = 0. We found that it is possible to obtain M_w of amylose from whole rice starch by using low speed sedimentation equilibrium: ~5 x 10^5 g/mol, was obtained for native rice starch.

The AUC method has also been applied to rice starches subjected to different durations of thermal treatment or acid hydrolysis. In both these cases the treatment was seen to have an effect on the amylopectin. The apparent sedimentation coefficient of amylopectin shifted towards that of amylose as the processing conditions were increased.