Journal of Authentic Research
https://journal-center.litpam.com/index.php/jar/index

November 2026 Vol. 5, No. 4
e-ISSN: 2828-3724
pp. 7902-7917

Ethnoscience Reconstruction of Sasak Poteng Fermentation for Contextual Chemistry Learning

Pina Listia[1], Meilynda Pomeistia[1]*, Faizul Bayani[1], Arifka Safitrian[1], Ibnu Malkan Habibi[1], Bq Dina Hardianti[1], Rahman[1], Temi Ainul Syafitri[1], Thauhidayatul Hidayah[1]

[1] Science Education Study Program, Faculty of Teacher Training and Education, Universitas Qamarul Huda Badaruddin Bagu, Indonesia

*Corresponding author e-mail: pomeistia.meilynda@gmail.com

Received: –; Revised: –; Published: –

Abstract

Traditional food preparation can connect community knowledge with chemistry, but a credible ethnoscience reconstruction must distinguish documented practices from mechanisms inferred from the literature. This study aimed to document the preparation sequence of Sasak Poteng, reconstruct relevant chemical concepts, and propose assessable contextual-learning questions. We conducted a descriptive qualitative documentary case study using an 11-page semi-structured interview report and accompanying photographs from Bonjeruk, Central Lombok, supplemented by focused scientific literature. Preparation events were coded chronologically and classified as documented observations (D), literature-supported mechanisms (L), or untested product-specific hypotheses (H). The report described three washing cycles, approximately three hours of soaking, two steaming stages (20 and 15 minutes), katuk-leaf coloration, cooling, starter and sugar addition, and approximately three days of fermentation. Literature-supported interpretations included water uptake, starch gelatinization, enzymatic saccharification, possible alcoholic and organic-acid fermentation, and pigment-related processes. Three instructional matrices/representations linked these stages to testable questions, candidate measurements, and common misconceptions. The central contribution is an auditable, culturally situated distinction between what was reported, what scientific mechanisms can explain, and what remains to be tested. Neither chemical composition, starter microbiota, product safety, nor learning outcomes were directly measured; therefore, the proposed teaching applications require further validation.

Keywords: Chemistry education; Ethnoscience; Fermentation; Glutinous rice; Local knowledge.

How to Cite: Listia, P,. Pomeistia, M. , Bayani, F. ., Safitrian, A. ., Habibi, I. M. ., Hardianti, B. D. ., Rahman, R., Syafitri, T. A. ., & Hidayah, T. . (2026). Ethnoscience Reconstruction of Sasak Poteng Fermentation for Contextual Chemistry Learning. *Journal of Authentic Research*, *5*(4), 7902-7917. https://journal-center.litpam.com/index.php/jar/article/view/7306

https://journal-center.litpam.com/index.php/jar/article/view/7306

Copyright© 2026, Listia et al.
This is an open-access article under the CC-BY-SA License.

INTRODUCTION

Traditional foods are dynamic repositories of technological decision-making: communities select substrates, regulate water and heat, combine plant materials, and interpret sensory changes without necessarily recording measurements in laboratory units. Food-based local knowledge can therefore provide authentic contexts for asking why particular transformations occur and how claims may be tested. Ethnographic studies of indigenous and traditional foods show that recipes are simultaneously material practices and cultural expressions rather than simply combinations of ingredients (Narzary et al., 2016; Downs et al., 2022; Andrada et al., 2025). Research on plant-based food traditions likewise emphasizes the value of documenting local terminology and preparation sequences before interpreting them scientifically (Mhlanga et al., 2024).

In chemistry education, a familiar food can bridge macroscopic observations (color, odor, texture, sweetness), submicroscopic entities (starch chains, enzymes, microorganisms, pigments), and symbolic representations (formulas, reactions, and measured concentrations). Studies of ethnoscience-based contextual and collaborative learning report promising science-literacy outcomes in their own instructional settings, while investigations in Indonesian classrooms argue for culturally grounded inquiry and explicit treatment of evidence (Dewi et al., 2021; Kurniawan et al., 2024; Harjono et al., 2025). These findings provide pedagogical rationale; they do not demonstrate the effectiveness of an untested Poteng lesson.

Research from Indonesia and other settings has expanded the scope of culture-based chemistry learning, including local Lombok fire-making knowledge, Sasak Nyamplung practices, and chemistry teaching informed by Rote Ndao food and beverage production (Andayani et al., 2022; Khery et al., 2025b; Ardyansyah, 2024). Community-based ethnoscience projects involving preservice teachers in Central Lombok demonstrate that field documentation can be translated into curriculum-oriented representations, but the credibility of that translation depends on preserving the distinction between observed practice and scientific interpretation (Bayani et al., 2025; Lorduy et al., 2026).

This need is particularly important for fermented foods. Fermentation is not a single reaction; enzymatic hydrolysis and microbial metabolism may occur sequentially or concurrently, and their rates depend on the starter community and environment. Classic investigations of Indonesian tape ketan established that molds, yeasts, and bacteria may coexist in a fermentation consortium (Ardhana & Fleet, 1989; Siebenhandl et al., 2001). More recent research shows variation among commercial rice starters and demonstrates that packaging can alter the bacterial community and physicochemical characteristics of glutinous-rice tapai (Rakmai et al., 2019; Barus et al., 2023). Consequently, a named microorganism or a measured ethanol concentration from one study cannot be attributed automatically to a different household's starter.

Glutinous rice is also a chemically distinctive substrate. Its low-amylose, amylopectin-rich starch affects gelatinization, viscosity, adhesiveness, and the exposure of polymers to amylolytic enzymes. Contemporary studies link starch microstructure and amylopectin architecture to glutinous-rice texture and thermal properties (Ali & Hashim, 2024; Wang et al., 2023; Honda et al., 2023; Liang et al., 2025). Its traditional preparation therefore permits meaningful links between polymer chemistry, enzyme specificity, and metabolic transformations.

Prior ethnoscience research has explored cultural literacy, creative inquiry, curriculum design, and teacher preparation, but each context requires material-specific and evidence-sensitive reconstruction. Reviews and empirical studies stress the potential of inquiry-oriented cultural projects while identifying needs for validated learning resources and robust assessment (Atmojo et al., 2025; Hikmah et al., 2025; Fitria et al., 2025; Lestari, 2024). Local chemistry projects and interdisciplinary studies of fermented food further suggest that a narrowly defined process can support multiple levels of inquiry without losing its cultural setting (Khery et al., 2025a; Laksmiwati et al., 2024).

Poteng is a traditional Sasak fermented glutinous-rice food in Lombok. The case report describes an unusual process combination: katuk coloration between two

steaming stages, followed by starter inoculation, sugar addition, and fermentation for approximately three days. Research on tape ketan provides evidence about possible microbial consortia and metabolites, whereas studies on glutinous rice and chlorophyll clarify distinct substrate and pigment processes (Ardhana & Fleet, 1989; Siebenhandl et al., 2001; Wang et al., 2023; Ebrahimi et al., 2023). However, these studies do not establish what occurred chemically in this particular Poteng preparation. The research gap is the absence, within the available case documentation, of a traceable account separating household-reported actions from literature-based explanations and testable product-specific claims. The novelty is therefore methodological and pedagogical rather than a claim to have discovered a new fermentation reaction: an evidence-status reconstruction of this reported preparation, including its two-stage steaming and katuk-coloring step, connected to assessable chemistry tasks.

Accordingly, this documentary case study sought to (1) inventory the reported processing steps and quality indicators, (2) establish evidence-bounded connections with starch chemistry, biocatalysis, microbial metabolism, plant pigments, and heat and mass transfer, and (3) translate these connections into testable learning questions. The intended output is a conceptual resource for chemistry educators and a research agenda for future product analysis, not a validated teaching intervention or a representative ethnographic description of all Sasak households

METHOD

Research design and evidence sources

We used a descriptive qualitative documentary single-case design. The unit of analysis was the reported Poteng preparation sequence, not a sample of households or classroom learners. The empirical source was an 11-page student report, "Hasil Wawancara Pembuatan Poteng (Tape Ketan)," based on a semi-structured interview dated 20 October 2026 in Bonjeruk Village, Jonggat District, Central Lombok, and supplemented by process photographs (Listia et al., 2026). We extracted actions, quantities, timing, ingredients, sensory indicators, and contextual claims exactly as recorded. No verbatim interview transcript, audio recording, independent respondent validation, supplementary interview, laboratory measurement, or classroom trial was available. Accordingly, the document supports a case-level reconstruction only and cannot establish between-household variation or population-level generalizability.

A second evidence stream consisted of focused, relevant peer-reviewed studies and authoritative scientific sources on glutinous-rice starch, rice-starter microbiology, chlorophyll chemistry, botanical nomenclature, transport phenomena, and contextual science education. The available bibliography compilations were used to identify candidate references. For each mechanistic proposition, we checked whether the cited source addressed the same process or only an analogous substrate, starter, or teaching context; claims based solely on analogous systems were labelled as literature-supported possibilities rather than local measurements. This focused narrative corroboration was not a systematic review: no exhaustive database query, predefined screening counts, or meta-analysis was undertaken.

Coding and scientific reconstruction

The analysis proceeded in five auditable steps. First, we extracted the field-report events in their documented order. Second, we grouped evidence into ingredient/input, hydration, heat treatment, coloration, inoculation, fermentation, and product-assessment stages. Third, we mapped each stage to an observable change, candidate mechanism, and chemical concept. Fourth, we checked the mechanistic account against relevant literature and balanced reaction equations where applicable. Fifth, we formulated a falsifiable student question and candidate measurement for each stage. Each statement was classified D (documented in the report), L (mechanism supported by external literature but not measured in the sampled product), or H (specific hypothesis requiring new observations). For instance, the 20-minute steaming step is D, the general occurrence of starch gelatinization during wet heating is L, and complete gelatinization in the reported batch is H. The classifications establish an audit trail but are not inter-rater reliability statistics.

For documentary trustworthiness, we cross-referenced the written preparation sequence against the photographs, retained local units rather than inventing mass conversions, and noted discrepancies and missing process parameters. Photographs were treated as visual corroboration of visible actions only; they cannot validate chemical identity, microbial community composition, temperature history, or metabolite concentrations. The underlying interview record was not independently verified with the informant, and no formal intercoder agreement procedure was conducted. Reproducibility therefore means that another analyst can inspect the stated coding rules and reported evidence, not that the physical fermentation can be replicated with the missing water volumes, starter masses, and temperatures. When translating this case into educational activities, we distinguished observation, explanation, and required tests (Arifin et al., 2025; Lestari, 2024).

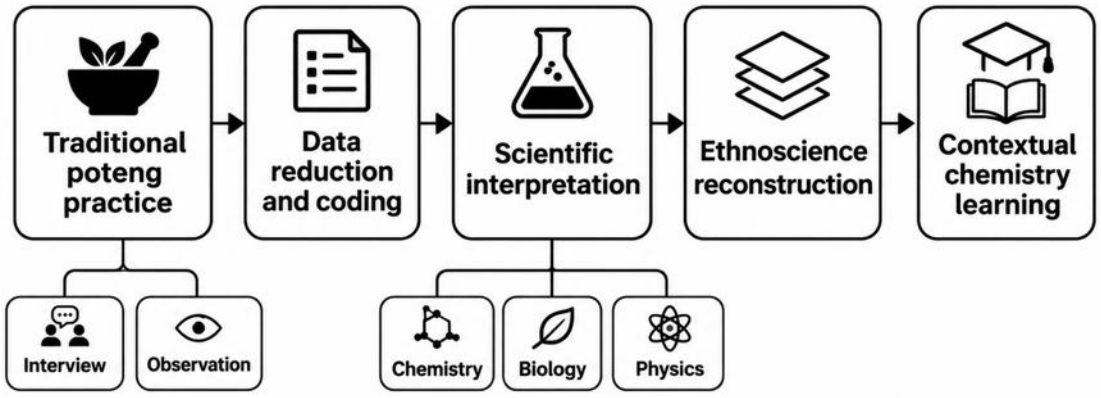


Figure 1. Evidence-sensitive reconstruction workflow from traditional Poteng practice to contextual chemistry learning. The diagram summarizes documentary analysis, not new field measurements.

RESULTS AND DISCUSSION

Reconstructed preparation sequence and locally reported indicators

The case report records a recipe comprising 3 kg of glutinous rice, three tablets of commercial tape starter (*ragi*), 100 g of granulated sugar, and two large bundles of katuk leaves. The rice was washed three times, immersed for approximately three

hours, and steamed for 20 minutes. A blended and strained katuk-leaf preparation was mixed into the partly cooked rice, which was then steamed for a further 15 minutes. After cooling, the starter was crushed and scattered over the rice, sugar was added, and the mixture was placed in a clean closed container for approximately three days at ambient conditions. A successful product was described as soft, slightly sour, sweet, and characteristically fermented (Listia et al., 2026).

These amounts describe recipe inputs, not final proximate composition. The ratio of added granulated sugar to initial dry rice is 100/3000 × 100 = 3.33%, whereas the starter dose is one tablet per kilogram of initial rice; neither figure quantifies soluble sugar concentration, total fermentable carbohydrate, viable-cell load, or microbial biomass. The 20-minute and 15-minute steaming stages are separated by mixing and cannot be treated as one uninterrupted 35-minute thermal exposure. Water volume during washing and soaking, katuk extract yield, starter mass, center temperature, pH, and final ethanol concentration were not provided.

The report places Poteng in a family tradition transmitted across generations and describes its use during religious festivities, including Eid and Mawlid-related gatherings, with some production also undertaken for household income (Listia et al., 2026). This is a case-level cultural account, not a prevalence estimate for all Sasak households. Cross-cultural food documentation and local-knowledge studies suggest that such contextual details can support respectful classroom questions about whose knowledge is recorded and which aspects of a practice are shared or variable (Andrada et al., 2025; Downs et al., 2022).

A further interpretive distinction concerns evidence strength. Household descriptions establish the intended order and approximate durations of the preparation, whereas photographs offer selective visual confirmation; neither captures the full thermal or fermentation profile. Studies of tape ketan and commercial rice starters can justify candidate pathways but cannot supply measured values for this recipe (Ardhana & Fleet, 1989; Rakmai et al., 2019; Barus et al., 2023). This comparison prevents a descriptive case from being read as a laboratory characterization.

Table 1. Reported Poteng operations, quantities, and associated evidence limitations

Stage	Recorded operation (D)	Unmeasured quantity or uncertainty
Preparation	3 kg glutinous rice; 3 starter tablets; 100 g sugar; 2 large bundles of katuk	Actual starter mass, leaf mass, water additions
Washing / hydration	Three washing cycles; approximately 3 h soaking	Water uptake, temperature, washing losses
Steaming I	20 minutes in a traditional steamer	Core temperature and degree of gelatinization
Leaf coloration	Katuk blended, strained and mixed into steamed rice	Extract composition, pigment profile, pH
Steaming II	Additional 15 minutes	Thermal profile after remixing

Stage	Recorded operation (D)	Unmeasured quantity or uncertainty
Cooling / inoculation	Starter added to cooled rice; sugar dispersed	Inoculation temperature, viable microbial counts
Fermentation	Covered clean container, approximately 3 days at room temperature	Actual temperature, oxygen availability, pH, ethanol
Product judgment	Soft texture; sweet–slightly sour taste; characteristic aroma	Instrumental sensory and safety measures



Figure 2. Photographs from the original Poteng interview report: (a) soaking glutinous rice; (b) steaming apparatus; (c) katuk leaves; (d) mixing rice with katuk extract; (e) rice spread before starter addition; and (f) product in individual containers (Listia et al., 2026, pp. 5–9).

Chemical reconstruction: gelatinization, saccharification, and fermentation

The chemical sequence begins before fermentation. Soaking increases access of water to the rice grain and subsequent steaming promotes hydration and gelatinization of starch granules. In glutinous rice, the branched architecture of amylopectin, with α-(1→4) linked chains and α-(1→6) branch points, influences swelling, cohesiveness, and texture. Starch composition and the genetic background of the Waxy trait vary across cultivars, so no absolute amylose percentage is assigned to the rice batch (Jiang et al., 2022; Ali & Hashim, 2024; Wang et al., 2023; Shoukat et al., 2025).

Gelatinization should not be written as the stoichiometric conversion of starch into glucose: it is principally a thermally induced physical–structural transformation involving water uptake and disruption of granule order. Exact transition temperatures depend on moisture and substrate structure; they cannot be inferred from the reported steaming time alone. Classical processing research and recent studies of glutinous-rice starch both support this distinction (Lund, 1984; Honda et al., 2023; Liang et al., 2025).

Subsequent starch saccharification requires hydrolytic enzymes, potentially contributed by amylolytic microorganisms associated with the starter. The idealized overall balance for exhaustive conversion of anhydroglucose units to glucose is:

$(C6H_{10}O_5)_n + n\ H_2O \rightarrow n\ C_6H_{12}O_6$ [ideal enzymatic hydrolysis]

Actual enzyme systems produce intermediate dextrins, maltose, and other oligosaccharides, and different enzymes differ in their action on α-(1→4) versus α-(1→6) glycosidic bonds. Thus, a sweet sensory impression does not demonstrate that all starch was hydrolyzed, particularly because sucrose is intentionally added. Comparative work on functional rice starters shows that amylolytic molds or yeasts and fermentative yeasts can contribute distinct activities (Rakmai et al., 2019; Delva et al., 2022).

The added sucrose could be hydrolyzed by appropriate invertase activity, producing glucose and fructose according to the idealized reaction:

$C_{12}H_{22}O_{11} + H_2O \rightarrow C_6H_{12}O_6 + C_6H_{12}O_6$ [sucrose hydrolysis]

One established metabolic endpoint for fermentable hexoses is alcoholic fermentation. The balanced net reaction and ideal theoretical mass yield from glucose are:

$$C_6H_{12}O_6 \rightarrow 2\ C_2H_5OH + 2\ CO_2$$

$$Y(\text{ethanol/glucose}) = 2(46.07) / 180.16 = 0.511\ g\ g^{-1}$$ [theoretical]

The ideal 0.511 g g^{-1} yield describes stoichiometric potential under a defined pathway, not the ethanol yield of this recipe. Some substrate can enter biomass, respiration, or alternative metabolites, and intermediate sugars may remain. The three-day fermentation described by the informant therefore cannot be converted into an ethanol percentage without chemical analysis (Ardhana & Fleet, 1989; Siebenhandl et al., 2001; Barus et al., 2023).

Organic-acid formation is another plausible route. The net equation for homofermentative lactate formation is $C_6H_{12}O_6 \rightarrow 2\ CH_3CH(OH)COOH$. This is not a description of all bacteria in tape, nor proof that lactic acid was present at a particular concentration. The measured biochemical variables in prior tape ketan studies included glucose, ethanol, lactic acid, and pH, illustrating how the case could be tested rather than supplying values for the current sample (Siebenhandl et al., 2001).

$C_6H_{12}O_6 \rightarrow 2\ CH_3CH(OH)COOH$ [possible homolactic route]

The starter must likewise be treated as a potential multi-organism community. Research on Indonesian tape has reported *Amylomyces rouxii*, different yeasts, and bacterial associates, while molecular work confirms diversity among *A. rouxii* isolates from Java. More recent observations of rice tapai demonstrate that fermentation ecology may change with packaging and environmental factors (Ardhana & Fleet, 1989; Delva et al., 2022; Barus et al., 2023). None of these organisms was isolated or identified from the three tablets in the present field report; taxonomic attribution would require appropriate microbiological and molecular analysis.

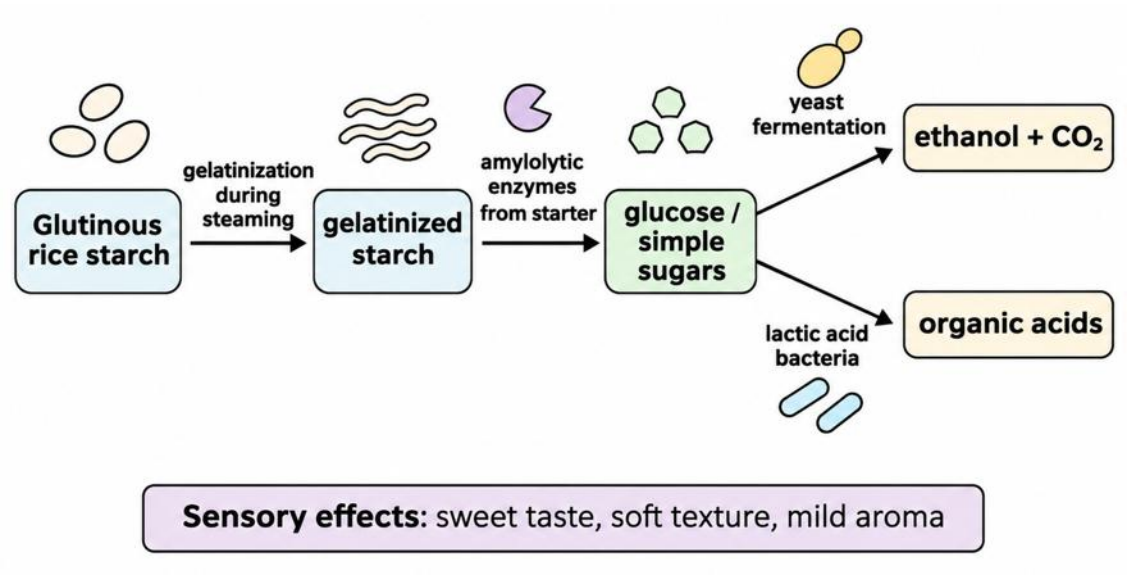


Figure 3. Literature-supported pathways linking glutinous-rice starch processing, enzymatic saccharification, and potential microbial metabolites. The pathways were not measured in the reported Poteng sample.

Katuk pigments and the meaning of a 'green extract'

A distinctive feature of the reported practice is the green coloring of rice between two steaming stages. Katuk is frequently cited under the historical scientific name *Sauropus androgynus* (L.) Merr.; under the current taxonomic treatment in Plants of the World Online, the accepted name is *Phyllanthus androgynus* (L.) Chakrab. & N.P.Balakr. (Royal Botanic Gardens, Kew, 2026). This nomenclatural correction is based on the plant name in the report; a voucher specimen or diagnostic botanical examination was not supplied, so the harvested leaves were not independently authenticated.

Chlorophylls a and b reside primarily in photosynthetic membranes rather than being freely soluble in water. Consequently, the green liquid generated by blending and straining katuk leaves may contain dispersed tissue fragments and membrane-associated pigments alongside dissolved components; calling it a chemically pure chlorophyll solution would be inaccurate. The structures, magnesium coordination, and susceptibility of chlorophylls to processing conditions have been reviewed comprehensively (Ebrahimi et al., 2023).

One acid-associated reaction commonly used to explain color deterioration is chlorophyll-a pheophytinization, represented at the molecular level as chlorophyll a + 2 H^+ → pheophytin a + Mg^{2+}. Its presence in this sample cannot be inferred from photographs: pigment identity, reaction extent, and color stability would require controlled pH, colorimetric measurements, and chemical analysis. The katuk stage therefore offers a useful chemistry question about solution versus dispersion and structure–color relations, not evidence that a particular pigment transformation occurred.

Water, heat, and safety as chemistry-supporting concepts

The three-hour soaking step permits an introductory mass-balance and diffusion investigation. With consistent draining conditions, fractional water uptake can be estimated as $U(t) = 100(m_t - m_0)/m_0$, whereas Fick's law $J = -D_{eff}(\partial C/\partial x)$ supplies

a simplified model for water transport into the grain. The coefficient would depend on cultivar, temperature, grain geometry, and processing history, and must not be borrowed from a different experiment without calibration (Bello et al., 2004).

During steaming, hot vapor transfers energy by convection and condensation while heat propagates inward by conduction. Useful educational models include $Q = mc_p\Delta T$ for sensible heat, Q = m_vh_fg for phase-change heat, and $\alpha = k/(\rho c_p)$ for thermal diffusivity. At near-atmospheric pressure, the latent heat of water condensation near 100 °C is roughly 2257 kJ kg^{-1}, a property available from authoritative steam tables, not a value directly recorded in the household practice (Harvey, 1998). The second steaming step follows mixing with a comparatively cooler green extract and may therefore produce a distinct thermal trajectory; the document contains no core-temperature curve.

Cooling before starter addition has a plausible microbiological rationale because starter viability depends on temperature, but this does not prove microbial safety. The report mentions clean containers and sensory rejection of obviously spoiled material; nevertheless, appearance and smell cannot establish absence of pathogens or toxins. Reviews of *Bacillus cereus* associated with rice emphasize that cooking, cooling, and storage conditions are critical risk factors and that heat-resistant spores require appropriate control (Woh & Ng, 2024). This educational discussion should not be read as an instruction to culture unknown microorganisms in an unsupervised classroom.

From community knowledge to assessable chemistry learning

A productive lesson should retain the local maker's observations as a legitimate starting point, then require students to distinguish the explanation's evidential strength. Table 2 maps the household process onto concepts and candidate measurements. Rather than merely memorizing the reaction for ethanol formation, learners can interrogate how the substrate becomes accessible, what role different microorganisms might play, and which observations would actually count as evidence.

Table 2. Evidence-aware reconstruction of Poteng processing as a chemistry learning resource

Local practice (D)	Scientific concept (L)	Testable learning question (H)
Rice is soaked for ~3 h	Water uptake, diffusion, mass balance	How does uptake (%) vary with soak duration and temperature?
Rice is steamed in two stages	Starch hydration, gelatinization, thermal transport	Does core temperature or texture differ across stages?
Katuk is blended and strained	Plant pigments, dispersions vs true solutions	Which particle-size fractions retain visible green color?
Rice is cooled before starter addition	Thermal history, viable microorganisms	What inoculation temperature is recorded, and why control it?
Crushed ragi and sugar are distributed	Biocatalysis, dissolution, sucrose hydrolysis	Which substrates and enzymes are needed to produce reducing sugars?

Local practice (D)	Scientific concept (L)	Testable learning question (H)
Mixture is held ~3 days	Possible ethanol and acid formation, kinetics	How do pH and reducing sugars change during controlled incubation?
Product is sweet and slightly sour	Sensory response versus analytical measurement	Can tasting alone distinguish sucrose, ethanol and organic acids?

The pedagogical rationale is supported by empirical and conceptual studies showing that ethnoscience integration can create a meaningful bridge between community settings and inquiry-oriented science instruction. In Indonesia, investigations have documented positive results for specific contextual models, whereas systematic reviews caution that the effectiveness of a designed resource should be separately demonstrated (Dewi et al., 2021; Khery et al., 2025a; Hikmah et al., 2025; Muchson et al., 2024). These outcomes are not transferable as measured effects of the present, untested manuscript.

The literature also differs in study design and outcome measures: classroom studies investigate performance under a specific intervention, whereas the present work analyzes only a preparation document (Dewi et al., 2021; Harjono et al., 2025; Hikmah et al., 2025). Consequently, agreement in pedagogical rationale is not evidence of equal effects. A future evaluation would need a defined learner population, an explicit instructional comparator, valid measures of chemical reasoning, and documented implementation conditions before effectiveness could be estimated.

The Poteng case also offers a carefully bounded cross-disciplinary extension. Seed anatomy and rice genetics provide biological context for the carbohydrate substrate; mass transfer and heat transport provide physical models for soaking and steaming; and microbial metabolism provides reaction-level explanations for fermentation. Comparable culturally situated studies have linked food-based projects to cross-disciplinary learning and inquiry, and recent research in science teacher education reinforces the value of such interdisciplinary interpretation (Laksmiwati et al., 2024; Lufri et al., 2026; Nagashybayeva et al., 2026).

Table 3. Suggested instructional alignment and defensible assessment evidence

Chemistry focus	Proposed student task	Evidence to collect	Key misconception to avoid
Macromolecules	Draw amylose and branched amylopectin linkages	Annotated molecular diagram	Gelatinization is hydrolysis
Chemical change	Balance glucose-to-ethanol equation	Atom balance and yield calculation	Fermentation yield equals product ethanol content
Reaction pathways	Distinguish amylase action from yeast metabolism	Evidence-based explanatory chain	All starter organisms perform all reactions

Chemistry focus	Proposed student task	Evidence to collect	Key misconception to avoid
Mixtures and pigments	Classify katuk filtrate as possible dispersion	Filtration/color observations	Green filtrate is pure dissolved chlorophyll
Acid–base chemistry	Design a pH monitoring plan	Variables, calibrated pH data	Sour taste gives a numerical pH
Experimental design	Critique documented vs inferred statements	D/L/H evidence matrix	A photograph confirms molecular composition

Project-based and culturally sustaining models provide useful design options once the material is validated and teaching conditions are assessed. Studies of science and chemistry instruction have examined ethnoscience integration, critical thinking, and cultural literacy in diverse educational contexts (Atmojo et al., 2025; Harjono et al., 2025; Fitria et al., 2025; Arifin et al., 2025). The teacher may therefore use Poteng as a prompt for hypothesis formation and measurement planning, but not claim measurable student improvement until a classroom trial with appropriate instruments has been undertaken.

Knowledge transfer must also be culturally respectful. Traditional expertise comprises experiential quality judgments, inherited recipes, and the social timing of foods, which cannot be reduced to a list of chemical names. Broader studies of culture-responsive and intercultural science education emphasize dialogue and ethical treatment of community knowledge, whereas locally focused projects suggest the importance of institutional collaboration and student reflection (Lange et al., 2025; Lorduy et al., 2026; Bayani et al., 2025; Andrada et al., 2025).

The proposed investigations should be proportionate to the learning level: simple water-uptake and dispersion tests are feasible with ordinary educational equipment, while microbial community identification, ethanol quantification, metabolomic profiling, and safety certification require trained laboratory personnel and validated instruments. Cultural food projects and science-literacy scholarship likewise indicate that assessment should focus on quality of explanation and evidential reasoning, not only the novelty of the cultural example (Lestari, 2024; Kurniawan et al., 2024; Minarni et al., 2026).

Strengths and limitations of the reconstruction

A key contribution of this study is a product-specific chain of evidence: each learning concept can be traced to a documented action and matched to a mechanistic literature claim with an explicit boundary between D, L, and H. This addresses a recurring risk in ethnoscience writing, where labels such as fermentation, color change, or diffusion are applied without specifying which measurement would discriminate among possible mechanisms. A second contribution is integration of the two-stage katuk coloring step, which creates distinct questions about aqueous dispersions, pigment chemistry, and thermal exposure.

The D/L/H framework is intended as a transparent reporting device, not a validated assessment instrument. Its usefulness should be examined through independent expert review of classifications, agreement between coders, usability

testing with chemistry teachers, and evaluation of students' capacity to distinguish observations from hypotheses. Such evaluation may lead to merging, subdividing, or revising the categories; the current article offers no reliability coefficient or causal instructional evidence.

The principal limitation is that the original record represents one semi-structured interview report and accompanying photographs rather than multiple independently sampled household preparations. The supplied report also contains unrelated food names in two introductory/method passages and duplicated image numbering, which were treated as editing anomalies rather than substantive Poteng evidence. There was no verbatim transcript, member-check record, botanical voucher, controlled starter characterization, analytical measurement, sensory panel, or classroom intervention. Accordingly, this article makes neither population-level ethnographic claims nor causal claims regarding an educational intervention.

The emphasis on one culturally specific fermented food also limits chemical generalization. Findings on tapai starter consortia, glutinous-rice texture, and green pigments from other studies offer defensible mechanistic analogies but cannot establish the concentrations, kinetics, or safety status of the local product. This constraint is consistent with the broader literature on fermented-food diversity and biocultural food traditions (Ardhana & Fleet, 1989; Rakmai et al., 2019; Mhlanga et al., 2024; Narzary et al., 2016).

CONCLUSION

This case documents a culturally specific sequence of soaking, two-stage steaming with intervening katuk coloration, starter inoculation, sugar addition, and approximately three days of fermentation. The evidence-sensitive reconstruction links these reported steps to scientifically plausible water transport, starch gelatinization, enzymatic saccharification, microbial metabolism, and pigment chemistry without treating those mechanisms as product-specific measurements. Its principal contribution is a traceable D/L/H framework and accompanying learning tasks that require students to distinguish reported practice, literature-supported explanation, and experimentally testable hypotheses. Because the analysis rests on one documentary case without independent biochemical characterization or classroom evaluation, neither the chemical profile of Poteng nor the educational effectiveness of these tasks can be inferred. The next stage is to validate the documentary account, measure relevant process variables, and independently test the instructional design.

RECOMMENDATION

Before this reconstruction is adopted as a tested learning resource, the team should confirm the original interview record and publication permissions, identify the katuk plant specimen, and standardize starter mass, leaf-extract volume, inoculation temperature, and fermentation conditions. A controlled follow-up study could measure reducing sugars, pH, titratable acidity, ethanol, color stability, and microbial composition over time. A separate classroom evaluation should assess scientific reasoning and chemistry concept understanding using validated instruments and a transparent comparison design. No food produced during unsupervised microbial experiments should be consumed.

REFERENCES

Ali, M. M., & Hashim, N. (2024). Exploring nutritional compositions, volatile compounds, health benefits, emerging processing technologies, and potential food products of glutinous rice: A review. Rice Science, 31(3), 251–268. https://doi.org/10.1016/j.rsci.2024.02.002

Andayani, Y., Hakim, A., Doyan, A., & Handayani, A. A. A. T. (2022). Medaq Api traditional ethnoscience study: Identification of chemical concept from indigenous knowledge of the Lombok people. AIP Conference Proceedings, 2638. https://doi.org/10.1063/5.0104624

Andrada, Z. M., Estares, S. D., Mangulabnan, N. P., & Acanto, R. B. (2025). Exploring Community Funds of Knowledge for Culturally Relevant Science in Food Preservation in a Coastal Community in Negros Island, Philippines. Journal of Educational and Social Research, 15(3), 152–170. https://doi.org/10.36941/jesr-2025-0088

Ardhana, M. M., & Fleet, G. H. (1989). The microbial ecology of tape ketan fermentation. International Journal of Food Microbiology, 9(3), 157–165. https://doi.org/10.1016/0168-1605(89)90086-X

Ardyansyah, A. (2024). Enhancing chemistry education through the integration of Rote Ndao cultural practices: An ethnographic exploration of ethnochemistry. Journal of Educational Chemistry, 6(2). https://doi.org/10.21580/jec.2024.6.2.22321

Arifin, Z., Sukarmin, S., & Saputro, S. (2025). Feasibility and effectiveness of culturally sustaining inquiry-based learning integrated with socio-scientific issues for enhancing critical thinking on climate change. Journal of Baltic Science Education, 24(4), 624–636. https://doi.org/10.33225/jbse/25.24.624

Atmojo, S. E., Anggriani, M. D., Rahmawati, R. D., Skotnicka, M., Wardana, A. K., & Anindya, A. P. (2025). Bridging STEM and culture: The role of ethnoscience in developing critical thinking and cultural literacy. Jurnal Pendidikan IPA Indonesia, 14(2), 251–266. https://doi.org/10.15294/jpii.v14i2.23505

Barus, T., Cenniati, N., & Prasasty, V. D. (2023). Variations in the properties and bacterial community of white glutinous rice tapai under different packaging conditions during fermentation. Biodiversitas, 24(11), 6240–6247. https://doi.org/10.13057/biodiv/d241146

Bayani, F., Hulyadi, Pomeistia, M., Sudirman, Rahman, Hidayah, T., Hardianti, D., Safitri, T. A., & Gargazi. (2025). Preservice science teachers as mediators of indigenous artisanal knowledge: A community-based ethnoscience project in Central Lombok. Journal of Authentic Research, 4(2), 2122–2145. https://doi.org/10.36312/f6svsq19

Bello, M., Tolaba, M. P., & Suarez, C. (2004). Factors affecting water uptake of rice grain during soaking. LWT–Food Science and Technology, 37(8), 811–816. https://doi.org/10.1016/j.lwt.2004.02.014

Delva, E., Arisuryanti, T., & Ilmi, M. (2022). Genetic diversity of Amylomyces rouxii from ragi tapai in Java Island based on ribosomal regions ITS1/ITS2 and D1/D2. Mycobiology, 50(2), 132–141. https://doi.org/10.1080/12298093.2022.2028436

Dewi, C. A., Erna, M., Martini, Haris, I., & Kundera, I. N. (2021). The effect of contextual collaborative learning based ethnoscience to increase student's scientific literacy ability. Journal of Turkish Science Education, 18(3), 525–541. https://doi.org/10.36681/tused.2021.88

Downs, S. M., Kapoor, R., Merchant, E. V., Sullivan, T., Singh, G., Fanzo, J., & Ghosh-Jerath, S. (2022). Leveraging Nutrient-Rich Traditional Foods to Improve Diets among Indigenous Populations in India: Value Chain Analysis of Finger Millet and Kionaar Leaves. Foods, 11(23). https://doi.org/10.3390/foods11233774

Ebrahimi, P., Shokramraji, Z., Tavakkoli, S., Mihaylova, D., & Lante, A. (2023). Chlorophylls as natural bioactive compounds existing in food by-products: A critical review. Plants, 12(7), 1533. https://doi.org/10.3390/plants12071533

Fitria, D., Asrizal, A., & Lufri, L. (2025). Enhancing 21st-Century Skills through Blended Problem-Based Learning with Ethnoscience Integration: A Mixed-Methods Study in Indonesian Junior High Schools. International Journal of Learning, Teaching and Educational Research, 24(1), 464–480. https://doi.org/10.26803/ijlter.24.1.23

Harjono, A., Verawati, N. N. S. P., Gummah, S., & Prayogi, S. (2025). Integrating ethnoscience in inquiry-creative learning: A new breakthrough in enhancing critical thinking. International Journal of Evaluation and Research in Education, 14(1), 636–647. https://doi.org/10.11591/ijere.v14i1.29259

Harvey, A. H. (1998). Thermodynamic properties of water: Tabulation from the IAPWS formulation 1995 (NISTIR 5078). National Institute of Standards and Technology. https://doi.org/10.6028/NIST.IR.5078

Hikmah, N., Yohandri, Arsih, F., Azhar, M., & Razak, A. (2025). Uncovering the potential of ethnoscience in science learning to improve students' literacy: A systematic literature review (2014–2024). Jurnal Pendidikan IPA Indonesia, 14(3), 550–562. https://doi.org/10.15294/jpii.v14i3.19591

Honda, Y., Saito, Y., Katsumi, N., Nishikawa, M., & Takagi, H. (2023). Physicochemical properties of starch in rice flour with different hardening rates of glutinous rice cake (mochi). Journal of Cereal Science, 112, 103687. https://doi.org/10.1016/j.jcs.2023.103687

Jiang, C., Rashid, M. A. R., Zhang, Y., Zhao, Y., & Pan, Y. (2022). Genome wide association study on development and evolution of glutinous rice. BMC Genomic Data, 23, 33. https://doi.org/10.1186/s12863-022-01033-1

Khery, Y., Hakim, A., Rokhmat, J., & Sukarso, A. (2025a). Effectiveness of ethnoscience oriented project to improve students performance. Multidisciplinary Science Journal, 7(8). https://doi.org/10.31893/multiscience.2025417

Khery, Y., Hakim, A., Rokhmat, J., & Sukarso, A. (2025b). Improving student chemistry laboratory performance through Nyamplung ethnoscience-oriented learning of the Sasak tribe. Eclética Química, 50, e1567. https://doi.org/10.26850/1678-4618.eq.v50.2025.e1567

Kurniawan, W., & Basuki, F. R. (2024). Ethnoscience learning: How do teacher implementing to increase scientific literacy in junior high school. International Journal of Evaluation and Research in Education, 13(3), 1719–1730. https://doi.org/10.11591/ijere.v13i3.26180

Laksmiwati, P. A., Abrori, F. M., Lavicza, Z., & Cahyono, A. N. (2024). Merging mathematics, biology, and local culture: Exploring a traditional food project in elementary education. Science Activities, 61(2), 57–70. https://doi.org/10.1080/00368121.2024.2302992

Lange, B. M. M., Pedersen, J. M., Kristiansen, G., Mackisack, V., & Killengreen, S. T. (2025). Integrating Coastal Sámi Traditional Knowledge in Science Education: Challenges, Approaches, and the Path Forward. Education Sciences, 15(2). https://doi.org/10.3390/educsci15020230

Lestari, D. P. (2024). Development and validation of the inquiry-based nature of science and argumentation: A new instructional model on students' scientific argumentation ability. International Journal of Education and Practice, 12(2), 189–206. https://doi.org/10.18488/61.v12i2.3657

Liang, C., Han, Y., Xu, H., Liu, D., Jiang, C., Li, Q., Hu, Y., & Xiang, X. (2025). The high molecular weight and large particle size and high crystallinity of starch increase gelatinization temperature and retrogradation in glutinous rice. Carbohydrate Polymers, 348, 122756. https://doi.org/10.1016/j.carbpol.2024.122756

Listia, P., Safitrian, A., & Habibi, I. M. (2026). Hasil wawancara pembuatan Poteng (tape ketan) [Unpublished field interview report]. Science Education Study Program, Universitas Qamarul Huda Badaruddin Bagu.

Lorduy, D. J., Flórez-Nisperuza, E., & Adúriz-Bravo, A. (2026). Navigating Knowledge Systems in Intercultural Science Education: From Integration to Epistemic Dialogue. Science and Education. https://doi.org/10.1007/s11191-026-00786-w

Lufri, L., Razak, A., Ahda, Y., & Kasmita, W. (2026). Integrating Ethnoscience Within Project-Based Learning: Enhancing Twenty-First Century Skills of Science Pre-Service Teachers Through Lecturer Perceptions. Canadian Journal of Science, Mathematics and Technology Education, 26(3). https://doi.org/10.1007/s42330-026-00464-7

Lund, D. (1984). Influence of time, temperature, moisture, ingredients, and processing conditions on starch gelatinization. Critical Reviews in Food Science and Nutrition, 20(4), 249–273. https://doi.org/10.1080/10408398409527391

Mhlanga, P., Mianda, S. M., & Sivakumar, D. (2024). Impact of Fermentation of Pumpkin Leaves and Melon Varieties with Lactobacillus Strains on Physicochemical Properties, Antioxidant Activity, and Carotenoid Compounds. Foods, 13(22). https://doi.org/10.3390/foods13223562

Minarni, Asyhar, R., Haryanto, & Hariyadi, B. (2026). Enhancing science literacy through ethnoscience-based project-based learning integrated with the flipped classroom: A bibliometric analysis. Discover Education, 5, 555. https://doi.org/10.1007/s44217-026-01718-0

Muchson, M., Cobern, W. W., & Saefi, M. (2024). The science education research trends (SERT) in Indonesian secondary schools: A systematic review and bibliometrics study. Cogent Education, 11(1). https://doi.org/10.1080/2331186X.2024.2308407

Nagashybayeva, P., Zhandavletova, R., & Zhuamgulova, K. (2026). Teaching microorganisms in education: A systematic literature review using PRISMA guidelines. Natural Sciences Education, 55(2). https://doi.org/10.1002/nse2.70074

Narzary, Y., Brahma, J., Brahma, C., & Das, S. (2016). A study on indigenous fermented foods and beverages of Kokrajhar, Assam, India. Journal of Ethnic Foods, 3(4), 284–291. https://doi.org/10.1016/j.jef.2016.11.010

Rakmai, J., Cheirsilp, B., & Srinuanpan, S. (2019). Designation of rice cake starters for fermented rice products with desired characteristics and fast fermentation. Journal of Food Science and Technology, 56(6), 3014–3022. https://doi.org/10.1007/s13197-019-03784-9

Royal Botanic Gardens, Kew. (2026). Plants of the World Online: Phyllanthus androgynus (L.) Chakrab. & N.P.Balakr. https://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:77119613-1

Shoukat, R., Cappai, M., Pilia, L., & Pia, G. (2025). Rice starch chemistry, functional properties, and industrial applications: A review. Polymers, 17(1), 110. https://doi.org/10.3390/polym17010110

Siebenhandl, S., Lestario, L. N., Trimmel, D., & Berghofer, E. (2001). Studies on tape ketan—an Indonesian fermented rice food. International Journal of Food Sciences and Nutrition, 52(4), 347–357. https://doi.org/10.1080/09637480120057585

Wang, B., Xu, J., Guo, D., Long, C., Zhang, Z., Cheng, Y., Huang, H., Wen, P., He, H., & He, X. (2023). Research on the relationship between the amylopectin structure and the physicochemical properties of starch extracted from glutinous rice. Foods, 12(3), 460. https://doi.org/10.3390/foods12030460

Woh, P. Y., & Ng, C. (2024). Bacillus cereus in rice: A review on food poisoning, antimicrobial resistance, and control measures. Tropical Biomedicine, 41(3), 298–309. https://doi.org/10.47665/tb.41.3.010