Technical Article

Introduction to Xanthan

Xanthan is a high molecular weight polysaccharide that is found naturally in the extra cellular matrix of the bacterium *Xanthomonas campestris.* It is produced on a commercial scale via an aerobic bacterial fermentation process. It is widely used in food for thickening, suspension & emulsion stability and also as a processing aid.

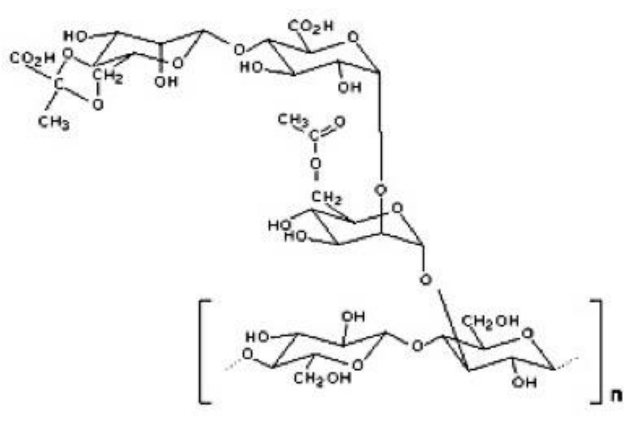
Xanthan was originally discovered as part of a USDA programme in the 1950s that screened a range of novel polysaccharide producing organisms that might have some commercial potential including several different *Xanthomonas* cultures. Kelco-AIL (Alginate Industries ltd) was the first to commercialise a process for the production of xanthan gum.

Xanthan was approved for food use in 1969 by the FDA and 1974 by the EU where it is known by its E-number E415. Xanthan's unique rheology was first noted in the literature by Jeanes et al. (1961) and it has become one of the most successful hydrocolloids largely due to its high functionality, particularly in difficult environments such as acid, high salt and high shear stress. In fact, Xanthan has been described as *"the almost perfect gum".*

Structure & properties

Xanthan has a particularly complicated molecular structure. The backbone is a β-(1-4)-D-glucose which is the same as cellulose, but every alternate glucose reside has a three sugar side chain consisting of two mannose residues with a glucuronic acid residue between them.

The mannose reside nearest the main chain can carry a C6 acetyl group and the terminal mannose can carry a pyruvate group between C4 and C6. The level of acetylation and/or pyruvylation varies depending on fermentation conditions but typically, pyruvate residues are found on 30-40% of the terminal mannose residues and 60-70% of the internal mannose residues contain acetate groups.



Complex structure of Xanthan showing glucose backbone and 3 sugar molecule side chain ↑

Xanthan is produced in its native state as a twin stranded, right handed fivefold helix. The complexity of the side chains give protection and makes Xanthan very stable under wide range of conditions including acidic, alkaline, high salt concentrations and also to shear and enzymatic hydrolysis. Xanthan is also stable to a range of temperatures but it's properties change. On heating the xanthan helix goes through a transition to a disordered state and upon cooling it reverts to a helical structure. However, it is believed that native xanthan exists in a form where chains are paired and once that has been lost and the xanthan molecules allowed to reorder the exact pairing cannot be retained and a partially crosslinked structure is formed as helices twist around various neighbours.

Xanthan gum does not gel on its own but shows some gelling synergy with other galacto- and glucomannan gums. These gums also give a synergistic increase in viscosity.

References

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