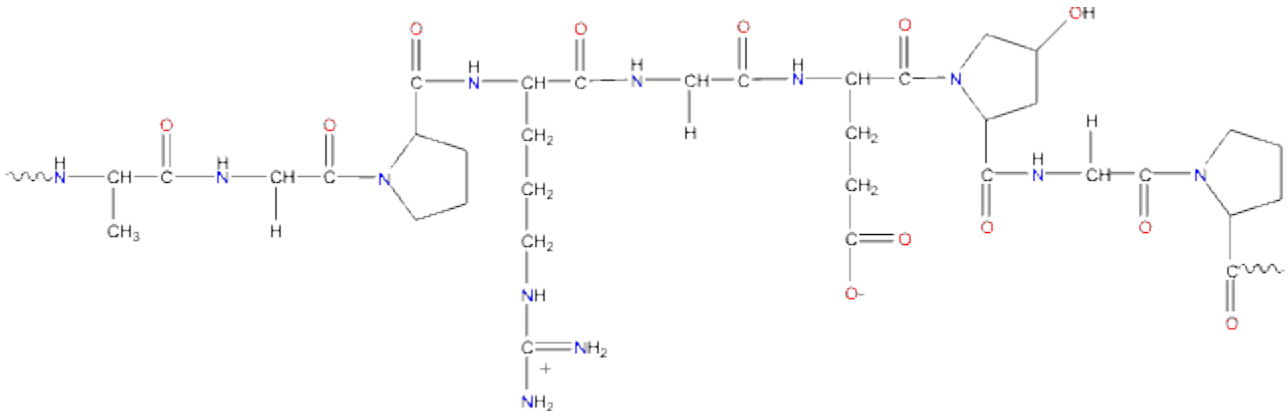
Gelatin

Sources for gelatin

Gelatin (also called gelatine) is prepared by the thermal denaturation of collagen, isolated from animal skin and bones, with very dilute acid. It can also be extracted from fish skins.

Structural unit

Gelatin contains many glycine (almost 1 in 3 residues, arranged every third residue), proline and 4-hydroxyproline residues. A typical structure is -Ala-Gly-Pro-Arg-Gly-Glu-4Hyp-Gly-Pro-.



Molecular structure

Gelatin is a heterogeneous mixture of single or multi-stranded polypeptides, each with extended left-handed proline helix conformations and containing between 50 - 1000 amino acids. The triple helix of type I collagen extracted from skin and bones, as a source for gelatin, is composed of two α1(I) and one α2(I) chains, each with molecular mass ~95 kD, width ~1.5 nm and length ~0.3 μm. Gelatin consists of mixtures of these strands together with their oligomers and breakdown (and other) polypeptides. Solutions undergo coil-helix transition followed by aggregation of the helices by the formation of collagen-like right-handed triple-helical proline/hydroxyproline rich junction zones. Higher levels of these pyrrolidines result in stronger gels. There is some dispute over whether each

of the three chains in the helical structure has a 10/1 helix (the three strands forming a 10/3 helix) with a 85.8 Å axial repeat or a 7/1 helix (the three strands forming a 7/2 helix) with a 60 Å axial repeat, with tripeptides forming each unit. Although the former view seems prevalent at the present time, recent evidence indicates the latter to be correct [1054]. Each of the three strands in the triple helix require about 21 residues to complete one turn; typically there would be between one and two turns per junction zone [449]. Gelatin films containing greater triple-helix content swell less in water and are consequentially much stronger [632]. Chemical cross-links can be introduced, to alter the gel properties, using transglutaminase to link lysine to glutamine residues [246] or by use of glutaraldehyde to link lysine to lysine.

There are two types of gelatin dependent on whether or not the preparation involves an alkaline pretreatment, which converts asparagine and glutamine residues to their respective acids and results in higher viscosity. Acid pretreatment (Type A gelatin) uses pigskin whereas alkaline treatment (Type B gelatin) makes use of cattle hides and bones.

Functionality and concerns

Gelatin is primarily used as a gelling agent [319] forming transparent elastic thermoreversible gels on cooling below about 35 °C, which dissolve at low temperature to give 'melt in the mouth' products with useful flavor-release. In addition, the amphiphilic nature of the molecules endows them with useful emulsification (for example, whipped cream) and foam-stabilizing properties (for example, mallow foam). On dehydration, irreversible conformational changes take place [397] that may be used in the formation of surface films. Such films are strongest when they contain greater triple-helix content. Gelatin is also used as a fining agent to clarify wine and fruit juice.

Although gelatin is by far the major hydrocolloid used for gelling, current concerns about the possibility of such an animal-derived product containing the prions that cause Creutzfeldt-Jakob Disease (CJD)[a], plus the need generated by vegetarians and certain religions, has recently encouraged the serious search for alternatives. The combination of the melt in the mouth, elastic and emulsification characteristics of gelatin gels is, however, difficult to reproduce.

Gelatin is nutritionally lacking as a protein being deficient in isoleucine, methionine, threonine and tryptophan.

Interactive structures are available (Jmol).

Footnotes

[a] It should be noted that gelatin is prepared under harsh conditions that make it effectively impossible for the survival of the CJD-causative prion, even in the unlikely circumstance of it being present. However, concern exists due to the severity of the disease and the known stability of the prion taken together with the difficulty at analyzing for it at the extremely low levels that may cause the disease. [Back]

Source : http://www1.lsbu.ac.uk/water/hygel.html