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Exploring the Local Wisdom Potential of Kerinci for Contextual Ethnochemistry Learning

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ABSTRACT

This study aims to explore the integration of local wisdom from Kerinci into chemistry learning by utilizing an ethnochemistry approach. The background of the research focuses on the importance of contextual learning in facilitating the understanding of chemistry concepts. The research method employed is a field study with a qualitative approach and descriptive design. The study involves chemistry teachers from SMA Negeri 7 Kerinci and the community of Koto Tuo Pulau Tengah village as informants. Data was collected through interviews, observations, and documentation. The data analysis technique applied is the Miles & Huberman model, which includes data reduction, data presentation, and conclusion drawing. The main findings of the research indicate that Kerinci's local wisdom, such as the use of turmeric, betel leaves, betel lime, jackfruit leaves, and banana peels, has significant relevance to chemistry material and can be integrated to enhance students' understanding. Teachers can create context-based lesson plans that link theoretical knowledge to practical examples, allowing students to grasp the real-world relevance of chemistry.

INTRODUCTION

Chemistry is a conceptual field of study, making it crucial to understand each concept and the relationships between them. Learning chemistry becomes more comprehensible when using a contextual learning approach (Yogiswara, 2024). One way to achieve contextual learning is by integrating local wisdom (Ayuni et al , 2021). Local wisdom encompasses the ways of life, knowledge, and various life strategies employed by local communities to address the challenges of meeting their needs (Njatrijani, 2018). Local wisdom is passed down from one generation to the next as part of the cultural heritage of a community (Arianti, 2021). Local wisdom can be integrated into education to support the preservation of the distinctive cultural heritage of a region (Pingge, 2017). One form of integrating local wisdom into education is through ethnoscience (Putri et al, 2022). Ethnoscience is a teaching method that uses local knowledge as a source or object of learning and can be integrated into instruction presented in a contextual manner (Wae et al, 2022). The ethnoscience paradigm in education supports the use of direct manipulation of concrete objects from the learners' environment. This is considered an important element in developing the learning process, understanding concepts, and scientific skills (Ibe&Nwosu, 2017). One branch of ethnoscience, namely ethnochemistry, links chemistry with traditions and local wisdom, offering students an additional attraction to learn chemistry in a more engaging and relevant way (Munandar et al, 2024).

The application of local wisdom-based learning by educators is crucial for enhancing students' knowledge and understanding, while also fostering a sense of appreciation for the

cultural values of their region (Rummar, 2022). Integrating local wisdom values into the Merdeka curriculum positively contributes to all members of the school community, particularly by improving the quality of educational institutions, strengthening the role of educators, and enhancing students' competencies (Simanungkalit et al, 2024). The Merdeka curriculum, which incorporates local wisdom, is introduced as a transformative step in education, aiming to provide flexibility in designing a learning process that better meets the needs and conditions of students (Rahma & Hindun, 2024). Utilizing local wisdom as an inspiration source in the Merdeka Belajar curriculum is essential as it demonstrates respect for Indonesia's cultural and geographical diversity. Integrating local cultural heritage into education also has the potential to strengthen educational foundations (Kusnadi, 2022).

Integrating local wisdom into education includes applying it to chemistry through ethnochemistry. Ethnochemistry-based learning, which integrates science, culture, local wisdom, and community as a learning approach, can enhance students' interest, motivation, and achievement in science (Shidiq, 2016). Teachers also emphasize the importance of connecting chemistry content with local wisdom, as contextual learning approaches today require integration with the conditions and local wisdom of the region (Agustina, 2023).

The rich cultural heritage of Kerinci highlights the potential of integrating local plant-based wisdom into chemistry education. However, there remains a lack of comprehensive studies exploring this connection (Yelianti et al., 2024). Cataloging the traditional uses of jackfruit (*Artocarpus heterophyllus*), betel (*Piper betle*), and banana (*Musa spp.*) leaves as resources for medicinal, culinary, and cultural purposes could enrich chemistry education by linking traditional knowledge with scientific practice (Aumeeruddy-Thomas et al., 2024). By bridging this gap, educators can provide students with a practical learning experience that connects the scientific and cultural dimensions of natural products (Hamilton, 2013).

The integration of local plants such as jackfruit leaves (*Artocarpus heterophyllus*), betel leaves (*Piper betle*), and banana leaves (*Musa spp.*) in chemistry education is highly relevant, especially when combined with local wisdom. In Jambi Province, particularly in Kerinci Regency, these plants are widely used for various traditional purposes, including medicinal applications and cultural rituals (Julianti & Yelianti, 2021). The chemical compounds found in these plants, such as flavonoids, tannins, saponins, and phenols, offer rich opportunities to explore core chemistry concepts like chemical extraction, qualitative analysis, and the chemistry of natural products (Yusran et al., 2019 ; Hamayun, 2005).

The plant diversity in Kerinci has led to various local wisdoms, such as the use of natural materials in traditional medicine, the use of natural dyes in making Incung batik, and the use of natural substances as cosmetics by the people of Kerinci. Cataloging the local wisdom potential of Kerinci could provide an interesting source of material to enrich chemistry education in schools or universities. Therefore, I am interested in exploring the theme of Kerinci's local wisdom as chemistry material to understand the inventory of local wisdom potential that can be integrated into chemistry education.

The plant diversity in Kerinci serves as the foundation for an array of local wisdom practices, including the use of natural materials in traditional medicine, natural dyes for creating Incung batik, and cosmetics. These practices underscore a deep understanding of the chemical properties of plants and their application in everyday life. Research highlights the cultural richness embedded in Kerinci's traditional medicine, where plants such as turmeric (*Curcuma longa*), gambier (*Uncaria gambir*), and areca nut (*Areca catechu*) are utilized for their medicinal properties (Supiandi et al., 2021). These applications, rich in ethnobotanical knowledge, present opportunities to integrate the study of plant-derived compounds, such as flavonoids and tannins, into chemistry curricula.

The traditional use of natural dyes in Kerinci, particularly for Incung batik, reflects the community's innovation in utilizing plant-based resources. Studies have shown that local plants

like *Indigofera tinctoria* for blue dye and *Ceriops tagal* for red dye provide sustainable alternatives to synthetic dyes (Nurcahyani et al., 2019). Such practices can be employed as case studies in chemistry education to teach students about the chemical processes involved in dye extraction and application, such as solubility, chromophore interactions, and mordant effects.

Local wisdom also extends to cosmetics, with residents employing natural resources such as coconut oil and plant extracts for skin care (Aumeeruddy-Thomas & Hossaert-McKey, 2024). emphasize that such traditional practices not only highlight the diversity of plant usage but also showcase the community's understanding of chemical interactions between natural compounds and human physiology. Introducing these elements into chemistry education allows students to explore both traditional knowledge and its scientific basis, fostering a holistic learning experience.

METHODS

Research Design

This study uses a field study method with a qualitative approach and a descriptive model. The qualitative approach was chosen to gain a deep understanding of the research questions rather than to test hypotheses. By describing and analyzing the data, this research aims to identify general patterns that can serve as a foundation for further investigation. The method applied in this study is a case study. During this, the researcher systematically gathered data necessary to address the research objectives (Creswell, 2009).

Research Target

To enhance the depth and reliability of the data collection, this study employed interviews as the primary method, targeting two key participant groups: Chemistry Teachers at SMA Negeri 7 Kerinci and Residents of Koto Tuo Pulau Tengah Village.

Research Data

The data collected focused on identifying and cataloging Kerinci's local wisdom for its integration into chemistry teaching materials. Data collection involved interviews, direct observations, and the analysis of relevant documents. Interviews with chemistry teachers were conducted to examine contextual learning approaches and how local wisdom is integrated into the chemistry curriculum. The teachers also provided insights into the relevance of Kerinci's local wisdom and its potential applications in chemistry education. Sources of information included educators at SMA Negeri 7 Kerinci and members of the local community, who provided both academic and cultural perspectives on Kerinci's indigenous knowledge. Conversations with local community members aimed to document the specific aspects of Kerinci's traditional knowledge, focusing on practices within Koto Tuo Pulau Tengah that could enrich chemistry education.

Research Instruments

This research instrument uses a direct interview questionnaire to collect data on the experiences, knowledge, and perceptions of respondents regarding Exploring the Local Wisdom Potential of Kerinci for Contextual Ethnochemistry Learning

Data Analysis

The data was analyzed qualitatively using the Miles and Huberman framework, which includes three key steps: data reduction, data presentation, and drawing or verifying conclusions. This structured approach was selected to accommodate the diverse types of data gathered, including observations, interview responses, and documentation). (Miles&Huberman, 1994).

RESULTS AND DISCUSSION

The research findings indicate that Kerinci's local wisdom, encompassing cultural products and values, is significantly relevant to various chemistry concepts, particularly in areas such as natural materials used in traditional medicine and cosmetics.To implement ethnochemistry-based learning, it is crucial to identify local wisdom potential that is relevant to chemistry material. Integrating local wisdom with chemistry content is essential to achieving the learning objectives. This approach can be applied to various chemistry topics linked with local wisdom potential. Kerinci Regency, with its diverse local wisdom potential, offers many opportunities for applying this approach.

In this study, the integration of local wisdom potential with chemistry learning material requires analysis conducted through observations, interviews, and literature review. An explanation of the potential of Kerinci's local wisdom and how to integrate it with chemistry material will be presented as follows. The study's findings reveal that the cultural heritage and values of Kerinci hold considerable relevance to chemistry education, highlighting their potential as a resource for learning. Local traditions, such as the use of natural materials in traditional medicine and natural substances in cosmetics, demonstrate a strong connection to chemistry concepts (Supiandi et al., 2021).

For successful implementation of ethnochemistry-based learning, it is essential to identify aspects of local wisdom that align with chemistry topics. Integrating this cultural knowledge into the chemistry curriculum fosters a more meaningful learning experience and helps achieve educational objectives. This method can be effectively applied across various chemistry topics related to the unique cultural practices of Kerinci Regency, which is rich in diverse local wisdom (Nurcahyani et al., 2019). The integration process involves detailed analysis supported by observations, interviews, and a review of relevant literature. The subsequent discussion will explore the potential of Kerinci's local wisdom and its alignment with chemistry education, offering insights into how these elements can be seamlessly incorporated into teaching practices (Creswell, 2009).

The tradition of Kerinci's medicine using natural materials

Herbal plants are plants that can be used for traditional treatment of various diseases. Since ancient times, the people of Kerinci have utilized herbal plants with medicinal properties. This traditional medicine involves using remedies made from natural materials available in the surrounding environment. Traditional medicine receives significant attention from both the community and health professionals, as it continues to be used alongside modern medicine. Additionally, traditional medicine can serve as an alternative for human health recovery. Research by (Sudardi, 2012) The natural materials used in the traditional medicine of the Kerinci community include the following :

1. Turmeric

Turmeric is a perennial herbal plant with rhizomes (underground stems) and belongs to the ginger family (Zingiberaceae). Turmeric is used to treat a condition known as alamyus or tampirus, which is when dog ticks enter the ear. The treatment involves crushing turmeric and squeezing out its juice, which is then dropped into the ear. The compounds in turmeric help to expel insects from the ear. Additionally, turmeric is used to neutralize toxins by mixing it with betel lime. Turmeric can also be used to alleviate coughs and colds, especially in young children. The process involves grating one rhizome of turmeric, extracting the turmeric juice, and then boiling it with a mixture of one chopped piece of palm sugar and half a tamarind pod. Other research also reveals that turmeric is highly beneficial for health as it functions as an antioxidant, anti-inflammatory, antitumor, antimicrobial, cancer preventative, and can lower blood fat and cholesterol levels, as well as act as a blood cleanser (Salim& Munadi, 2017). The main chemical components in turmeric rhizomes include curcumin, essential oil, resin,

demethoxycurcumin, oleoresin, and bisdemethoxycurcumin, as well as gum, fat, protein, calcium, phosphorus, and iron (Hayakawa et al, 2011).

In the high school chemistry curriculum on acids and bases, turmeric can be used as a natural indicator to identify whether a solution is acidic or basic. Turmeric contains curcumin, a compound that changes color depending on the pH of the solution. Using turmeric as a natural indicator is an effective way to teach the concept of pH and acid-base reactions through a practical and visual approach at the high school level. This natural acid-base indicator is studied in the topic of acid-base solutions in the XI-grade chemistry curriculum. Thus, the use of natural materials for traditional medicine can be integrated into the chemistry material on acid-base solutions.

2. Betel Leaf

Betel leaf (*Piper betle*) is characterized by its distinct aroma and spicy flavor and is frequently employed in Kerinci's traditional medicine for treating ailments such as toothaches and coughs. Additionally, it is utilized in remedies for liver-related conditions and as a detoxifying agent, often in combination with other herbal plants to amplify its effects (Chakraborty&Shah, 2011). The plant's diverse chemical composition, including compounds like essential oils, flavonoids, and tannins, makes it an exemplary resource for teaching chemical diversity in natural products. Its active components, such as betelphenol, possess antibacterial properties that can be explored in terms of molecular structure and mechanisms of action (Qonitah&Afwan, 2018). Furthermore, betel root is traditionally used as a contraceptive by women (Hoque et al, 2011). The leaf's chemical profile varies based on geographical and environmental factors and contains up to 4.2% essential oil, with betelphenol as a key antibacterial constituent (Akter et al, 2014). The leaf is often used because it contains 4.2% essential oil, with the major component being betelphenol, which acts as an antibacterial agent (Dwianggraini et al, 2013). Other compounds, such as steroids, tannins, flavonoids, saponins, alkaloids, and coumarins, further demonstrate its bioactivity (Patil et al, 2015).

In high school chemistry lessons, betel leaf can be integrated into the curriculum by using its chemical properties to teach key concepts. For example, essential oils can be extracted through steam distillation, showcasing separation techniques. Testing for tannins and flavonoids using iron (III) chloride and magnesium-hydrochloric acid solutions, respectively, can demonstrate chemical identification methods. Similarly, saponin content can be evaluated using foam tests, offering students an opportunity to explore surfactant properties. These practical activities provide hands-on experiences that bridge the gap between theory and real-world applications in natural product chemistry.

3. Betel Lime

Betel lime is used to neutralize toxins by mixing it with turmeric (Ravico, 2022). In practice, betel lime is first chewed and then mixed with turmeric. Historically, betel lime has been used in various traditional medicines to address a range of ailments, including as an ingredient in dental care preparations. Betel lime (CaCO3) also exhibits anti-inflammatory activity. The combination of kumpai mahung leaf extract and betel lime in a 1:3 ratio has an anti-inflammatory effect of 14.91%, which is higher compared to using betel lime alone. The use of betel lime in combination with other materials can address various health issues; for example, mixing betel lime with *Stachytarpeta jamaecensis* leaves can help treat swelling from injuries caused by falls (Febrianti & Musiam, 2019).

Integrating betel lime into high school chemistry material can be done by utilizing its chemical properties to explain various chemistry concepts. Some applications of betel lime (CaO) in chemistry education include topics such as chemical compounds, combustion reactions, and stoichiometry. Betel lime is a chemical compound consisting of calcium oxide

(CaO). The combustion reaction of calcium carbonate ($CaCO_3$) to produce betel lime (CaO) and carbon dioxide (CO_2) is represented by the following reaction:$CaCO_3$ (s) → CaO (s) + CO_2 (g). In the topic of stoichiometry, calculations related to betel lime reactions can be performed, such as determining the amounts of reactants and products in combustion and neutralization reactions.

Ethnochemistry in the field of cosmetics

1. Jackfruit Leaves

Jackfruit leaves (*Artocarpus heterophyllus Lam.*) also hold educational value due to their chemical and antioxidant properties. Traditionally used in cosmetics as a facial mask, dried jackfruit leaves are ground into a powder and applied to cleanse and smooth the skin. Extracts from jackfruit leaves exhibit high antioxidant activity, with an IC50 value of 12.65 µg/mL, highlighting their efficacy in inhibiting oxidative processes. IC50 is a value that indicates the ability to inhibit 50% of the oxidation process at a given sample concentration (ppm) (Adnyani et al, 2016). Cosmetics made from jackfruit leaves have been proven effective for facial use when applied regularly twice a week after morning bathing. Their chemical components, such as flavonoids, tannins, and saponins, provide opportunities for students to engage in chemical extraction and qualitative analysis experiments, fostering practical skills in laboratory settings.

Jackfruit leaves are highly relevant in chemistry education due to their chemical properties and the opportunity they provide to explore fundamental chemical concepts and practical laboratory techniques. The leaves contain various chemical compounds such as flavonoids, tannins, and saponins, which can be investigated in the classroom. By using solvents like alcohol to extract these compounds, students can learn about the technique of chemical extraction, which is crucial in isolating substances from natural materials. This process mirrors real-world applications in the pharmaceutical and food industries. After extraction, students can perform simple chemical tests to identify these compounds, such as using reagents that cause color changes when they react with tannins or flavonoids. This hands-on approach not only deepens students' understanding of chemical principles but also enhances their practical skills in laboratory techniques, such as extraction, filtration, and qualitative analysis. The integration of jackfruit leaves into chemistry lessons thus provides an engaging way for students to learn both theoretical and applied chemistry, fostering a deeper appreciation of the chemistry of natural products.

2. Banana Peel

Several natural materials traditionally used as cosmetics include jackfruit leaves, sweet banana peels, and apple peels. The traditional method for processing and using banana peels as cosmetics involves separating the peel from the fruit. The banana peel can then be directly applied to the face, left for 5 minutes, and then rinsed off with water. The main benefits of banana peels for the skin include providing a cooling sensation on the face, helping to reduce dark spots, and potentially mitigating the effects of mercury on the skin. Banana peels contain potassium and protein, which can help to soften the skin (Haq et al, 2014).

Banana peels, often considered waste, contain various beneficial chemical compounds and can be applied as a chemistry material. In the topic of chemical nomenclature, banana peels can be used to provide concrete examples of nomenclature according to IUPAC (International Union of Pure and Applied Chemistry) rules or common naming systems. For instance, if flavonoid compounds are extracted from banana peels, students can learn the systematic names of these compounds and how the names reflect their chemical structures. This process involves learning about naming organic compounds based on their chemical structure, such as acids or esters, which may be found in banana peel extracts. Students will be taught how to determine compound names by understanding and analyzing their chemical structures, and practice

nomenclature according to the applicable rules. With this contextual learning approach, students not only grasp the theory of nomenclature but also see its application in the context of natural materials they study directly.In contextual learning, integrating ethnochemistry helps students understand how chemistry concepts are applied within their own cultural context or other cultures. For example, studying how chemical substances are used in traditional medicine or cosmetics can provide deeper insights into the application of chemistry in daily life.

Interviews with chemistry teachers indicate that the Project-Based Learning (PBL) model is often applied contextually because it focuses on solving problems relevant to everyday situations. The Problem-Based Learning (PBL) model is frequently used contextually as it emphasizes addressing issues pertinent to daily life. In eleventh grade, topics such as acids and bases can be related to everyday situations, like the hydrolysis reactions in soap. Similarly, in tenth grade, topics on green chemistry and waste management can be connected to students' daily experiences. For instance, in the use of soap, the basic compounds it contains undergo hydrolysis when mixed with water, resulting in partial or complete hydrolysis. The relevance of the material to daily life depends on how these concepts can be applied in contexts familiar to students.

In tenth grade, students are introduced to chemistry concepts that are relevant to their everyday lives. To make the material more tangible and easier to understand, images or videos depicting real-life applications are often used. For instance, in agricultural areas in Kerinci, there is a common practice of spreading lime on the soil. In this context, students can explore the reasons behind using lime and the chemical content it contains, allowing them to connect chemistry theory with real-world practices.

Learning resources can include various types of materials, such as relevant YouTube links or Student Worksheets (LKPD). Educational media often involves using applications like Quizizz. The selection of these resources and media is typically aligned with the teaching model used to ensure the effectiveness and relevance of the material to students' learning experiences. By applying contextual learning, students demonstrate higher enthusiasm because they can see the connections between chemistry and their daily lives. Their interest in learning chemistry also increases, as they feel more motivated when they can directly observe the application of chemistry concepts in their surroundings, rather than just reading from books, which are often perceived as boring.

To integrate Kerinci's local wisdom into chemistry curriculum, it is essential to consider the most suitable materials and relevant local wisdom for application. Teaching chemistry is greatly enhanced when it is connected to the surrounding environment, allowing the subject matter to relate directly to students' daily experiences. Therefore, it is crucial to first understand Kerinci's local wisdom before integrating it into the learning process. Incorporating Kerinci's local wisdom into chemistry lessons is likely to make students more enthusiastic, although this approach has not yet been widely implemented. This approach may be applicable in the future, but further exploration is needed to identify which aspects of Kerinci's local wisdom are relevant and can be effectively applied

CONCLUSION AND RECOMMENDATIONS

The conclusions of this study indicate that Kerinci's local wisdom, such as traditional medicine using natural materials and natural cosmetics, has significant relevance to chemistry curriculum and can be used as an effective learning resource. Traditions involving turmeric, betel leaves, and lime in medicine, as well as the use of natural cosmetics made from jackfruit leaves and banana peels, can be integrated into high school chemistry materials. For example, using turmeric as a natural indicator in acid-base reactions or employing lime in chemical reactions are concrete applications of local wisdom. Additionally, jackfruit leaves and banana peels, which are rich in chemical compounds, can be utilized to teach chemistry concepts such

as compound nomenclature and extraction. To apply an ethnochemical approach, it is crucial to identify local wisdom that is relevant to chemistry content and connect it to students' daily contexts. Contextual learning that links chemistry material with Kerinci's local wisdom is expected to enhance student enthusiasm and motivation. Although this approach shows promise, further research is needed to explore other local wisdom potentials that can be integrated into chemistry education to make it more effective and engaging.

To enhance chemistry education, local materials like turmeric, betel leaves, lime, jackfruit leaves, and banana peels should be incorporated into lessons to illustrate concepts such as chemical extraction, reactions, and natural compound properties. Teachers can create context-based lesson plans that link theoretical knowledge to practical examples, allowing students to grasp the real-world relevance of chemistry. Activities like extracting plant compounds and conducting chemical tests can engage students in active learning. Continued research is recommended to evaluate the impact of integrating local wisdom on students' motivation and comprehension, as well as to identify other culturally significant resources from Kerinci for inclusion in the curriculum

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