Gum Arabic

Source

Gum arabic (E414, acacia gum) is prepared from an exudate from the stems and branches of sub-Saharan (Sahel zone)*Acacia senegal* and *Acacia seyal* (Leguminosae) trees and produced naturally as large nodules during a process called gummosis to seal wounds in the bark of the tree. It is a less consistent material than other hydrocolloids. There is a recent review of this [1759] and an earlier one together with other exudate gums [562].

Structural unit

Gum arabic is a complex and variable mixture of arabinogalactan oligosaccharides, polysaccharides and glycoproteins. Depending on the source, the glycan components contain a greater proportion of L-arabinose relative to D-galactose (*Acacia seyal*) or D-galactose relative to L-arabinose (*Acacia senegal).* The gum from *Acacia seyal* also contains significantly more 4-O-methyl-D-glucuronic acid but less L-rhamnose and unsubstituted D-glucuronic acid than that from *Acacia senegal* [370].

Molecular structure

Gum arabic consists of a mixture of lower molecular weight polysaccharide (M.Wt.. ~0.25×10^6; major component) and higher molecular weight hydroxyproline-rich glycoprotein (M.Wt. ~2.5×10^6 minor component) [368] but with wide variability between commercial samples [1526]. Because it is a mixture and the material varies significantly with source, the exact molecular structures are still rather uncertain. Its glycoprotein is a high molecular weight hydroxyproline rich arabinogalactan (~2% protein) containing a repetitive and almost symmetrical 19-residue consensus motif -ser-hyp^a-hyp^a-hyp^a-thr-leu-ser-hyp^b-ser-hyp^b-thr-hyp-thr-hyp^a-hyp^a-hyp^a-gly-pro-his- [368] with contiguous hydroxyprolines (^{a}) attached to oligo-α-1,3-L-arabinofurans and non-contiguous hydroxyprolines (^{b}) attached to galactose residues of oligo-arabinogalactans. combining a β-1,3-D-galactopyran core with side chains of β-D-uronic acids, β-D-galactose, α-L-arabinose and α-L-rhamnose joined to the main chain by 1,6-linkages [368] and single termini of α-L-rhamnopyranose, α-L-arabinofuranose and β-D-uronic acids via 1,2- and 1-4-linkages [*A. senegal* 1949 ; *A. seyal* 1991].

Functionality

As with many other hydrocolloids, gum arabic is a useful prebiotic promoting beneficial physiological effects [1157, 1467]. As a food additive, it is a useful if rather expensive hydrocolloid emulsifier, texturizer and film-former, widely used in the drinks industry to stabilize flavors and essential oils, for example in soft drink concentrates. The simultaneous presence of hydrophilic carbohydrate and hydrophobic protein enables its emulsification and stabilization properties. Emulsification, which is dependent on the amount of arabinogalactan protein present [1526], is particularly enhanced due to molecular flexibility which allows greater surface interaction with the oil droplets. Gum arabic is used in confectionery such as traditional hard (wine) gums, pastilles and as a foam stabilizer in marshmallows.

The gum arabic glycoprotein possesses a flexible but compact conformation. It is readily soluble to give relatively low viscosity newtonian solutions even at high concentrations (20-30 % wt/wt). However, and rather confusingly, molecular aggregation can cause both shear thinning and time-dependent thickening behavior at low shear [369].

Gum tragacanth (*Astragalus gummifer*, E413) is a related exudate gum consisting of a mixture of polysaccharides including an arabinogalactan containing α-L-arabinofuranose and 1-4-linked β-D-galalactopyranose [367] and an acidic complex poly-1-4-linked α-D-galalacturonate. It is used as an acid-resistant thickener and emulsifier in sauces, salad dressings and confectionery lozenges. Yet another exudate gum, gum karaya (*Sterculia urens*) has similar physical properties but consists of an α-D-galacturonic acid/α-L-rhamnose backbone with β-D-galactose and β-D glucuronic acid side chains. Another related gum is the main component of mesquite gum (*Prosopis*) [1720]; an arabinogalactan with a β-1,3-galactopyran core and L-arabinose side chains. Gum ghatti is also an emulsifying exudate gum, from the *Anogeissus Latifolia* tree, containing alternating 4-O and 2-O-substituted α-D-mannopyranose units and 1-6-linked β-D-galalacto-pyranose chains [1526, 1527].

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