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Ethnochemistry: Analysis of the Relevance of the Concepts of Ionic Bonds, Covalent Bonds, and Metallic Bonds to Samawa Local Wisdom as a Source of Learning

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ABSTRACT

The lack of contextual teaching materials at the secondary school level is a challenge in chemistry learning, so the application of ethnochemistry is important. This study aims to analyze the relevance of the concepts of ionic bonds, covalent bonds, and metal bonds with the local wisdom of the Samawa community as a learning resource in the context of ethnochemistry. Using a qualitative approach, this study explores local Samawa values that can be integrated into chemistry learning. Data collection techniques include literature studies, interviews, and documentation of local cultural practices. The data obtained were analyzed using Spradley's qualitative. The subjects of the study consisted of community leaders, academics in the field of chemistry, and relevant literature sources. The results of the study showed that several local traditions such as nyorong, sedekah lang, and isong bale contain principles that are in line with the concepts of ionic bonds, covalent bonds, and metal bonds. These findings indicate that the integration of local Samawa wisdom in chemistry learning not only enriches the learning context, but also strengthens local cultural values in science education. Thus, local wisdom can be utilized as a contextual, relevant, and meaningful learning resource for students.

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INTRODUCTION

In general, understanding of chemical concepts is conveyed through the chemical triangle, which includes: (1) macroscopic, which covers chemical phenomena that can be observed directly and are often encountered in everyday life; (2) submicroscopic, which describes events at the smallest particle scale, such as atoms, molecules, and electrons, which cannot be seen directly with the naked eye; (3) symbolic, which is a representation of chemical phenomena presented through various forms of models, images, and formulas (Andriani, Muhali, & Dewi, 2019; Ali et al., 2026). The chemical triangle is considered very useful in helping students understand chemical concepts comprehensively. However, many teachers still face difficulties when applying it in teaching. This problem often makes the learning process ineffective, especially when explaining microscopic and symbolic aspects, which are usually perceived as abstract. As a result, students struggle to grasp the meaning of fundamental chemical concepts (Wahyudiati & Qurniati, 2023). Therefore, chemical triangles can be supported by teaching materials related to students' daily lives, with the hope that educators can help students understand chemical characteristics using a constructivist-focused learning approach (Wahyudiati & Qurniati, 2023; Cahyani & Wahyudiati, 2023; Ali et al., 2025).

Constructivist-based learning strategies involve creating teaching materials that are directly related to students' daily lives, thereby creating a more engaging and meaningful learning experience (Wahyudiati et al., 2020; Wahyudiati & Fitriani, 2021). Teaching materials created using constructivist strategies offer many benefits, one of which is encouraging students to actively build their own understanding. They will engage in physical and mental interactions to acquire knowledge, understanding, skills, and new experiences, thereby achieving optimal learning outcomes (Ador, 2017; Fadli, 2019; Wahyudiati et al., 2019; Hasanah et al., 2016; Sumardi et al., 2020).

Currently, the limited availability of constructivist-based chemistry learning resources remains one of the main obstacles in the classroom learning process. Many chemistry teaching materials are designed to focus more on abstract and theoretical concepts, making the delivery of material feel boring. As a result, learning becomes less relevant to real-life experiences, less engaging, and fails to fully encourage active participation and curiosity among students to better understand chemical concepts (Ador, 2017; Sutrisno et al., 2020; Wahyudiati, 2016). Bringing chemistry lessons closer to the facts and realities of daily life is one effective way to overcome these challenges. Therefore, the availability of learning resources, whether instructional materials or media that align with students' real-life experiences, is crucial. By adopting an ethnochemistry approach, students can more easily grasp chemical concepts, as the material they study becomes more relevant and meaningful to their lives (Suanda & Wahyudiati, 2023).

Ethnochemistry is the study of how chemical concepts are used in everyday life, as seen through local wisdom, social systems, cultural symbols, and cultural products of a community (Wahyudiati, 2021; Singh & Chibuye, 2016). Results from several studies on ethnochemistry indicate that integrating local wisdom as a learning resource significantly contributes to enhancing students conceptual understanding. Additionally, this approach is effective in developing critical thinking skills, fostering scientific attitudes, and enhancing students awareness of human rights values (Fadli & Irwanto, 2020; Amora et al., 2024; Sumardi & Wahyudiati, 2021). Thus, it can be concluded that the application of ethnochemistry in the chemistry learning process through the integration of local wisdom is important.

The integration of local wisdom elements into learning can create a more meaningful, contextual, and culturally aligned learning experience, thereby promoting a deeper understanding of chemical concepts (Umam & Wahyudiati, 2023). *Samawa* local wisdom can be linked to chemical concepts, particularly in the areas of ionic bonds, covalent bonds, and metallic bonds. Examples include the tradition of *nyorong* (delivering and receiving wedding gifts), the tradition of *sedekah lang* (a communal meal and prayer ceremony), and the tradition of *isong bale* (collective effort to move a traditional house). These three cultures are related to the concepts of electron transfer, shared use of electrons, and electrostatic attraction in chemical bonds. In this study, the concept of analogy is used to facilitate understanding and application of chemistry lessons. In line with the demands of 21st-century education, learning is expected to focus not only on cognitive aspects but also on strengthening students' affective and psychomotor aspects (Wahyudiati, 2022). This study has a novelty in that it explores various local *Samawa* wisdom as an application of ethnochemistry to the concept of chemical bonding as a learning resource.

METHOD

In this study, researchers used a qualitative approach with ethnographic research. Participants involved in this study were community leaders, chemistry experts, and relevant literature sources related to the research topic. The research process was divided into three stages: description, analysis, and interpretation. In the initial stage, namely the description stage, the researchers sought to identify and explore issues related to the research object in greater depth. This process was carried out through initial observations in the field and interviews with community leaders and chemistry experts. The aim was to gather relevant information and describe the research situation comprehensively from various perspectives.

The analysis stage has the main objective of collecting valid and in-depth data based on the formulation of the problem and research objectives. In this process, a review is conducted of various field findings, especially those related to cultural products and local Samawa wisdom values that are relevant to the subject of chemical bonds. Then, the interpretation stage serves to explain the results of the analysis that has been carried out. The aim is to draw logical and accurate conclusions in accordance with the data and information that has been collected. Through this interpretation, a deeper understanding of the relationship between local cultural values and scientific concepts can be revealed in a more comprehensive and contextual manner.

This study applied several techniques to collect data, such as literature studies, interviews, and documentation in accordance with the type of data to be obtained. The researchers used instruments in the form of interview guidelines, observation guidelines, and documentation guidelines as a guide in collecting data. All collected data were then analyzed using the data analysis technique proposed by Spradley (2007), which consists of four stages: (1) domain analysis; (2) taxonomic analysis; (3) component analysis; and (4) cultural theme analysis.

Domain analysis and taxonomic analysis are used to select and summarize raw data that has been recorded in observations, interviews, and documentation. This also includes removing data that is considered irrelevant or unrelated to the research objectives. After the data reduction and analysis process, the next step is to organize the data in a more structured manner and then examine its relationship with existing theory or related research findings (component analysis and cultural

themes). The final stage is to draw conclusions based on the results of the data analysis and research findings that answer the research questions.

RESULT AND DISCUSSION

The local wisdom of the *Samawa* people in the *nyorong* tradition (a wedding gift exchange ceremony) is related to the concept of ionic bonds, namely positive ions (electron donors) and negative ions (electron acceptors). The *sedekah lang* tradition (a communal meal and prayer ceremony) is relevant to the concept of covalent bonds, namely the shared use of electrons. The tradition of *isong bale* (a cooperative activity involving the relocation of a raised house) is connected to the concept of metallic bonding, which forms due to the attractive force between the positive charges of metal ions and the negative charges of free-moving electrons.

1. The Tradition of *Nyorong* in the Marriage Customs of the *Samawa* Tribe

   In the wedding customs of the *Samawa* tribe, known as *pangantan*, there is a tradition called *nyorong* that is closely related to the concept of chemical bonds, particularly ionic bonds. The *nyorong* tradition involves the groom presenting the bride with items she will need for the wedding. The exchange of these items fulfills the requirements of a traditional *Samawa* wedding. There is a similarity between the theory of *nyorong*, which involves the exchange of agreed-upon offerings, and the concept of ionic bonding, which occurs through the exchange of electron pairs-positive ions (releasing electrons) and negative ions (receiving electrons). The underlying concept is the giving and receiving that form the basis of living together through the marital bond, as illustrated in Figure 1.

Figure 1. The *Nyorong* Tradition in the *Pangantan* Customs of the *Samawa* Tribe

Atoms tend to achieve electron stability by giving up or taking electrons in their outer shell, so that they resemble the configuration of noble gases. This process triggers electron transfer

between atoms and results in the formation of positively charged ions (cations) and negatively charged ions (anions). For example, the element aluminum (Al) has an electron configuration of $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^1$, indicating that this atom is unstable and needs to release three electrons to achieve stability, forming the Al^{3+} ion with the configuration $1s^2\ 2s^2\ 2p^6$. On the other hand, the element fluorine (F) has an electron configuration of $1s^2\ 2s^2\ 2p^5$, making it prone to accept one electron to become an F^- ion with the stable configuration $1s^2\ 2s^2\ 2p^6$. Due to their opposing charges, these two ions are electrostatically attracted to each other and form ionic bonds within the crystal lattice structure. Such bonds occur through the transfer of electrons and can be analogously associated with the cultural practice of *nyorong* among the *Samawa* tribe, which represents mutual giving and receiving as a symbol of harmony (Cahyani & Wahyudiati, 2023).

2. *Sedekah Lang* Tradition (Communal Meal and Prayer Event)

The tradition of *sedekah lang* is an annual tradition of the village community that is manifested through communal eating and prayer. This tradition reflects a sense of gratitude for the abundance of the harvest, which is then shared among the villagers. The activity is generally carried out by farmers as a spiritual effort to ask for blessings and fertility for their agricultural land. In addition, sedekah lang represents the community's respect for nature as an entity that supports life, as can be seen in Figure 2.

Figure 2. The Tradition of *Sedekah Lang* of the *Samawa* Tribe
(Source: https://pulausumbawanews.net/2024/05/27/sedekah-sekat-tradisi-pasca-panen-di-desa-lawin/)

The relationship between these concepts can be seen in the mechanism of covalent bond formation, which occurs due to the attractive force between two atoms that share one or more pairs of electrons in their outer shells. The theory of *sedekah lang* is consistent with Gilbert Lewis' theory, which states that atoms combine to achieve a more stable electron configuration. The basic principle of this bond reflects collaborative values such as togetherness, cooperation, and a sense of belonging. These values align with the symbolic meaning in the *sedekah lang* tradition practiced

by the *Samawa* ethnic group, where the spirit of sharing, social solidarity, and tolerance form the cornerstone of communal life.

3. The Tradition of *Isong Bale* (Working Together to Move a Stilt House)

The tradition of *isong bale* is a hereditary activity in which people help each other to lift a stilt house (*bale panggung*) belonging to one of the residents so that it can be moved. The tradition of *isong bale* is carried out collectively by the community, who work together to lift and pull the stilt house so that it can be moved or repositioned, as shown in Figure 3.

Figure 3. The *Isong Bale* Tradition of the *Samawa* Tribe

(Source: https://www.mediaamanat.com/memindahkan-rumah-panggung-sebuah-tradisi-yang-masih-lestari/)

The concept of the *isong bale* tradition is highly relevant to the concept of metallic bonds formed by the attractive force between the positive charges of metal ions and the negative charges of free-moving electrons. The community members who work together to move a house can be analogized as positive ions (cations) in a metallic structure that move to change the shape and position of an object. For example, a stilt house that originally had six support pillars was changed to eight pillars and moved from the east side to the west side. This phenomenon aligns with the properties of metals, where when metal is forged or bent, there is a shift in cations within the metal lattice, allowing for changes in shape without causing structural damage.

A visualization approach based on the chemical triangle concept can be used to develop learning resources that incorporate *Samawa* local wisdom into chemical bonding material (Wahyudiati, 2022). The connection between chemical concepts, particularly ionic bonds, covalent bonds, and metallic bonds, and the traditions of *nyorong*, *sedekah lang*, and *isong bale* in *Samawa* culture can be seen in the principle of electron sharing and the use of shared electron pairs to achieve stability. For example, in ionic bonds, electrons move from positively charged atoms to negatively charged atoms to achieve

a stable configuration like noble gases. This concept aligns with the philosophy of the *nyorong* tradition in the *pangantan* custom, which describes marriage as a bond between a man and a woman needed to create balance and stability in life (Cahyani & Wahyudiati, 2023). In covalent bonds, the basic concept that can be linked to the local wisdom of *Samawa* is the concept of sharing to achieve a more stable electron configuration, reflected in the tradition of *sedekah lang*, where food from the harvest is shared and eaten together. The concept of metallic bonds aligns with the principle of *isong bale*, which is part of *Samawa*'s local wisdom. Residents working together to move a house can be analogized as positive ions (cations) in a metallic structure that move to change the shape and position of an object.

The application of the analogy approach in chemistry learning provides benefits in the form of increased student interest and understanding, so that they are more active and involved in learning activities. In addition, the use of the analogical approach also contributes to improving student learning outcomes in chemistry (Sutrisno, Wahyudiati & Louise, 2020). The integration of local wisdom into chemistry learning makes an important contribution to strengthening conceptual understanding, increasing motivation, and connecting education with the realities of everyday life. Through classroom learning, students are able to connect and compare real-life experiences they encounter around them with the concepts or theories they learn (Azizah & Premono, 2021). Previous research has proven that combining knowledge concepts with students' existing experiences has a positive impact on the development of their cognitive, emotional, and psychomotor abilities (Wahyudiati et al., 2020; Sumardi, Rohman & Wahyudiati, 2020; Fadli, 2018).

This study is novel in its use of an ethnochemistry approach, which is rarely applied in learning. The researchers combined *Samawa* local wisdom with the concepts of ionic bonds, covalent bonds, and metallic bonds, which had not been done before. The findings of this study are expected to contribute to innovation in chemistry learning. Students can learn chemistry in a more engaging, meaningful, and enjoyable way when the material is presented through concrete examples commonly encountered in their daily lives (Wahyudiati, 2016; Aldian & Wahyudiati, 2024). Therefore, exploring *Samawa*'s local wisdom as an innovative approach in chemistry education plays a crucial role in fostering pride and love among the younger generation for their cultural heritage.

CONCLUSION

The findings of this study indicate that the traditions of *nyorong*, *sedekah lang*, and *isong bale*, which are part of the local wisdom of *Samawa*, have pedagogical relevance and can be integrated into chemistry learning, particularly the material on chemical bonds, which includes ionic bonds, covalent bonds, and metallic bonds. This integration is analyzed through the approaches of analogy, representation, and visualization, which conceptually support students' understanding of abstract material. Therefore, this research contributes to addressing the issue of the limited availability of ethnochemistry-based learning resources to support the chemistry learning process at the high school level.

RECOMMENDATIONS

The limitation of this study is that it only focuses on analyzing the relationship between chemical bonding material and Samawa local wisdom. Therefore, further research is needed to conduct a more in-depth analysis and test the effectiveness of applying Samawa local wisdom-based chemistry

teaching materials. Similarly, ethnochemical studies that integrate local wisdom from other regions in Indonesia are still wide open for development.

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