Insights into high hydrostatic pressure pre-treatment generating a more efficient catalytic mode of maltogenic α-amylase: Effect of multi-level structure on retrogradation properties of maize starch

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Maltogenic α-amylase (MA) is an enzyme used to retard starch retrogradation in the baking industry. However, sometimes it exhibits low efficiency which may restrict the enzymatic application. This study investigates the effects of using High hydrostatic pressure (HHP) as a pre-treatment to promote MA catalysis. The results showed that HHP resulted in more indentations and fissures of the starch granules promoting the susceptibility of MA. While MA treatment alone introduced short malto-oligosaccharide chains with degree of polymerization (DP) 1–5, the combined HHP-MA treatment exhibited a higher proportion of DP 1–9, but a lower proportion of DP 13–24. Furthermore, when increasing the pressure, the ratio of α-1,6 to α-1,4 glycosidic bonds increased in the MA-treated starch. MA modification on the HHP-pretreated starch showed increasing gelatinization temperature and enthalpy, while it had a reverse impact on long-term retrogradation enthalpy due to the shortening of the outer chains of amylopectin. LF-NMR was applied to analyze the water mobility and compartmentalization in starch gel systems after 1- and 7-days storage. Compared with single MA-treated system, HHP-MA treated starches showed no significant changes in the value of the transverse relaxation times, but less amount of bulk water was detected due to higher amounts of soluble small oligosaccharides. In conclusion, HHP pre-treatment combined with MA could improve the water holding properties of retrograded starch gels and that HHP prior to MA catalysis provides an efficient alternative method to modify starch-based food products with anti-stalling properties.

Słowa kluczowe

Maltogenic a-amylase, High hydrostatic pressure, Less-crystalline granular starch, Anti-aging, Water mobility