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Chemistry in Traditional Cirebon Cuisine: Reconstruction of Local Knowledge into Chemical Concepts as Contextual Learning

Fatimah Khoirunisa[1*)], Woro Sumarni[1], and Triastuti Sulistyaningsih[1]

[1]Department of Chemistry, Faculty of Mathematics and Natural Sciences, Universitas Negeri Semarang, Indonesia

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ABSTRAK

Penelitian ini bertujuan untuk mengeksplorasi dan merekonstruksi etnokimia pada kuliner khas Cirebon sebagai sumber pembelajaran kimia kontekstual. Kuliner yang dikaji meliputi nasi jamblang, empal gentong, tahu gejrot, dan tape ketan. Penelitian menggunakan pendekatan deskriptif kualitatif dengan desain etnografi melalui observasi, wawancara, dokumentasi, dan studi literatur. Data yang diperoleh dianalisis dan direkonstruksi menjadi konsep ilmiah kimia. Hasil penelitian menunjukkan bahwa proses pengolahan kuliner khas Cirebon mengandung berbagai konsep kimia, seperti gelatinisasi pati, denaturasi protein, sistem koloid, reaksi oksidasi-reduksi, fermentasi, laju reaksi, termokimia, koagulasi protein, dan reaksi Maillard. Integrasi konsep-konsep tersebut ke dalam pembelajaran kimia dapat meningkatkan pemahaman peserta didik karena bersifat kontekstual dan dekat dengan kehidupan sehari-hari. Penelitian ini memberikan alternatif sumber belajar berbasis kearifan lokal yang mendukung implementasi Kurikulum Merdeka.

ABSTRACT

This study aims to explore and reconstruct ethnochemistry in traditional Cirebon cuisine as a source of contextual chemistry learning. The culinary items examined include nasi jamblang, empal gentong, tahu gejrot, and tape ketan. The research employs a qualitative descriptive approach with an ethnographic design through observation, interviews, documentation, and literature study. The collected data are analyzed and reconstructed into scientific chemistry concepts. The results show that the processing of traditional Cirebon cuisine contains various chemical concepts, such as starch gelatinization, protein denaturation, colloidal systems, oxidation-reduction reactions, fermentation, reaction rates, thermochemistry, protein coagulation, and Maillard reactions. Integrating these concepts into chemistry learning can enhance students' understanding because it is contextual and closely related to everyday life. This study provides an alternative learning resource based on local wisdom that supports the implementation of the Merdeka Curriculum.

*) **Correspondence address:**
Sekaran, Gunungpati, Kota Semarang
E-mail: fatimahkhoirunisa@students.unnes.ac.id

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INTRODUCTION

Chemistry learning is still often perceived as an abstract, difficult subject that lacks relevance to students' daily lives (Sariati *et al.,* 2020; Priliyanti *et al.,* 2021). This perception arises because chemical concepts are generally presented in a theoretical manner without being explicitly connected to real-life experiences familiar to students. As a result, students tend to have difficulties in understanding concepts, show low interest in learning, and are less able to apply chemical knowledge in real-life contexts (Purba *et al.,* 2024).

On the other hand, various everyday activities in society, particularly those related to local culture, inherently contain complex chemical phenomena (Wahyudi, 2021; Sari *et al.,* 2022; Gunawan *et al.,* 2020). One form of culture rich in scientific value is traditional cuisine (Purnomo & Setyowanti, 2020). Food processing activities such as cooking, boiling, fermenting, and mixing ingredients involve various chemical concepts, including physical and chemical changes, oxidation-reduction reactions, fermentation, and interactions between substances. However, this great potential has not been optimally utilized as a source of contextual chemistry learning (Hartoyo & Hairida, 2024).

The ethnochemistry approach emerges as a solution to bridge the gap between abstract chemical concepts and the real-life experiences of students (Andayani, 2025). Ethnochemistry examines cultural practices that are related to chemical concepts, enabling the integration of local knowledge with scientific knowledge (Lalang, 2023). Through this approach, learning becomes not only more meaningful and contextual but also contributes to the preservation of local wisdom. In addition, the integration of local wisdom in learning aligns with the Merdeka Curriculum, which emphasizes context-based learning and students' real-life experiences (Goni *et al.,* 2023).

Indonesia, as a country with rich cultural diversity, has great potential for developing ethnochemistry-based learning. One region rich in local wisdom, particularly in the culinary field, is Cirebon (Rahmawati *et al.,* 2025). Traditional Cirebon foods such as nasi jamblang, empal gentong, tahu gejrot, and tape ketan not only carry cultural value but also contain various chemical concepts in their processing (Purnomo & Setyowanti, 2020). However, studies that specifically explore and reconstruct local knowledge of Cirebon traditional cuisine into scientific chemical concepts are still limited (Tahya *et al.,* 2022).

This limitation indicates a gap between the potential of local wisdom and its utilization in chemistry learning (Hartoyo & Hairida, 2024). Therefore, efforts are needed to explore, document, and reconstruct community local knowledge into systematic scientific knowledge that can be used as a learning resource.

Based on this, the present study aims to reconstruct local community knowledge of traditional Cirebon cuisine into scientific knowledge that can be used as a contextual chemistry learning resource. Thus, it is expected that chemistry learning will become more meaningful and relevant to students'lives.

METHODS

This study employed a qualitative descriptive approach with an ethnographic design to explore and reconstruct local community knowledge of traditional Cirebon cuisine into scientific chemical concepts. The ethnographic approach was chosen because it is capable of uncovering cultural meanings, social practices, and implicit knowledge embedded in community activities through direct observation and interaction with research subjects. The study was conducted through three main stages: (1) preparation, (2) data collection and processing, and (3) data analysis and interpretation. The research flow is presented in **Figure 1**.

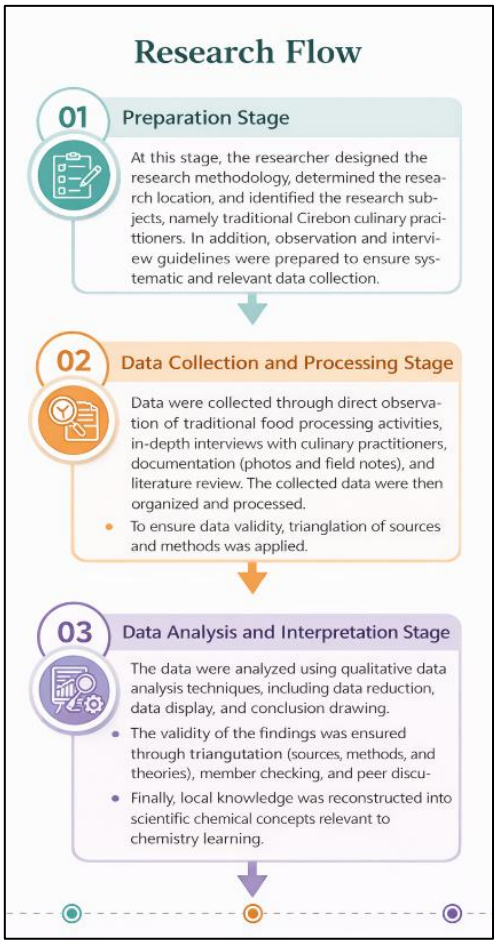


Figure 1. Research Flow

In the preparation stage, the researcher designed the research method, determined the research location, and identified the research subjects, namely traditional Cirebon culinary practitioners who are directly involved in the food processing activities. In addition, observation and interview guidelines were developed to obtain relevant data.

The data collection stage was carried out through direct observation of the preparation processes of traditional Cirebon cuisine, in-depth interviews with culinary practitioners, documentation in the form

of photographs and field notes, as well as literature studies supporting the research. The use of these various techniques aimed to enhance data validity through source and method triangulation.

The collected data were then analyzed using qualitative data analysis techniques based on the model of Miles and Huberman (1994) as cited in Manan (2021), which includes data reduction, data display, and conclusion drawing. To ensure data validity, this study employed triangulation techniques (sources, methods, and theories), member checking with informants to validate interview results, and peer discussions. Furthermore, the data were reconstructed from local community knowledge into scientific chemical concepts relevant to learning materials, so that they can be used as contextual learning resources.

RESULT AND DISCUSSION

Result

This study identifies various chemical concepts embedded in traditional Cirebon culinary practices, which are subsequently reconstructed into scientific understanding that can be applied in chemistry learning. The following presents several results of integrating local knowledge of the Cirebon community into chemical concepts.

Table 1. Reconstruction of Local Knowledge of Traditional Cirebon Cuisine into Scientific Knowledge and Its Integration into Chemical Concepts in *Tape Ketan*

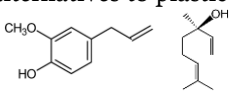
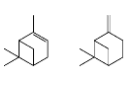
Process	Local Knowledge	Scientific Knowledge	Chemical Concept
Steaming guava leaves	Guava leaves are steamed to make them flexible and easy to use as wrapping	Heating causes softening of leaf tissues and pigment changes, resulting in color change	Compound (pigment) changes, heating
Steaming glutinous rice	Glutinous rice is steamed until cooked	Heating causes starch granules to absorb water and undergo structural changes	Starch gelatinization
Extraction of katuk leaves	Daun katuk diambil sarinya untuk digunakan dalam proses pembuatan	Compounds in katuk leaves dissolve in water and mix within the system	Extraction, dissolution
Grinding fermentation starter (ragi)	Ragi dihaluskan agar mudah dicampurkan	Grinding increases surface area, accelerating microbial activity	Surface area (reaction rate)
Sprinkling fermentation starter	Starter is added to rice	Microorganisms convert sugars (from starch hydrolysis) into ethanol and CO_2	Fermentation (redox reaction)
Packaging using guava leaves	Tape is wrapped in guava leaves as natural packaging	Guava leaves contain organic compounds and serve as eco-friendly alternatives to plastic  Eugenol Linalool  α-pinene, β-pinene	Organic compounds, green chemistry

Table 2. Reconstruction of Local Knowledge into Chemical Concepts in *Nasi Jamblang*

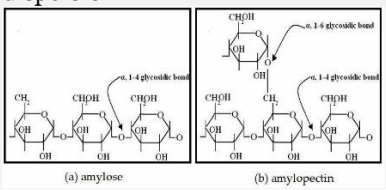
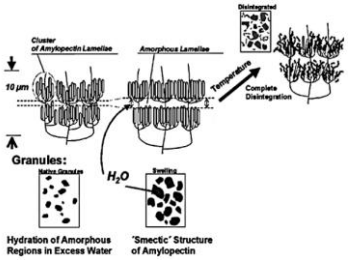
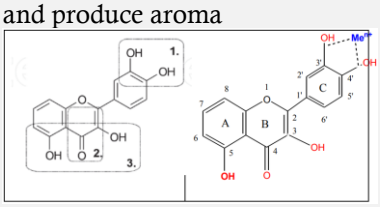
Process	Local Knowledge	Scientific Knowledge	Chemical Concept
Washing rice	Rice is washed to remove impurities and prevent stickiness	Rice contains starch (amylose and amylopectin); washing releases amylopectin, forming a cloudy dispersion 	Colloidal system (starch suspension), starch structure
Steaming and stirring rice	Rice is cooked and stirred to produce fluffy texture	Heating causes starch granules to absorb water and change structure  Mekanisme Gelatinasi Pati	Starch gelatinization
Wrapping with teak leaves	Teak leaves are used to enhance aroma and preservation	Teak leaves contain organic compounds that interact with rice and produce aroma  Struktur Flavonoid Daun Jati	Organic compounds

Table 3. Reconstruction of Local Knowledge into Chemical Concepts in *Empal Gentong*

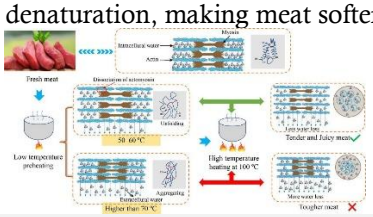
Process	Local Knowledge	Scientific Knowledge	Chemical Concept
Grinding spices	Spices are ground for better mixing and absorption	Particle size reduction increases surface area and enhances interaction	Surface area (reaction rate)
Boiling beef	Meat is boiled until tender	Heating causes protein denaturation, making meat softer 	Protein denaturation
Adding coconut milk	Coconut milk creates a rich broth	Coconut milk is a fat-in-water emulsion forming a colloidal system	Colloidal system (emulsion)
Adding spices	Spices provide flavor and aroma	Organic compounds (essential oils) dissolve and disperse	Organic compounds
Using clay pot (gentong)	Clay pot used for cooking and serving	Clay distributes heat evenly	Heat transfer
Using firewood	Wood used as fue	Combustion produces heat energy through chemical reactions	Combustion reaction (thermochemistry)

Table 4. Reconstruction of Local Knowledge into Chemical Concepts in *Tahu Gejrot*

Process	Local Knowledge	Scientific Knowledge	Chemical Concept
Grinding soybeans	Soybeans are ground to ease processing	Particle size reduction disperses proteins and fats in water	Surface area, colloidal system
Boiling soybean slurry	Boiled to remove raw odor	Heating causes protein denaturation and maintains dispersion	Protein denaturation, colloidal system
Filtering soybean milk	Separation of pulp and liquid	Filtration separates solids while colloids remain in liquid	Filtration
Coagulation and tofu molding	Coagulant added to form tofu	Proteins reach isoelectric point and coagulate into solids 	Protein coagulation
Soaking tofu	Maintains texture and quality	Water diffusion occurs until equilibrium	Diffusion
Frying tofu	Tofu is fried until cooked	Heat causes water evaporation, pore formation, and Maillard reaction	Heat transfer, Maillard reaction

Discussion

Figure 2. Map of the Cirebon Regency Location, West Java
(A) Research location of Nasi Jamblang, (B) Research location of Empal Gentong, (C) Research location of Tape Ketan, (D) Research location of Tahu Gejrot

This study was conducted on traditional Cirebon culinary entrepreneurs who still maintain hereditary food processing practices. Cirebon City is one of the regions in West Java Province that possesses a rich variety of traditional cuisine with strong cultural values. Culinary items such as nasi jamblang, empal gentong, tahu gejrot, and tape ketan not only function as food but also reflect the local knowledge of the community developed through empirical experience.

This study aims to explore and reconstruct such local knowledge into scientific knowledge, particularly from a chemistry perspective. Based on observations and interviews with culinary practitioners, it was found that each stage in the food processing process contains relevant chemical concepts. These processes include cooking, mixing ingredients, fermentation, and the use of natural materials as packaging.

In the preparation of nasi jamblang, the rice washing process indicates the release of starch, particularly amylopectin, which disperses in water and forms a colloidal system (Yulianto, 2024). Furthermore, the steaming process involves starch gelatinization, in which starch granules absorb water and undergo structural changes, resulting in soft and fluffy rice (Patria et al., 2021). The use of teak leaves as packaging provides a distinctive aroma derived from natural organic compounds in the leaves, although it does not involve significant chemical reactions (Rizquna et al., 2024).

Figure 3. Nasi Jamblang

In empal gentong, prolonged cooking of meat causes protein denaturation, resulting in a more tender texture (Sunayardi, 2021). The addition of coconut milk forms a colloidal system in the form of a fat-in-water emulsion (Sandra et al., 2023). In addition, the use of firewood as a heat source involves combustion reactions that produce thermal energy, while the use of clay pots allows for more even heat distribution during the cooking process (Suheri et al., 2026).

Figure 4. Empal Gentong

In tahu gejrot, soybean processing begins with grinding to produce soybean slurry, which is a dispersion system. After filtration, soybean milk is formed as a more stable colloidal system consisting of proteins and fats dispersed in water. The next step is coagulation using acidic substances, which lowers

the pH to the isoelectric point of proteins, resulting in coagulation and tofu formation. During frying, the Maillard reaction occurs between sugars and amino acids, producing a brown color and characteristic aroma.

Figure 5. Tahu Gejrot

Meanwhile, in the production of tape ketan, fermentation is the main process involving the activity of microorganisms in yeast. These microorganisms convert sugars into ethanol and carbon dioxide through redox reactions (Wahyuningsih et al., 2023). Prior to fermentation, the steaming process involves starch gelatinization, while the use of guava leaves as packaging reflects the utilization of environmentally friendly natural materials in accordance with green chemistry principles.

Figure 6. Tape Ketan

The results of this study indicate that traditional culinary practices of the Cirebon community contain various chemical concepts that can be reconstructed into scientific knowledge. The integration of this local knowledge into chemistry learning can provide more contextual and meaningful learning experiences, as well as improve students' chemical literacy. Furthermore, this approach also contributes to preserving local wisdom as part of the community's cultural identity.

CONCLUSION

The results of this study indicate that four traditional Cirebon culinary practices—namely the preparation of nasi jamblang, empal gentong, tahu gejrot, and tape ketan—contain various scientific elements relevant to chemical concepts. These practices were successfully identified and systematically reconstructed into chemical concepts such as starch gelatinization, colloidal systems, protein

denaturation, protein coagulation, the Maillard reaction, fermentation (redox reactions), reaction rates, thermochemistry, as well as pH and solution concepts. This reconstruction demonstrates that local community knowledge can be transformed into structured scientific understanding aligned with chemistry learning materials.

The integration of local wisdom into chemistry learning provides more contextual and meaningful learning experiences for students. By linking chemical concepts with everyday cultural practices, students can more easily understand the material, increase their engagement in learning, and develop an appreciation for local culture. This approach not only contributes to improving chemical literacy but also strengthens the connection between science and real-life applications.

Furthermore, this study contributes to the development of ethnochemistry-based chemistry learning that is contextual and relevant to students' environments. The reconstruction of local knowledge into scientific concepts can serve as an innovative alternative learning resource while supporting the implementation of local wisdom-based education. The findings of this study are expected to serve as a reference for educators, curriculum developers, and researchers in integrating local culture into chemistry learning, thereby creating learning experiences that are not only scientific but also meaningful and sustainable.

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