as a consequence of thermodynamical incompatibility. However, a clear understanding of the role of caseinate on starch properties requires a more detailed description of starch, and of interactions between caseinate and starch components, in the mixed system.

STRUCTURAL PROPERTIES OF MALTODEXTRIN–SODIUM CASEINATE SINGLE AND MIXED GELS

PRETIMA MANOJ, STEFAN KASAPIS, EDWIN R. MORRIS and ROBERT K. RICHARDSON

Department of Food Research and Technology, Cranfield University, Silsoe College, Silsoe, Bedford MK45 4DT, UK

Differential scanning calorimetry measurements of Paselli-caseinate preparations demonstrate the denatured coil structure (flat, featureless thermogram) of the protein and the broad melting process (midpoint transition temperature of about 68°C) of the polysaccharide, thus arguing for a non-interactive coexistence of the two components. Centrifugation (up to 3500 *g* for 30 min) of the binary systems at 45°C failed to show signs of bulk phase separation, the two polymers remaining in a single phase. However, dynamic oscillatory data for gelled mixed systems (5°C) indicate that the physical arrangement changes as a function of polymer ratio and overall concentration. Hence, mixed gels containing Paselli at levels above the minimum critical gelling concentration ($C_o \approx 20{\cdot}2\%$) behave similarly to gels of maltodextrin alone, i.e. tan δ values of $\approx 0{\cdot}1$ upon network maturation at 5°C for 3 h and structure disintegration ($G'' > G'$) above 70°C during heating.

At amounts of SA-2 below the C_o, increasing concentrations of caseinate are necessary for gel formation; e.g. 2·5 as opposed to 7·5% protein at initial concentrations of 20 and 15% maltodextrin in the blend, respectively. This pattern of behaviour indicates that the presence of caseinate makes some of the solvent unavailable to maltodextrin, thus raising its effective concentration to at least C_o, with gels then behaving as described above. The viscoelastic properties of mixed systems with a maltodextrin content below 15% change abruptly throughout the experimentally accessible range of protein concentration. The build-up and destruction of structure is reminiscent of the caseinate colloidal assembly with a high loss component (about half of the G' values) and early melting on heating (20–30°C). On the whole, there is clear evidence that at lower concentrations of maltodextrin the sodium caseinate forms a continuous suspension whereas at higher concentrations phase inversion promotes an SA-2 continuous network.

RHEOLOGICAL PROPERTIES OF COMMERCIAL EDIBLE DISPERSIONS

IOANNIS S. CHRONAKIS and STEFAN KASAPIS

Department of Food Research and Technology, Cranfield University, Silsoe College, Silsoe, Bedford MK45 4DT, UK

Several commercial edible dispersions have been evaluated for rheological properties at large and small deformation analysis in an attempt to differentiate, rather empirically at this stage, the viscoelastic and textural properties of these products. Traditionally, compression testing has been used to characterise the properties of firmness and spreadability, which are considered to reflect the consumer's choice on edible fats. It has been proposed that a fair evaluation of firmness and spreadability is obtained by the parameters of maximum stress (σ_m), which is the point where the stress goes through a maximum value, maximum strain (ε_m) whch is the strain at σ_m, and the plastic stress (σ_p) which is the stress at a horizontal or near-horizontal portion of the curve at a strain (ε_p) slightly larger than ε_m (Cain *et al.*, 1989). Conventionally produced samples (80% fat content), require strains (ε_m) from 0·2 to 0·3% to deform, producing σ_p to σ_m ratios between 0·95 and 1. Commercial dispersions with a fat content between 40 and 20% show more pronounced stress maxima resulting in σ_p to σ_m ratios of about 0·8. Obviously, the sharper, more gel-like force-deformation profile in the low fat products is due to the addition of biopolymers (usually starch), used to prevent syneresis of the water phase. Edible dispersions with less than 10% fat in the product employ phase separated mixtures of biopolymers (e.g. gelatin–maltodextrin; Kasapis *et al.*, 1993) to structure the disproportional water phase, thus inheriting the undesirable characteristic of a gel-like structure. Similarly, dynamic oscillatory measurements have characterised low fat spreads (Nielsen & Hansen, 1994) and they have been also used in this investigation to monitor product elasticity. Thus mechanical spectra of spreads with a large aqueous phase ($\geqslant 90\%$) produce storage to loss moduli ratios of two to three times higher than those of the high fat content blends (80%) and strain sweeps demonstrate that the long range deformation in the latter products commences at least an order of magnitude before the destabilisation of the aqueous network in a low fat product.

References

Cain *et al.* (1989). European Patent application, number: 0 298 561.

Kasapis *et al.* (1993). *Carbohydr. Polym.*, **21**, 269–276.

Nielsen & Hansen (1994). *Ann. Trans. Nord. Rheol. Soc.* **2,** 44–46.

DYNAMIC MECHANICAL THERMAL ANALYSIS OF BREAKFAST CEREAL FLAKES AND THEIR COMPONENTS

D.M.R. GEORGET and A.C. SMITH

Institute of Food Research, Norwich Research Park, Colney, Norwich NR4 7UA, UK

In order to understand the textural properties of breakfast cereals it is important to study their mechanical properties as they vary with composition and structure. Cereal flakes comprise biopolymers, principally starch and gluten. The mechanical properties of these polymers are determined to a large extent by their glass transition (Levine & Slade, 1990). The combination of these polymers and the addition of other constituents, such as water and sucrose, alter the glass transition and the final properties of the flakes.

The mechanical properties of hot-pressed specimens of starch and gluten polymers as well as those of two component mixtures with sugars have been recently reported (Kalichevsky and Blanshard, 1992; Kalichevsky *et al.*, 1992*a*, *b*). This study considers the mechanical behaviour of breakfast wheat flake