SMALL MOLECULE RELEASE FROM STARCH MATRICES

By

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ABSTRACT

Work by Ferry et al. (2004, 2006a and b) at Nottingham indicated that starchy materials may be better thickeners than other hydrocolloids, at equivalent viscosity, due to their superior flavour release characteristics. The mechanism put forward for this finding was efficient mixing of starches within the mouth so that the sodium was released from the matrix and could interact with the taste buds.

In this current study, the mixing efficiency of processed starches was examined further using cassava, rice and wheat. The major objective was to understand the influences of processing at different water levels [19%, 39% and excess (>85%)] compared to weight of starch and different levels of shear on the starch structures and its effect on the small molecule (a commercial food colourant and sodium chloride) release from starch matrices to the solution after mixing with water. A standard mixing methodology was successfully developed in the early stages of study and it included the quantification of the colour and salt released on mixing.

To create processed samples the Rapid Visco Analyser was used to form gelatinised samples, oven baking produced the samples of low shear and for high shear samples thermomechanical extrusion was used. These processed samples were evaluated for their physicochemical characteristics and the amount of order they contained.

Samples gelatinised at high water content (>85%) showed that concentration and processing conditions affected the ability of colour or salt to be released from the starch paste on mixing with water. More than 80% of the total colour was released for all starches processed at low starch concentrations (below close-packed concentrations), whereas less than 40% colour was released when the starch concentrations exceeded their close-packing level. Additional processing of cassava and rice starches made release of markers easier, for wheat starch less efficient mixing occurred.

Starches that retain their native semicrystalline structure, or are in a particulate form that does not hydrate and swell, mix well with excess water. For example, starches processed with static heating (low and moderate water levels) and ungelatinized starch (>85% water content) released 100% salt after mixing. The salt, co- dried with the starches, is readily dispersed. This is not the case if the starches are in a particulate form where they can swell in water, as occurs on drying gelatinised starch or extruded material. Rice samples created by thermomechanical extrusion had better mixing properties than wheat and cassava. For the extruded starches processed at low water levels (19%), rice starch released the highest amount of salt (60%), followed by wheat starch with only 40% salt released after mixing with excess water. However, more salt was released from samples prepared by extrusion using moderate water contents (39%). Extruded rice starch released the highest salt amount (90%), followed by wheat (80%) and

cassava starches (50%). There was no direct correlation between the cold water swelling capacity of the starch particulates and salt release values.

The implication of the results was that starches showed different breakdown behaviours in the regimes used and mixing behaviour would first decrease as the starch was processed, as granular structures broke, and then it subsequently will increase as the polymeric form loses molecule weight and its ability to entangle.