

## Multiscale Characterization of Interfacial Binding Between Soluble Amylose Chains and Waxy Corn Starch Granules

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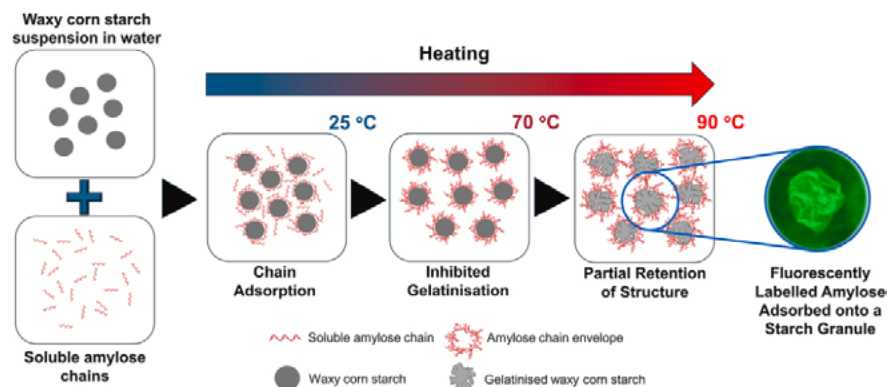
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In this study, soluble amylose chains with varying degrees of polymerisation (DP 186–4020) were isolated via isoamylase debranching of amylopectin from native and waxy corn starches. When these soluble amylose chains are mixed with aqueous suspensions of waxy corn starch, spontaneous adsorption onto the surface of starch granules occurs. The resulting coating envelops the granules and markedly inhibits gelatinisation, increasing the onset temperature by up to 10 °C. Additionally, the amylose coating alters the pasting and short-term retrogradation properties of waxy corn starch, as evidenced by a reduction in trough viscosity, up to a 20 % decrease in breakdown viscosity, and approximately a 50 % increase in setback viscosity. This effect is both concentration- and DP-dependent. We found that chains with a critical length of  $200 \leq DP \leq 700$  produce the most pronounced effect and exhibit the strongest concentration dependence, suggesting that entropic considerations play a key role in starch–amylose interactions. Complementary analyses – including calorimetry, viscosity, turbidity measurements, and small-angle X-ray scattering – confirmed the inhibited gelatinisation and retrogradation. X-ray diffraction data further corroborated that the adsorbed amylose forms a hydrated, V-type-like polymorphic envelope. We hypothesise that this amylose coating restricts water ingress and inhibits granular gelatinisation, providing a physical basis for the observed inhibition. These findings highlight a previously undocumented role of soluble amylose chain length in directing starch thermal and structural transitions. Our results advance the fundamental understanding of starch–amylose interactions and offer a novel route for designing starch systems with enhanced functionality for applications in food processing and, more broadly, in (bio)material design.

### Keywords:

Soluble amylose chains, Isoamylase, Small angle X-ray scattering, Adsorption, Interfacial supra-molecular assembly



*Schematic illustration of soluble amylose chains adsorption on to waxy corn starch granule surfaces and the effect on the gelatinisation.*

### References:

Tongbram, T., et al. "Soluble amylose chains inhibit gelatinisation and retrogradation in waxy corn starch", *Food Hydrocolloids*, 172 (1), 2026, 111936