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Integration of Ethnochemical Principles in the Preservation of Indonesian Batik Based on Tafsir Al-Maraghi

Irfan Maulana Rohmatulloh [a,1,*], Mochammad Taufiq Ridho [b,2]

[*a,1] Universitas Islam Indonesia, Yogyakarta, Indonesia, [b,2] Universitas Islam Indonesia, Yogyakarta, Indonesia
[1]25612023@students.uii.ac.id; [2]135130508@uii.ac.id
*Correspondent Author

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ABSTRACT

This study aims to examine the integration of ethnochemistry principles into the preservation of Indonesian batik through the perspective of *Tafsir Al-Maraghi*. This research employed a qualitative approach using a literature review by analyzing various scholarly sources related to ethnochemistry, the batik-making process, and the interpretation of relevant Qur'anic verses. The findings indicate that the batik production process, particularly the waxing, dyeing, and wastewater treatment stages, embodies chemical concepts embedded in local community knowledge, representing the practical application of ethnochemistry. Furthermore, the analysis of *Tafsir Al-Maraghi* reveals that batik symbolizes personal adornment, as reflected in Qur'an Surah Al-A'raf (7):31, while the diversity of colors found in batik corresponds to the meaning of Surah Fatir (35):27, which emphasizes the diversity of Allah's creations as a manifestation of His greatness. Therefore, batik serves not only as a cultural heritage but also as a culturally responsive medium for science education and a means of strengthening Islamic values within society.

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Introduction

In the current era of globalization, preserving local culture has become increasingly important to maintain national identity amid the growing influence of modernization. One of Indonesia's cultural heritages with significant historical, philosophical, and aesthetic value is batik, which was recognized by UNESCO as an Intangible Cultural Heritage in 2009. This recognition demonstrates that batik possesses not only cultural significance for the Indonesian people but also universal cultural value acknowledged by the international community (Evita et al., 2022).

Batik was selected as the focus of this study because of its strong association with ethnochemistry through its production process, which involves dyeing, material mixing, wax application, and color fixation. Unlike other cultural expressions, such as dance, music, or literature, which primarily emphasize artistic and expressive dimensions, batik integrates artistic value with empirical knowledge closely related to scientific principles. Therefore, batik serves as an appropriate representation of the relationship between local culture and the application of chemical concepts in everyday life.

The batik production process consists of waxing, dyeing, and wax removal (pelorodan), all of which involve the use of various chemical substances and generate liquid waste containing dyes and organic compounds that require proper treatment before being discharged into the environment (Fitriana & Rahmayanti, 2020). This demonstrates that batik is not merely a form of art and cultural heritage but also a representation of chemical principles embedded in daily life that can be examined through an ethnochemical perspective.

The environmental impact of batik wastewater has become a critical issue because it contains heavy metal pollutants that pose significant environmental risks if not properly treated in accordance with established standards. Batik effluent contains hazardous heavy metals that can contaminate ecosystems and threaten public health. A recent study identified variations in the concentrations of thirteen heavy metals, Ag, As, Cd, Cr, Co, Cu, Fe, Hg, Mn, Ni, Pb, Sn, and Zn, in batik wastewater collected from eight industrial sites in Jambi (Utami, 2025). These heavy metal ions are highly toxic to both humans and animals when introduced into drinking water or the food chain. Several metals, including Ag, Cd, and Hg, were reported to exceed the quality standards stipulated in the Indonesian Ministry of Environment and Forestry Regulation (Permen LHK) No. 5 of 2014. Therefore, appropriate wastewater treatment is essential to protect communities surrounding batik industries from the adverse effects of heavy metal pollution.

Ethnochemistry is defined as the study of chemical knowledge and practices that have developed within communities over generations as part of their local wisdom (Pasa et al., 2023). This approach contributes to cultural preservation while enhancing the understanding of chemical concepts embedded in traditional practices. Consequently, ethnochemistry provides a contextual framework that connects chemistry with culture, making scientific learning more relevant to real-life experiences and indigenous knowledge.

In Islam, scientific knowledge is regarded as an inseparable component of religious teachings. From an Islamic perspective, revelation (*wahy*) and human reason (*'aql*) complement one another as sources of knowledge; therefore, scientific advancement is not viewed as conflicting with Islamic values but rather as a means of understanding the signs of Allah's greatness manifested throughout the universe (Wakid et al., 2026). In line with this view, the concept of knowledge integration in Islam is founded upon the principle of *tawhid*, which affirms that all knowledge ultimately originates from Allah. Within this framework, scientific development is achieved through the integration of revelation, intuition, rational inquiry, and empirical experience, ensuring that Islamic values remain the foundation for scientific advancement (binti Khalid & Putri, 2020).

From an Islamic perspective, batik is closely associated with the Qur'anic command to wear proper, clean, and beautiful clothing. Islam encourages believers to adorn themselves appropriately as part of the concept of *az-zinah* (self-adornment), which is explicitly prescribed in Islamic teachings. Preserving batik as a cultural heritage represents an expression of gratitude for the diversity bestowed by Allah upon humanity. Wearing batik as an elegant traditional garment is consistent with the Islamic injunction to dress neatly and modestly, while the prohibition against extravagance encourages its use in a wise and balanced manner.

As the theoretical foundation of this study, three previous studies on ethnochemistry in the context of batik culture were reviewed. Azizah and Premono (2021) demonstrated that the local culture of Bantul Regency possesses considerable potential as a source of ethnochemistry-based learning, where the batik-making process can be associated with concepts such as acid-base solutions, chemical bonding, the mole concept, and chemical nomenclature. Furthermore, Wirasti (2024) found that ethnoscience-based chemistry learning through *Batik Sekar Jagad* of Kebumen enhanced students' understanding of local culture while fostering environmental awareness. Likewise, Anissa and Silfianah (2023) reported that the production of Tulungagung batik embodies ethnoscientific concepts, particularly ethnochemistry in the dyeing process related to solution concentration, while simultaneously promoting character values such as diligence, precision, creativity, honesty, and environmental responsibility.

This article shares similarities with the studies conducted by Azizah and Premono (2021), Anissa and Silfianah (2023), and Wirasti (2024), as all investigate batik through ethnochemical and ethnoscientific perspectives to reveal the chemical concepts underlying its production process and to support cultural preservation and local wisdom-based learning. However, the present study offers a novel contribution by extending beyond the identification of chemical concepts in batik production to integrate these concepts with Islamic values through the perspective of *Tafsir Al-Maraghi*. Unlike previous studies that primarily focused on ethnochemistry, ethnoscience, and character education, this research interprets the chemical principles embodied in batik based on relevant Qur'anic verses as explained in *Tafsir Al-Maraghi*, thereby presenting an integrated perspective encompassing science, culture, and religion. Moreover, this study examines Indonesian batik from a broader national perspective rather than limiting its scope to a specific region, providing new insights into batik preservation as not only a cultural and scientific endeavor but also an expression of gratitude for Allah's blessings in accordance with Islamic values.

Accordingly, this study aims to identify the ethnochemical concepts embedded in the production process of Indonesian batik and to integrate these concepts with Islamic values based on the perspective of *Tafsir Al-Maraghi*. It is expected that this study will enhance understanding that batik embodies not only cultural and scientific significance but also Islamic values relevant to contemporary society. Thus, the present research seeks to elucidate not only the cultural and scientific dimensions of Indonesian batik but also its relevance to the implementation of Islamic values in community life.

Method

This study employed a qualitative research design using a library research approach. The data consisted of secondary sources obtained from the Qur'an, *Tafsir Al-Maraghi*, peer-reviewed journal articles, books, and other relevant literature concerning ethnochemistry, the batik production process, and the integration of science and Islam. Data were collected through a documentation study by selecting literature based on its relevance, credibility, and recency. The data were analyzed using content analysis, which involved data reduction, data presentation, interpretation of ethnochemical concepts embedded in the batik-making process, and their integration with the interpretation of relevant Qur'anic verses according to *Tafsir Al-Maraghi*. The study's conclusions were drawn from a comprehensive analysis of all collected data, resulting in an in-depth understanding of the interrelationship between ethnochemistry, batik culture, and Islamic values.

Results and Discussion

1. The Application of Ethnochemistry in Community Life

Ethnoscience is a field of study that integrates cultural elements with educational content embedded in local communities, thereby fostering a deeper understanding of scientific knowledge through a cultural perspective. One of its branches, ethnochemistry, establishes a connection between chemistry and traditional knowledge systems as well as local wisdom (Munandar et al., 2024). Ethnochemistry encompasses cultural practices within society that possess underlying chemical principles and describes the chemical knowledge embedded in identifiable cultural groups. In other words, it represents the integration of chemistry with cultural anthropology by examining chemical concepts inherent in diverse cultural traditions (Lalang et al., 2023).

One example of ethnochemistry in education is the traditional use of green coconut water in Javanese culture. Pregnant women commonly consume green coconut water based on the belief that it promotes fairer skin in newborns, facilitates childbirth, strengthens hair growth, and maintains the cleanliness of amniotic fluid. Scientifically, green coconut water functions as a natural isotonic beverage that supports maternal rehydration. This cultural practice can therefore be associated with the chemistry of

electrolyte and nonelectrolyte solutions, providing a contextual framework for chemistry learning (Azizah & Premono, 2021).

Another example is the *merarik* tradition of the Sasak community, particularly the *nenarih* and *sorong serah* (engagement) stages, which can serve as an analogy for explaining the concept of chemical bonding. These cultural practices share fundamental principles, symbolic meanings, and underlying values with chemical bond formation. The tradition emphasizes mutual complementarity and interdependence between men and women through ceremonial exchanges that ultimately establish a legitimate marital union. Similarly, chemical bonds are formed through the transfer or sharing of electrons between atoms to achieve stability. Chemical compounds attain stability when their constituent atoms satisfy the octet rule, which describes the tendency of atoms to acquire noble gas electron configurations and thereby reach a more stable state (Rahmawati et al., 2025).

Another illustration of ethnochemistry in everyday life is the traditional production of salted fish in Sibolga, North Sumatra. Fish preservation through salting and sun-drying has been practiced for generations as a means of maintaining quality and extending shelf life. Although this technique originated from indigenous knowledge, it fundamentally applies the chemical principle of osmosis, which can be scientifically explained through an ethnochemical perspective. The continuity of this tradition has also strengthened Sibolga's identity as a coastal region with a rich maritime culture and a reputation for producing high-quality salted fish (Nurfitriyani et al., 2024).

As a branch of ethnoscience, ethnochemistry demonstrates that many cultural practices developed within communities inherently embody scientific concepts that can be explained through modern chemistry. The traditional use of green coconut water in Javanese culture, the *merarik* tradition of the Sasak people, and the preservation of salted fish in Sibolga illustrate that local knowledge is deeply rooted in scientific principles transmitted across generations. Through ethnochemical studies, these forms of indigenous knowledge can be understood more comprehensively, allowing them to function not only as cultural heritage but also as contextual and relevant educational resources. Consequently, ethnochemistry plays a vital role in bridging modern scientific knowledge with cultural traditions while fostering greater appreciation for Indonesia's rich heritage of indigenous knowledge.

2. Application of Chemical Concepts in Indonesian Batik

Batik is not only an important cultural heritage of Indonesia but also serves as a valuable subject of ethnoscientific inquiry that embodies diverse forms of indigenous knowledge. Throughout the batik-making process, local communities utilize various plant species as sources of natural dyes while applying production techniques that have been transmitted across generations. Traditional batik production incorporates numerous chemical concepts, including extraction, color fixation, solutions, pigments, and natural dye compounds. Scientific studies have demonstrated that these practices reflect the development of ethnochemistry within Indonesian society (Sudarmin et al., 2020).

For generations, batik artisans have employed substances such as alum, lime, and ferrous sulfate (*tunjung*) as color fixatives during the dyeing process. These materials function as mordants that enhance the durability and fastness of natural dyes on textile fibers. From a chemical perspective, mordants increase the binding affinity of natural dye molecules to fabric, thereby producing stronger and more durable colors that are less susceptible to fading. The accumulated empirical knowledge regarding the use of these materials illustrates the evolution of ethnochemical practices within batik-producing communities (Riski et al., 2024).

Unlike synthetic dyeing, natural dyeing in batik production cannot be completed in a single stage. Instead, it involves a more complex process beginning with the extraction of

pigments from plant materials, followed by repeated immersion of the fabric until the desired color intensity is achieved, and concluding with a fixation process that locks and develops the final color (Setiyanto & Fuad, 2024). Chemically, natural dyes generally exhibit low affinity for textile fibers, necessitating fixation through mordants containing metal complexes, such as iron(II) sulfate ($FeSO_4$), aluminum sulfate ($Al_2(SO_4)_3$), and calcium carbonate ($CaCO_3$), to enhance dye fiber interactions while influencing the resulting color shade (Nugraheni et al., 2023). At the molecular level, this process involves the formation of coordination complexes between metal ions and dye molecules, as well as oxidation–reduction reactions involving natural pigments, thereby improving color stability on textile fibers (Wahyuningsih et al., 2026).

Modern batik production increasingly utilizes synthetic chemical compounds, including Remazol as a vinyl sulfone-based reactive dye, sodium bicarbonate ($NaHCO_3$) as a dyeing auxiliary, and sodium silicate (Na_2SiO_3), commonly known as waterglass, together with Fixanol during the fixation and wax-removal (*pelorodan*) stages. The application of these compounds demonstrates that batik production encompasses not only cultural practices but also the implementation of chemical principles aimed at improving the quality, durability, and stability of textile coloration (Karsam, 2022). This development indicates that contemporary batik artisans employ not only natural dyes but also chemically synthesized colorants.

From a chemical standpoint, reactive dyes such as Remazol function by forming covalent bonds between their reactive groups and the hydroxyl (–OH) groups present in cellulose fibers, resulting in excellent adhesion and high color fastness (Siddiqua et al., 2021). Nevertheless, synthetic dyes such as Remazol Black B belong to the azo dye group, characterized by complex aromatic molecular structures that are relatively resistant to degradation. Consequently, wastewater containing these dyes requires effective treatment before being discharged into the environment (Ayu & Kasiamdari, 2022).

The extensive use of synthetic dyes in modern batik production increases the generation of wastewater containing various chemical compounds, making proper waste management essential to prevent environmental pollution (Kirana, 2021). From the perspective of environmental chemistry, batik wastewater generally exhibits elevated levels of pH, Chemical Oxygen Demand (COD), Biological Oxygen Demand (BOD), and Total Suspended Solids (TSS). Therefore, sustainable wastewater treatment systems are required to ensure compliance with environmental quality standards prior to discharge into natural water bodies (Sulthonuddin & Herdiansyah, 2021).

As one of Indonesia's most significant cultural heritages, batik embodies not only historical and aesthetic values but also a rich body of ethnochemical knowledge preserved within local communities. The utilization of plants as natural dye sources, the application of mordants such as alum, lime, and ferrous sulfate, and the repeated dyeing procedures collectively demonstrate indigenous scientific knowledge related to chemistry. This knowledge has evolved through empirical experience and has been transmitted across generations, making it an integral component of the local wisdom of batik-producing communities. Therefore, preserving batik means not only safeguarding Indonesia's cultural heritage but also conserving the ethnochemical knowledge it embodies as an invaluable intellectual asset of Indonesian society.

3. Introduction to *Tafsir Al-Maraghi*

Tafsir Al-Maraghi is one of the most prominent contemporary Qur'anic commentaries authored by **Ahmad Mustafa al-Maraghi**, with the primary objective of facilitating public understanding of the Qur'an through clear and accessible language. This commentary adopts the *tahlili* method, in which Qur'anic verses are interpreted sequentially according to the order of the *mushaf*, while integrating explanations derived from other Qur'anic

verses, Prophetic traditions (*hadith*), and prevailing social realities. Consequently, *Tafsir Al-Maraghi* is widely recognized as representing the *al-adab al-ijtima'i* approach, a style of Qur'anic exegesis that emphasizes the relevance of Qur'anic teachings to the social conditions of society (Anshari & Rahman, 2021).

Tafsir Al-Maraghi is distinguished by eight methodological characteristics: (1) presenting the Qur'anic verse at the beginning of each discussion; (2) providing detailed explanations of difficult or unfamiliar vocabulary; (3) offering a general interpretation (*ma'na al-ijmali*) of the verses; (4) avoiding the excessive use of technical scientific terminology; (5) refraining from extensive scientific explanations; (6) employing language that is clear and easily understood by readers; (7) avoiding narratives derived from *Isra'iliyyat* traditions found in earlier commentaries; and (8) interpreting Qur'anic verses by incorporating authentic transmitted reports (*riwayat*) (Al et al., 2022).

These characteristics make *Tafsir Al-Maraghi* particularly relevant as the interpretative framework adopted in this study. Its *al-adab al-ijtima'i* orientation, which emphasizes the relationship between Qur'anic teachings and the realities of social life, is consistent with the ethnochemical approach that examines cultural practices through the lens of chemistry. Accordingly, the application of *Tafsir Al-Maraghi* enables the batik-making process to be understood not merely as a cultural tradition or technological activity but also as a practice that embodies Qur'anic values, particularly those related to the principles of beauty and the diversity of colors as manifestations of the signs of Allah's greatness.

4. **Integration of Indonesian Batik from the Perspective of *Tafsir Al-Maraghi***

a) The Meaning of Beauty in Indonesian Batik

Indonesian batik represents one of the nation's most significant cultural heritages, distinguished by its intricate motifs, artistic patterns, and profound philosophical values. The aesthetic beauty embodied in batik provides not only visual satisfaction but also a sense of comfort and appreciation for both the wearer and the observer. Beyond its artistic dimension, batik reflects cultural identity and the wisdom inherited across generations.

From an Islamic perspective, wearing beautiful and appropriate clothing is regarded as a commendable act that carries spiritual value before Allah SWT. This principle is explicitly affirmed in **Qur'an Surah Al-A'raf (7):31**, which states:

يٰبَنِيْٓ اٰدَمَ خُذُوْا زِيْنَتَكُمْ عِنْدَ كُلِّ مَسْجِدٍ وَّكُلُوْا وَاشْرَبُوْا وَلَا تُسْرِفُوْٓا ۚاِنَّهٗ لَا يُحِبُّ الْمُسْرِفِيْنَ ۚ ٣١

"O children of Adam, wear your finest attire at every place of worship, and eat and drink, but do not be excessive. Indeed, He does not love those who commit excess." *(Qur'an, Surah Al-A'raf [7]:31* (Online, n.d.-b)

This verse commands believers to wear their finest clothing when entering places of worship. Accordingly, wearing batik not only reflects appreciation for Indonesia's cultural heritage but also aligns with Islamic values that encourage cleanliness, modesty, and elegance in personal appearance. In this context, batik may be understood as a culturally meaningful form of attire that embodies both aesthetic and ethical values. Furthermore, **Ahmad Mustafa al-Maraghi** explains in *Tafsir Al-Maraghi*:

يا بَنِي آدَمَ خُذُوا زِينَتَكُمْ عِنْدَ كُلِّ مَسْجِدٍ) الزينة ما يزين الشيء أو الشخص،)
وأخذها التزين بها، والمراد بالزينة هنا الثياب الحسنة كما يدل على ذلك سبب نزول
الآيات، وأقلّ هذه الزينة ما يدفع عن المرء أقبح ما يشينه بين الناس وهو ما يستر عورته،

وهو الواجب لصحة الصلاة والطواف، وما زاد على ذلك من التجمل بزينة اللباس عند الصلاة ولا سيما صلاة الجمعة والعيد فهو سنة لا واجب

"(O children of Adam, adorn yourselves at every place of worship.) Adornment (*az-zinah*) refers to anything that beautifies a person or an object and is used as a means of beautification. In this verse, adornment specifically refers to proper and dignified clothing, as indicated by the circumstances surrounding its revelation. At the minimum, it denotes clothing that conceals those parts of the body whose exposure would be considered indecent in public, namely the *awrah*. Such clothing is obligatory for the validity of both *salah* (prayer) and *tawaf*. Beyond this minimum requirement, wearing finer garments for the purpose of enhancing one's appearance particularly when performing Friday (*Jumu'ah*) or *Eid* prayers—is regarded as recommended (*sunnah*) rather than obligatory. (Rosyidi et al., 1988)

Indonesian batik represents a cultural manifestation that embodies profound symbolic and aesthetic values. Each batik motif and pattern conveys meanings that reflect the experiences, local wisdom, and creativity of Indonesian communities in preserving and developing their cultural heritage (Salsabila & Ekawardhani, 2025). These motifs are rooted in collective experience, artistic innovation, and indigenous knowledge that have been transmitted from one generation to the next. Furthermore, the continued existence of batik demonstrates the ability of Indonesian society to harmonize tradition with innovation while preserving its essential cultural values (Heckie et al., 2025).

The aesthetic value embodied in batik is consistent with the concept of *az-zinah* (adornment) explained in *Tafsir Al-Maraghi*, which defines adornment as anything used to beautify oneself, particularly through appropriate and dignified clothing. As one of Indonesia's most distinguished cultural achievements, batik serves not only as attire that covers the body but also as a medium for expressing beauty through its diverse motifs, colors, and profound philosophical meanings. This aesthetic richness reflects human creativity in applying knowledge and craftsmanship that have been preserved across generations. Therefore, the preservation of Indonesian batik may be regarded as an effort to safeguard and further develop the beauty bestowed by Allah SWT upon humanity while upholding the ethics of dress in accordance with Islamic teachings.

b) The Dyeing Process of Indonesian Batik

In the production of Indonesian batik, the dyeing process must be carried out with great care and precision to produce fabrics that are both aesthetically pleasing and rich in philosophical meaning. As one of the most critical stages of batik production, dyeing determines not only the aesthetic quality but also the distinctive characteristics of each motif. The careful selection, preparation, and application of color significantly influence the visual appearance and symbolic significance of the finished batik.

From an Islamic perspective, the diversity of colors found throughout the natural world constitutes one of the signs (*ayat kawniyyah*) of Allah SWT, reflecting the perfection and magnificence of His creation. This concept is explicitly mentioned in **Qur'an Surah Fatir (35):27**, which states:

اَلَمْ تَرَ اَنَّ اللّٰهَ اَنْزَلَ مِنَ السَّمَآءِ مَآءً فَاَخْرَجْنَا بِهٖ ثَمَرٰتٍ مُّخْتَلِفًا اَلْوَانُهَا ؕ وَمِنَ الْجِبَالِ جُدَدٌۢ بِيْضٌ وَّحُمْرٌ مُّخْتَلِفٌ اَلْوَانُهَا وَغَرَابِيْبُ سُوْدٌ ﴿٢٧﴾

"Do you not see that Allah sends down water from the sky, and with it We bring forth fruits of various colors? And among the mountains are streaks of white and red, of varying shades, as well as others that are intensely black." *(Qur'an, Surah Fatir [35]:27)* (Online, n.d.-a)

This verse indicates that the diversity of colors created by Allah SWT not only enhances the beauty of the natural world but also invites humankind to reflect upon His infinite power, wisdom, and perfection in creation. The remarkable variety of colors manifested throughout nature serves as one of Allah's signs, encouraging believers to contemplate the magnificence of His creation and acknowledge His sovereignty over the universe. In this regard, **Ahmad Mustafa al-Maraghi** explains in *Tafsir Al-Maraghi*:

(أَلَمْ تَرَ أَنَّ اللَّهَ أَنْزَلَ مِنَ السَّماءِ ماءً فَأَخْرَجْنا بِهِ ثَمَراتٍ مُخْتَلِفاً أَلْوانُها) يقول سبحانه منبها إلى كمال قدرته: ألم تشاهد أيها الرائي أنا خلقنا الأشياء المختلفة من الشيءالواحد، فأنزلنا الماء من السماء و أخرجنا به ثمرات مختلفا ألوانها وطعومها وروائحها كما هو مشاهد من ألوان الثمار من أصفر إلى أحمر إلى أخضر إلى نحو ذلك طرائق مختلفة الألوان أيضا. فتبارك الله أحسن الخالقين ولما عدد آياته و أعلام قدرته و آثار صنعه بين أنه لا يعرف ذلك حق المعرفة إلا العلماء بأسرار الكون، العالمون بدقائق صنعه تعالى، فهم الذين يفهمون ذلك حق الفهم، ويعلمون شديد بطشه و عظيم قهره

"(Do you not see that Allah sends down water from the sky, and with it We bring forth fruits of various colors?) This verse demonstrates the perfection of Allah's power: from a single source of water, He brings forth countless varieties of fruits differing in color, taste, and fragrance. Their colors range from yellow, red, and green to many other shades, reflecting the diversity of His creation. Glorified is Allah, the Best of Creators. After mentioning these signs of His power and the manifestations of His creation, Allah explains that only those endowed with knowledge truly comprehend them. They are the scholars who understand the mysteries of the universe and the intricacies of His creation, thereby recognizing both the greatness of His power and the severity of His punishment." (Rosyidi et al., 1992)

Natural dyes used in batik production are primarily derived from biological resources, especially plants, whose roots, stems, leaves, bark, fruits, seeds, and flowers contain pigments that can be extracted for textile dyeing (K & Prasetyo, 2022). In addition, agricultural by-products, including cocoa pods, coconut husks, oil palm shells, rambutan peels, mangosteen rinds, guava leaves, mango leaves, and avocado leaves, have considerable potential as sustainable sources of natural dyes. These materials are capable of producing a wide spectrum of colors, ranging from yellow, reddish, and brown to gray and black, while exhibiting satisfactory color fastness (Eskak & Salma, 2020). Besides the choice of raw materials, the effectiveness of natural batik dyeing is also influenced by processing techniques such as fermentation, pH adjustment, and repeated immersion cycles, all of which play crucial roles in determining color intensity and the final dyeing outcome (Hapsari et al., 2025).

The message conveyed in this Qur'anic verse highlights the greatness of Allah SWT, who creates an extraordinary diversity of colors in plants despite their originating from the same source of water. This diversity has been utilized by humans as a source of natural dyes for batik, extracted from various plant parts, including roots,

stems, leaves, bark, fruits, seeds, and flowers. Furthermore, agricultural waste can also be transformed into environmentally friendly natural dyes capable of producing a broad range of colors. The resulting coloration depends not only on the plant species employed but also on processing techniques such as fermentation, pH regulation, and the frequency of dye immersion. Therefore, the utilization of natural dyes in batik production may be understood as an expression of appreciation for the signs of Allah's power manifested through the diversity and richness of His creation.

Conclusion

Based on the findings of this study, it can be concluded that the Indonesian batik-making process embodies a wide range of ethnochemical principles reflected in every stage of production, including fabric preparation, pattern design, wax application (*canting*), dyeing, color fixation, and wax removal (*pelorodan*). These principles demonstrate that batik production is not merely a cultural tradition but also encompasses chemical concepts that have evolved through the indigenous knowledge and practices of local communities. The findings further reveal that the ethnochemical values embedded in Indonesian batik are closely aligned with Islamic teachings as interpreted in *Tafsir Al-Maraghi*, particularly regarding the concepts of beauty and the dyeing process as manifestations of Allah SWT's *ayat kawniyyah* (signs in creation). Therefore, the objective of this study to identify the ethnochemical principles underlying the Indonesian batik-making process and to integrate them with Islamic values has been successfully achieved.

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