

# Potato Starch: Functional Selection, Process Stability and Procurement Validation

A practical technical guide for R&D, production, quality and procurement: starch selection, viscosity comparison, processing conditions, freeze-thaw testing, scale-up and batch acceptance.

Junsheng Agriculture

Version 1.1 | 2026-10-16

For general technical discussion and procurement reference. This document does not replace product specifications, batch testing or validation in the actual process. Product requirements and supply commitments follow the agreed technical documents and contract.

No unauthorized reproduction, distribution, republication, adaptation or commercial republication of copyright-protected original content. Downloading, reading and internal procurement evaluation are permitted. Statutory exceptions are preserved. Rights in quoted third-party material remain with its owners.

# Contents

01 Start with the finished product . . . . . 3

02 Structure, gelatinization and pasting . . . . . 4

03 Choose the modification route . . . . . 5

04 Map formulation and processing conditions . . . . . 6

05 Set endpoints for six applications . . . . . 8

06 Make test reports comparable . . . . . 10

07 Separate freeze-thaw, retrogradation and shelf life . . . . . 11

08 From screening to production validation . . . . . 13

09 Troubleshoot in a controlled sequence . . . . . 14

10 Purchasing, traceability and quality documents . . . . . 15

11 Compare cost and destination requirements . . . . . 17

12 Project records ready for use . . . . . 18

## 01 Start with the finished product

Potato starch selection starts with performance through production, storage and consumption. The objective is a suitable grade, not the largest viscosity number. A result measured in water does not establish performance in an acidic sauce, meat emulsion, frozen filling or noodle formulation. Ingredient identity, processing conditions, finished-product targets and purchasing documents should form one validation chain.

Junsheng supplies native starch through cooperative production and modified starch through procurement. Each order should identify botanical source, modification, grade and specification revision. Native starch, oxidized starch and hydroxypropyl distarch phosphate are different technical materials. Grades within a single category can also differ. Potato flour contains cellular material and other potato components and should not be treated as equivalent to isolated starch.

### Write requirements that can be tested

Before requesting samples, prepare a one-page application brief: product, destination market, heating and transfer operations, refrigerated or frozen storage, consumer reheating, and unacceptable defects. Replace broad terms such as “stable” with observable outcomes: flow at filling temperature, gel strength after cooling, separated liquid after specified storage, consistency after reheating and sensory acceptance.

| Starting need        | Information required                                    | Decision output                              |
|----------------------|---------------------------------------------------------|----------------------------------------------|
| Thickening           | Formula, concentration, heating and reading temperature | An operating and eating consistency range    |
| Processing tolerance | Holding, pumping, homogenization and acid addition      | Function retained after the complete process |
| Storage performance  | Pack, temperature, duration and reheating               | Acceptable stored and served product         |
| Cost reduction       | Dosage, losses, accepted output and logistics           | Cost per unit of accepted finished product   |

The trial sequences and recording fields in this paper are suggested working methods. They are not guaranteed properties of a commercial grade. Agree specifications and acceptance boundaries before trials begin.

## 02 Structure, gelatinization and pasting

With water and heat, starch granules lose ordered structure, swell and release some components. Further heating, agitation and cooling produce additional structural changes. The structure and phosphate groups of potato starch provide useful background, but botanical origin alone cannot predict the complete performance of a commercial grade. [1]

Gelatinization and subsequent viscosity development are different measurement targets. Differential scanning calorimetry (DSC) examines thermal transitions. A Rapid Visco Analyser (RVA) records apparent viscosity through a defined programme. A rotational rheometer or viscometer evaluates flow or viscoelastic behaviour under specified geometry, temperature and shear conditions. Their results are not automatically interchangeable.

| Observation               | Useful question                                               | What it does not establish alone         |
|---------------------------|---------------------------------------------------------------|------------------------------------------|
| Viscosity onset and peak  | When does consistency develop in this programme?              | Complete cooking on the production line  |
| Hot-hold trough           | How does the paste change under this heat and mixing history? | Shear tolerance on any machine           |
| Final cooled viscosity    | What consistency remains after this cooling programme?        | Long-term or freeze-thaw stability       |
| Gel texture and syneresis | What occurs under the specified storage and test?             | Performance across the entire shelf life |

Breakdown is commonly expressed as peak minus hot-hold trough. One common setback definition is final cooled viscosity minus trough. Check the laboratory's definitions, sampling points and programme before comparing reports. The full curve is more informative than one final value when investigating early peaks or continuing viscosity loss. [2]

Cooling-induced thickening can help forming while hindering transfer. A high peak can deliver initial consistency yet still be followed by substantial change. Interpret the curve against each unit operation. Research on starches from different potato varieties also supports assessing thermal and gel behaviour together with material identity. [3]

## 03 Choose the modification route

Establish a baseline with the target recipe and an accepted incumbent ingredient. “Modified” is not a single performance grade, and an additive number is not a viscosity, clarity or freeze-thaw guarantee.

Oxidized starch is identified as INS 1404; hydroxypropyl distarch phosphate as INS 1442. The latter combines phosphate crosslinking and hydroxypropyl substitution, which should be distinguished. The name establishes identity; commercial behaviour still depends on source, treatment, manufacturing conditions and application. [4][5]

| Route                            | First trial question                                          | Document focus                                          |
|----------------------------------|---------------------------------------------------------------|---------------------------------------------------------|
| Native potato starch             | Does it meet the target after actual heating and transfer?    | Botanical source, grade and viscosity method            |
| Oxidized starch                  | Does it provide the required flow, film or gel behaviour?     | Modification identity, intended grade and specification |
| Hydroxypropyl distarch phosphate | Does it withstand the actual process and storage combination? | Source, grade and intended-use documentation            |

If an incumbent native starch passes the complete process and storage trial, changing routes should deliver a defined benefit. Conversely, changing the product name without checking addition order, solids basis and thermal history may leave the original problem unresolved. Locate the operation where failure starts before selecting an alternative.

Pregelatinization status requires a separate check. Modified starch does not automatically disperse or thicken in cold water. State whether the application is cold prepared, hot prepared or requires a slurry, and whether changes to the existing process are permissible.

## 04 Map formulation and processing conditions

Map the process as dispersion, heating, holding, addition of acid or other ingredients, pumping or homogenization, filling, cooling, storage and reheating. Record product temperature, time, formulation state and equipment at every stage. Jacket setpoint is not product temperature. Agitator speed cannot be compared independently of impeller, vessel and fill level.

Acid addition before cooking and after starch development can produce the same final pH but different acid-and-heat exposure durations. When comparing addition sequences, keep final formulation and mass consistent and record acid identity, addition stage and measurement temperature.

Salt, sugar and hydrocolloid effects depend on the system. Experiments on flaxseed-polysaccharide/potato-starch mixtures showed changes in pasting, gel and syneresis behaviour with salt, sucrose and glucose. [6] This supports testing the actual formulation; it does not justify adopting the research dosages as commercial recommendations.

| Variable             | Record                                               | Useful comparison                            |
|----------------------|------------------------------------------------------|----------------------------------------------|
| Acidity              | Acid, addition point, measurement temperature and pH | Same endpoint pH, different addition order   |
| Thermal history      | Actual heating, holding and cooling curves           | Normal and permitted boundary conditions     |
| Mechanical history   | Equipment, flow, pressure drop, speed and passes     | Before/after transfer, measured consistently |
| Salt, sugar and gums | Type, dose, solids and water allocation              | Individual changes followed by combinations  |

Use initial single-variable comparisons to identify sensitive factors, then confirm combinations likely to occur together. Changing grade, dose, acid addition and homogenization simultaneously may improve the result without identifying why. A clear experimental question is more valuable than an unstructured collection of samples.

Distinguish fixed-formula screening from fixed-performance optimization. The former compares grades at the same dose. The latter adjusts dose to achieve equivalent product performance and then compares operating margin and cost. Report these as different experiments.

### **A four-cell trial for acid exposure and pumping load**

Suppose the product has two relevant acid-exposure conditions and two feasible pumping loads. For each candidate grade, test four combinations: lower acid/lower load, lower acid/higher load, higher acid/lower load and higher acid/higher load. These labels refer to measured project conditions, not universal pH or speed recommendations. Specify acid identity, pH measurement temperature and exposure duration; higher acid exposure must not be read as higher pH. Hold solids, thermal programme and evaluation temperature constant. Include reference material and independent preparations across testing days.

Testing shear only at the lower acid exposure and acid only at the lower shear exposure misses their combined effect. If the observed shear response differs between acid conditions, it suggests an interaction; independent replication is needed to estimate random error and assess whether that contrast is reliable. A four-cell display of individual results is usually more informative than an early composite “stability score”. Factorial designs and blocking are useful tools, with replication selected for variability and the precision needed.[9]

Keep the trial region within product and equipment constraints; stop if pumpability is lost or a validated food-safety process is compromised.

### **Worked example: an average can hide failure**

These four-cell data are hypothetical, not product test results. Evaluation temperature, measurement method, dry solids and thermal programme are fixed. The table reports apparent viscosity at the selected endpoint.

| Acid exposure / pumping load | Lower load  | Higher load |
|------------------------------|-------------|-------------|
| Lower acid                   | 1,500 mPa·s | 1,200 mPa·s |
| Higher acid                  | 1,400 mPa·s | 700 mPa·s   |

The load-associated change is  $1,200 - 1,500 = -300$  mPa·s under lower acid exposure and  $700 - 1,400 = -700$  under higher exposure. Their difference is  $-400$  mPa·s, a descriptive interaction contrast. It suggests that the mechanical-load response depends on acid exposure. One observation per cell does not provide an error estimate or a reliable significance test; independently prepared replicates and an interpretable design are needed.

Suppose this illustrative project predefined a functional minimum of 800 mPa·s. The four-cell mean is 1,200 and appears satisfactory, but the higher-acid/higher-load condition fails. The 800 threshold is invented for the example, not a general food or starch limit. Qualification must address combinations likely in production rather than allowing an overall average to hide a critical failure.

## 05 Set endpoints for six applications

An application name narrows the search but does not define the trial. Frozen foods include uncooked dough, cooked sauce and fillings with very different solids contents. Use the matrix below to select endpoints, then confirm the grade through samples and supply documentation.

| Application              | Process focus                          | Finished-product endpoints                             |
|--------------------------|----------------------------------------|--------------------------------------------------------|
| Sauces and soups         | Dispersion, acid, holding and pumping  | Filling flow, coating, reheated consistency, syneresis |
| Noodles and vermicelli   | Slurry, forming, cooking and cooling   | Breakage, cooking loss, bite and sticking              |
| Meat products            | Comminution, protein, salt and heating | Cooking loss, slicing, purge and eating quality        |
| Frozen foods             | Freezing rate, excursions and thawing  | Cracking, liquid release, structure and reheating      |
| Coatings and fried foods | Batter flow, pickup and frying         | Pickup, detachment, crispness and holding              |
| Bakery and fillings      | Sugar, baking and cooling              | Leakage, setting and stored texture                    |

## Progress from water screening to food confirmation

Water-based tests can eliminate clearly unsuitable candidates. A second stage should include major ingredients from the real recipe and preserve mixing order. A third stage uses production equipment or a representative process. Retain the accepted incumbent in every stage to separate material effects from changes between trial days.

For meat systems record meat source, fat, water and processing conditions. For noodles record other flours, hydration and cooking method. For coatings distinguish batter viscosity from actual pickup. Powder whiteness does not establish cooked colour, and high water-paste viscosity does not establish desirable bite.

When a laboratory pass becomes a production failure, first align the endpoint. Immediate kettle viscosity and the state of a filled product after refrigerated storage are different targets. Evaluate hot, cooled, stored and served states from the same trial batch.

## 06 Make test reports comparable

Before comparing viscosity, confirm product identity, sample state and test programme. mPa·s and cP are numerically equivalent, but identical units do not make results comparable. Apparent viscosity in a non-Newtonian system depends on measurement conditions. RVA or other instrument-specific units require their corresponding method interpretation.

| Check         | Fields to retain                                            |
|---------------|-------------------------------------------------------------|
| Identity      | Grade, batch, sampling point, opening and storage           |
| Concentration | Mass fraction or mass/volume; as-is or dry basis            |
| Preparation   | Water, order, mixing, heating, cooling and waiting          |
| Instrument    | Model, spindle or geometry, speed or shear rate             |
| Reading       | Sample temperature, time, selection rule and unit           |
| Repeatability | Independent preparations, individual results and exceptions |

### Standardize dry-solids input

For total slurry mass  $M$ , target dry-starch mass fraction  $c$  and ingredient wet-basis moisture fraction  $w$ , required as-is starch mass is  $m = M \times c \div (1 - w)$ . In a starch-and-water-only system, added water is  $M - m$ . Enter  $c$  and  $w$  as decimal fractions.

Illustrative calculation only: a 100 g slurry containing 5% dry starch, with assumed ingredient moisture of 20%, requires 6.25 g as-is starch and 93.75 g added water. The assumed 20% is not a Junsheng specification or batch result. Foods containing other solids require a complete material balance rather than this two-component recipe.

Moisture, ash, whiteness and particle size also require defined methods. Record the instrument and calibration for whiteness, and the technique, dispersion and statistic for particle size. “Average particle size” may refer to different quantities. When historical

reports omit methods, retest under common conditions instead of ranking suppliers from incomplete numbers.

### **Limits of the viscosity-retention ratio**

A viscosity-retention ratio can be defined as post-treatment apparent viscosity divided by pre-treatment apparent viscosity, multiplied by 100%, provided measurement temperature and procedure are comparable. If the two readings represent inherently different stages of structure development, the ratio cannot be interpreted simply as resistance to damage. A low-baseline material may retain a high percentage and still fail the application requirement.

## **07 Separate freeze-thaw, retrogradation and shelf life**

During cooling and storage, starch components may reorganize into ordered structures, with changes in texture and water distribution. Freezing and thawing add further physical events. Visible liquid release alone cannot distinguish retrogradation, freezing damage, formulation imbalance or moisture loss through packaging. Use separate storage groups to investigate.

[1]

Include an unfrozen control, target frozen storage and a temperature-excursion route relevant to actual distribution. Standardize fill mass, containers, packaging and preparation history; record freezing and thawing rates, frozen hold and sample-core temperature. Freezer setpoint does not replace product temperature.

Allocate separate containers to different cycle endpoints when investigating cycle effects. Portion them from each prepared batch and open only at their assigned endpoint. This prevents intermediate liquid removal from modifying the later specimen. An equal-age control held at a specified nonfreezing temperature can compare storage routes. That comparison includes a different temperature history and does not by itself separate all effects of time and freezing. Containers from one preparation are subsamples rather than independent preparations, so retain preparation-batch identity.

| Stage                 | Record                                          | Evaluate                                       |
|-----------------------|-------------------------------------------------|------------------------------------------------|
| Before freezing       | Cooking, starting temperature and pack          | Initial consistency, structure and mass        |
| Freezing and storage  | Product temperature history and time            | Conformance to the protocol                    |
| Thawing               | Method, time and core temperature               | Liquid release, cracks and structure           |
| Reheating and serving | Endpoint, standing time and serving temperature | Texture, consistency, sensory quality and loss |

Report passive drainage and centrifugal separation separately. Record relative centrifugal force, time, temperature and equipment rather than speed alone. Experimental work on hydroxypropyl potato starch shows that centrifugal force affects observed syneresis.[10]

Within a project, define liquid separation as collected liquid mass divided by sample mass at the start of that test, multiplied by 100%. If the term syneresis is used for this result, state that mass basis. Separated liquid can contain dissolved solids, so this is not pure-water loss as a fraction of the original total water. Specify whether the result represents one cycle or cumulative loss. If liquid is removed after every cycle and the residual gel is refrozen, its composition and denominator change. Percentages with different denominators cannot simply be added and reported as total loss from the original sample.

A 2026 study of wheat-potato starch gels and crystal dumpling wrappers found different effects of additives on apparent viscosity, freeze-thaw behaviour and retrogradation. [7] It supports evaluating several endpoints, not transferring one anti-retrogradation finding to every frozen food. It is not a Junsheng product trial.

### **Worked example: what less separated liquid establishes**

The following figures are illustrative, not product test results. A 100.0 g specimen in group A releases 4.0 g of liquid under a defined procedure: 4.0%. Group B releases 2.5 g from 100.0 g: 2.5%. The supported conclusion is that B separated less liquid in that test. It does not establish longer shelf life or better sensory quality. If B also becomes substantially firmer, evaluate whether that change suits the food.

Accelerated freeze-thaw testing screens candidates and identifies weak conditions; it cannot be converted directly into shelf life. Final approval also requires evidence for actual packaging, distribution, microbiology, sensory quality and use conditions.

## **08 From screening to production validation**

Use four decision gates: acceptable identity and documentation; laboratory screening; representative equipment validation; and storage plus finished-product confirmation. Define the condition, owner and next action for each gate. A promising sample observation should not automatically authorize bulk purchasing.

### **Design interpretable comparisons**

First compare grades at fixed formulation, dry solids and measurement conditions. Then optimize dose or critical settings for promising candidates. Finally validate adverse combinations within the intended operating range. Select levels from equipment capability and product requirements rather than imposing universal doses or temperatures.

At least three independent preparations can be a starting point for checking repeatability in important comparisons. This is a suggested starting design, not proof of batch or supply consistency. Repeated readings from one cup do not replace fresh weighing, dispersion and processing. Retain individual results as well as the mean.

| Stage              | Control                                                | Basis for progression                    |
|--------------------|--------------------------------------------------------|------------------------------------------|
| Grade screening    | Accepted incumbent at equal dry-solids input           | Predefined critical endpoints satisfied  |
| Optimization       | Unoptimized candidate and incumbent                    | A reproducible operating window          |
| Production trial   | Comparable baseline on the same line                   | Acceptable process, output and operation |
| Batch confirmation | Approved sample, multiple batches and retained samples | Agreement with acceptance rules          |

During scale-up compare actual thermal history, mixing, local addition concentration, transfer and cooling. Copying laboratory speed to a larger vessel does not reproduce shear. Equal total heating time does not ensure equal material temperature history. Samples from mixing, heating, transfer and finished-product stages can locate the first divergence. For continuous equipment, consider residence-time distribution: an average calculated from nominal flow does not mean every portion receives the same exposure.

Preserve anomalous results and samples. Exclude data only with a documented cause and an agreed rule. Large variation calls for investigation of preparation, equipment or sampling. A stable outcome near the target centre is more useful than an isolated best result.

## 09 Troubleshoot in a controlled sequence

Start with when the defect appears: dispersion, heating, transfer or storage. Then identify recent changes. The table lists diagnostic hypotheses, not confirmed causes. Change one principal factor per comparison where practical.

| Symptom                         | Check first                                         | Verification                                        |
|---------------------------------|-----------------------------------------------------|-----------------------------------------------------|
| Lumps or white cores            | Addition point/rate, premixing, local temperature   | Compare dispersion order at fixed grade and dose    |
| Low initial viscosity           | Dry solids, cooking and reading temperature         | Check weights/moisture and full temperature history |
| Loss after pumping              | Temperature, mechanical history and dilution        | Measure paired samples at the same temperature      |
| Excessive cooled consistency    | Cooling, standing, dose and target texture          | Compare at equal age and temperature                |
| Stored or thawed liquid release | Pack moisture loss, freeze-thaw history and formula | Include unfrozen and unopened controls              |
| Batch variation                 | Identity, moisture, sampling, equipment and method  | Retest retained and new samples consistently        |

If a post-pump sample is hotter or diluted, lower viscosity should not immediately be attributed to mechanical damage. Different times after cooling can likewise make structure development look like batch variation. Align sampling and measurement before changing grade.

A closure record should contain the defect, affected scope, hypotheses, experiments, original results, action and confirmation batch. If several changes were made together, state that their individual contributions remain unresolved. When storage testing is unfinished, limit approval to the completed processing stage.

## 10 Purchasing, traceability and quality documents

A TDS describes a grade and specification. A COA reports results for a batch. An application record documents performance in a particular formula and process. These records complement rather than replace one another. A batch pass does not establish performance in an untested application or identical behaviour for every future delivery.

| Document                          | Check                                                   | Order connection                         |
|-----------------------------------|---------------------------------------------------------|------------------------------------------|
| Specification and TDS             | Name, source, grade, revision, limits and methods       | Approved purchasing baseline             |
| Batch COA                         | Batch, test date, method, result and disposition        | Match pack and shipment batch            |
| Application approval              | Formula, equipment, operating range and product targets | Approved use and change conditions       |
| Credentials and use documentation | Entity, scope, validity and destination requirements    | Match product and manufacturing location |
| Delivery record                   | Quantity, pack, transport and receipt condition         | Traceable acceptance record              |

At Junsheng, R&D defines use and trial conditions, production checks equipment compatibility, quality defines inspection and release conditions, and sales coordinates the confirmed grade, specification revision and delivery requirements with the customer. Relevant source/variety, raw-material inspection, processing and finished-product verification records are linked to batches and recorded on-chain for information checks, as applicable.

Traceability links records; it does not replace verification of facts, test methods or product conformity. Match samples, COAs, packaging and orders through the same batch identity. Resolve inconsistent names or revisions before release.

Purchasing terms should define communication for material changes, including production source, grade, specification revision, packaging and process changes relevant to use. Qualify backup suppliers and substitute grades against the same critical application requirements rather than replacing them solely because additive numbers match.

## 11 Compare cost and destination requirements

Compare relevant total input cost divided by accepted finished-product quantity. Include ingredients, freight, additional processing, attributable losses and rework within the same boundary. A dosage reduction is not a saving by itself if it reduces acceptance or increases variation.

A supporting measure is delivered cost per kilogram of dry solids: delivered as-is price per kilogram divided by  $(1 - \text{wet-basis moisture fraction})$ . This makes moisture differences visible but does not establish suitability. Final comparison requires equivalent target performance, actual dosage and accepted output.

### Check identity, specifications and permission separately

The JECFA database provides additive identity and specification information. WHO records a 2021 specification revision for modified starches. [4] Such specifications are not universal permission for every country and food category. Before ordering, verify current destination requirements for the finished food and intended use, and retain the relevant version and product documents.

A practical sequence is botanical source and modification; intended food or other grade; destination and food category; applicable specifications, use conditions and labelling; then order identity and document requirements. Without a defined food category and market, a universal maximum use level would be inappropriate. An E number alone is not global compliance evidence.

At receipt inspect pack integrity, identification, batch and transport condition, and sample under the agreed plan. Use grade-specific storage, opened-pack and shelf-life instructions. If caking from moisture or an abnormal odour is observed, segregate and assess the material while retaining evidence before use.

## 12 Project records ready for use

Use the following fields to record samples, processing and approval evidence. Define objectives and acceptance criteria before testing; mark untested items explicitly rather than leaving blanks or entering zero.

| Record module           | Suggested fields                                                                                                                               |
|-------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|
| Project and sample      | Project, use, market, grade, batch, specification revision, sampler and date                                                                   |
| Formula and preparation | All ingredients, dry/as-is basis, water, weights, order and preparation ID                                                                     |
| Processing              | Equipment, fill, thermal profile, holding, acid identity/pH and measurement temperature, acid-addition stage, speed/flow, transfer and cooling |
| Testing and storage     | Method, instrument, temperature, time, pack and individual results                                                                             |
| Deviation and decision  | Deviation, hypothesis, verification, approved use, boundaries, owner and date                                                                  |

### Make technical discussions actionable

Provide Junsheng with the finished product, principal formulation variables, process conditions and evaluation target so that samples, specifications and documents can be discussed for a particular grade. A request for “high-viscosity starch” first needs concentration, temperature, instrument and application information to establish a shared basis.

After approval, retain the approved sample, full trial record and specification revision. Put the approved use, acceptance method and change-communication conditions into purchasing documents. Recheck critical endpoints after material changes to formulation or process rather than extending an old approval indefinitely.

The result should be an auditable chain: defined use, identifiable grade, repeatable method, bounded conclusion, matched order and feedback into selection. Performance decisions should follow actual validation rather than a product name or an unqualified table of numbers.

Junsheng Agriculture  
chinapotatostarch.com

## References

1. Reyniers et al. (2020). What makes starch from potato tubers unique: A review.  
<https://doi.org/10.1111/1541-4337.12596>
2. Physicochemical, functional and morphological characterization of starches isolated from three native potatoes of the Andean region (2019).  
<https://doi.org/10.1016/j.fochx.2019.100030>
3. Liu et al. (2023). Relationship among gelatinization, retrogradation behavior, and impedance characteristics of potato starch.  
<https://doi.org/10.1016/j.ijbiomac.2022.12.015>
4. WHO / JECFA: Modified starches evaluation record (2021 specification revision).  
<https://apps.who.int/food-additives-contaminants-jecfa-database/Home/Chemical/398>
5. UK Food Standards Agency: E 1442 identity.  
<https://data.food.gov.uk/regulated-products/id/food-additives/additive/e-1442.html>
6. Chen et al. (2014). Effect of NaCl and sugar on physicochemical properties of flaxseed polysaccharide-potato starch complexes. *ScienceAsia* 40:60-68.  
[https://www.scienceasia.org/2014.40.n1/scias40\\_60.pdf](https://www.scienceasia.org/2014.40.n1/scias40_60.pdf)
7. Mo et al. (2026). Functional Additives Enhance Freeze-Thaw Stability and Retard Retrogradation in Wheat-Potato Starch Gels and Crystal Dumpling Wrappers. *Foods* 15(5):943.  
<https://doi.org/10.3390/foods15050943>
8. FAO: Online Edition, Combined Compendium of Food Additive Specifications.  
<https://www.fao.org/food/food-safety-quality/scientific-advice/jecfa/jecfa-additives/en>
9. NIST/SEMATECH. Choosing an experimental design.  
<https://www.itl.nist.gov/div898/handbook/pri/section3/pri3.htm>
10. Eliasson and Kim (1992). Changes in rheological properties of hydroxypropyl potato starch pastes during freeze-thaw treatments I. A rheological approach for evaluation of freeze-thaw stability.  
<https://doi.org/10.1111/j.1745-4603.1992.tb00526.x>