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Thermal-Stable Whey Protein

A novel process uses deamidated whey protein to achieve enhanced thermal stability and reduced aggregation, resulting in high-clarity, better-tasting clear whey protein beverages with increased shelf life.

Whey is a protein-rich fluid leftover after milk has been curdled and strained to produce cheese. Among other applications, whey powder and premade whey-based drinks are some of the foremost forms of consumer protein supplements, enjoyed by many as meal replacements, dietary supplements, and support for muscle development. Although much of the commercially available whey protein comes in the form of opaque powders and mixed protein shakes, clear whey is an attractive alternative for consumers who want increased protein concentration and purity. However, clear whey can be difficult to produce due to high rates of aggregation and sedimentation of whey proteins. Whey-based beverages are prone to spoilage unless pasteurized, but high heat used in pasteurization tends to increase the rate of sedimentation. PH-altering treatments are often performed to reduce this effect, but they can lead to salty or astringent flavors in the final beverage, creating a poorer quality product for the consumer.

In response to this market gap, researchers at Purdue University have developed a method to produce deamidated whey proteins, which increases thermal stability and decreases aggregation during pasteurization. This enhanced thermal stability eliminates the need for pH treatments that produce foul-tasting whey, while also simplifying the manufacturing process. This deamidated whey also reduces the need for thickening agents, common in traditional forms of whey beverages. Overall, this innovation offers a simple, environmentally friendly, and scalable method for the preparation of enhanced whey protein and its use for preparing consumer beverages.

Technology Validation:

The deamidated whey was developed and then tested for turbidity, aggregate formation, solubility, and storage stability. The turbidity was 0.13-0.18, which was ~30-40% of PG-500 free sample. This demonstrates the efficiency of PG-500 in enhancing the heat stability of whey protein and reducing the turbidity of its solution at 5% concentration. Aggregate

Technology ID
2024-CHEN-70509

Category
Biotechnology & Life Sciences/Bioprocessing & Biomanufacturing
Agriculture, Nutrition, & AgTech/Food Safety & Traceability
Biotechnology & Life Sciences/Biomarker Discovery & Diagnostics
Chemicals & Advanced Materials/Specialty & Performance Chemicals
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Authors
Da Chen

Further information
Raquel Peron
rperon@prf.org

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formation was tested using X-ray scattering to measure the size of particulates. The radius of aggregates in an unmodified whey sample ranged between 2.5 nm and 35 nm, with a median value of ~8 nm. Deamidation shifted the distribution to smaller values (2-10 nm range) with a median value of 4 nm. The solubility of the whey protein aggregates was increased from ~32% in unmodified whey protein solution to ~60% in deamidated samples. Finally, storage stability was tested using normal and deamidated whey samples under refrigeration conditions for 1 week. After one week, the turbidity of the deamidated sample was 0.056, whereas the control sample was 0.26. This clearly indicates that deamidated whey samples are able to maintain high clarity after storage at refrigeration conditions.

Advantages:

-Enhanced thermal stability during pasteurization

-Reduced aggregation and sedimentation

-Suitable for production of clear whey

-Increased shelf stability

-Reduced need for thickening agents

-Improved flavor of final product

Applications:

-Whey-based protein beverages, specifically the production of clear whey

TRL: 4

Intellectual Property:

Provisional-Patent, 2024-04-25, United States | Utility Patent, 2025-04-23, United States