PURDUE INNOVATES | Office of Technology Commercialization

Physical Modification of Starches Using Small Molecules for Enhanced Gelatinization, Viscosity, and Stability

Small-molecule, hydrothermal treatments physically tune starch gelatinization and viscosity (no reagents), yielding clean-label functionality and stability.

The starch industry is important for food production and economies worldwide as starches are used as ingredients in food and animal feed products, as well as in consumer, pharmaceutical, and industrial products. The function of starch is intricately related to the complex microstructure of the starch granule, and structural transformations in starch are intimately related to the processing, quality, and stability of starch-based products. Modifying starch offers several functional advantages over native (unmodified) starch, including enhanced stability and viscosity control. Starch modifications can be split into the following categories: physical, chemical, biotechnological, enzymatic, or combinations of the prior categories. Of these, physical modifications offer the following advantages: clean label and regulatory acceptance, environmentally friendly, cost-effective and scalable, and consumer and market appeal. Researchers at Purdue University have designed a new physical modification methodology for starches using small molecules and hydrothermal treatments to create starches with enhanced properties such as elevated gelatinization temperature and favorable alterations to viscosity and stability that can be used in products to improve nutritional value and product quality traits. This technology can be applied to a variety of starches and small molecules wherein the goal is to create starches for human consumption with improved properties as compared to the native starch alone.

Technology Validation:

-The technology was applied to a variety of botanical sources of starch and a variety of small molecules and documented favorable alterations in starch stability and functionality.

-Gelatinization temperature measurements show higher gelatinization temperatures for modified starches as compared to native starches (by up

Technology ID

2025-MAUE-71083

Category

Agriculture, Nutrition, & AgTech/Food Safety & Traceability
Chemicals & Advanced Materials/Specialty & Performance Chemicals
Chemicals & Advanced Materials/Green & Bio-Based Chemistry

Authors

Lisa J Mauer
Lynne S Taylor
Jared Ward
Rui Zhu

Further information

Abhijit Karve
AAKarve@prf.org

View online page

to 15Â°C)

-Viscosity measurements to determine peak viscosity, breakdown viscosity, final viscosity, and setback viscosity indicated more stable structures and showed larger viscosity ranges available for modified starches as compared to native starches

Advantages

-Physical modification with the incorporation of small molecules favorably alters starch stability and functionality

-The process uses no chemical reagents, and physically modified starches may be labeled as 'natural' or 'clean label' ingredients

Applications

-The method and processes can be used to modify a variety of starches using a variety of small molecules to improve upon starch functionality for a wide variety of product uses

Related Publications

1.Allan, M. C., Rajwa, B., & Mauer, L. J. (2018). Effects of sugars and sugar alcohols on the gelatinization temperature of wheat starch. Food Hydrocolloids, 84, 593â€“607. https://doi.org/10.1016/j.foodhyd.2018.06.035

2.Woodbury, T. J., Grush, E., Allan, M. C., & Mauer, L. J. (2022). The effects of sugars and sugar alcohols on the pasting and granular swelling of wheat starch. Food Hydrocolloids, 126, 107433. https://doi.org/10.1016/j.foodhyd.2022.107433

3.Kitagawa, N., Hamaker, B. R., & Mauer, L. J. (2025). Exploring oligosaccharide effects on wheat starch gelatinization: Mechanisms and oligosaccharide structural perspectives. Food Hydrocolloids, 159, 110614. https://doi.org/10.1016/j.foodhyd.2025.110614

TRL: 3

Intellectual Property:

Provisional-Gov. Funding, 2025-05-29, United States

Keywords: physically modified starch,clean label starch enhancement,hydrothermal starch treatment,starch viscosity

Explore other available products test at The Office of Technology Commercialization Online Licensing Store

control,gelatinization temperature boost,food grade starch innovation,non chemical starch processing,starch functionality improvement,botanical starch optimization,small molecule starch modification,nutritional starch upgrade,stable starch ingredients

Explore other available products test at The Office of Technology Commercialization Online Licensing Store