VARIETAL DIFFERENCES IN CAPSULE GRADE GELATINS: MECHANICAL PROPERTIES

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The mechanical properties of a variety of hard capsule grade gelatins derived from hide and bone and manufactured by acid or lime hydrolysis, have been measured by stress-strain testing. Commonly-used industrial blends of different gelatins and "rogue" batches of limed ossein gelatins that pass the standard quality control tests and yet are poor performers on capsule-filling machines, have also been tested.

25%w/w solutions were spread onto glass plates at 18±2°C and the films allowed to dry overnight in a humidity and temperature controlled room maintained at 18±2°C and 40±3% R_H. Strips were cut of thickness 0.15mm, width 5mm and of sufficient length to provide a gauge length of 50mm. The strips were aged over moist salts or phosphorus pentoxide in individual desiccators.

Stress-strain tests were performed using an Instron bench model tensile tester equipped with self-aligning grips. A strain rate of 30mm min^{-1} enabled the time of exposure to ambient humidity to be less than 3 min. Mean tensile modules, fracture stress, fracture strain and yield stress from ten replicates were calculated from the load-extension curves. Moisture content determinations were performed on samples conditioned at the same time, by drying at 105°C for 18 hours (B.S. Method 757).

Fracture stress at all but the lowest moisture contents increased with ageing time up to 3 days but not thereafter. Ageing time was standardized at 3 days in subsequent experiments.

An acid ossein, a limed ossein and an acid pigskin gelatin were examined over the range 0 to 86% R_H, corresponding to 3 to 24%w/w film moisture content. Tensile modulus decreased from $3.4 \times 10^9 Nm^{-2}$ to $1.0 \times 10^9 Nm^{-2}$ and fracture stress from $1.8 \times 10^8 Nm^{-2}$ to $3.9 \times 10^7 Nm^{-2}$ over this range, with standard deviations at about 3% of the mean.

For both parameters plots of tensile modulus and fracture stress against moisture content showed an inflexion at about 13%w/w moisture content. This was the lowest moisture content at which a yield peak was observed. Only at the very highest and lowest moisture contents were small differences seen between the tensile moduli, fracture and yield stresses for the different gelatins.

Standard deviations of the fracture strain were of the order of 8 to 20% of the mean, but at 13%w/w moisture content the limed ossein gelatin exhibited a significantly greater value than the others. This corresponded to a humidity of 33% R_H, within the range 30-40% R_H cited as optimum for storage and filling of hard gelatin capsules (Kuhn 1963), and this humidity was selected for the comparison of a wider variety of gelatins and blends.

Unblended or blended (5 parts to 1 limed to acid processed) gelatins showed few differences in their mechanical properties and none that could be related in general to their manufacturing processes, tissue of origin or their performance on capsule filling machines. The higher strain to fracture of the limed gelatin tested previously proved to be only a property of that particular batch, and blending this gelatin in different proportions with an acid ossein gelatin produced only a proportional increase in fracture strain. Blending did not significantly alter any mechanical parameter.

Kuhn, T. (1963). Pharm. Zeitung 108, 130.

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