



Exploration of Synthetic Iron Oxides, Calcium Carbonate, and Polyvinyl Acetate (PVA) for Achieving Texture and Tonal Values in Contemporary Painting

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DOI: <https://doi.org/10.68050/JAMS.2026.624>

Received: 24 September 2026; Accepted: 30 September 2026; Published: 06 October 2026

ABSTRACT

Contemporary painting increasingly embraces material experimentation to expand artistic expression beyond conventional media. This study explored the creative potential of combining calcium carbonate, synthetic iron oxides, and polyvinyl acetate (PVA) as an alternative painting medium for achieving distinctive textures and tonal values. An experimental studio-based qualitative research design was adopted. Seven artworks were produced using different formulations of the materials, while semi-structured interviews were conducted with twelve purposively selected paint production stakeholders in Benin City, Edo State. Interview data were analysed using manual thematic analysis alongside visual examination of the completed artworks. The findings revealed that calcium carbonate enhanced surface texture and paint body, synthetic iron oxides generated rich earthy tonal variations, and PVA provided effective adhesion and structural stability. The integrated medium produced expressive textural effects and tonal depth that extended beyond conventional painting materials. The study concludes that the formulation offers a viable alternative painting medium capable of promoting material innovation and enriching contemporary artistic practice.

Keywords: Contemporary painting, calcium carbonate, synthetic iron oxides, polyvinyl acetate, texture, tonal values, alternative materials, Benin City.

INTRODUCTION

Contemporary painting has evolved beyond the traditional use of established artistic media into a field characterised by continuous experimentation with materials, techniques, and processes. Artists increasingly explore unconventional substances to develop new visual languages capable of communicating complex cultural, aesthetic, and social experiences. This shift reflects the dynamic nature of contemporary art, where innovation is regarded not merely as a stylistic preference but as an essential component of artistic practice. Smith (2009) argues that contemporary art is best understood within the context of its historical moment, emphasising its responsiveness to changing artistic, technological, and cultural realities. Consequently, artists are continually investigating alternative materials that can expand the expressive possibilities of painting.

Within the African art landscape, experimentation with indigenous and industrial materials has become a defining characteristic of contemporary artistic practice. This tradition gained significant momentum through the Natural Synthesis philosophy developed by the Zaria Art Society during the late 1950s. The movement encouraged artists to merge African visual traditions with Western artistic techniques, thereby creating a distinctly Nigerian artistic identity (Okeke, 1961; Beier, 1960). The influence of this philosophy remains evident in the works of many contemporary African artists who incorporate found objects, recycled materials, natural pigments, wood, clay, and other unconventional media to explore issues of identity, sustainability, and cultural expression (Kasfir, 2021; Oguike, 2004). These developments demonstrate that material innovation has become central to the advancement of contemporary African painting.

The growing interest in alternative materials has also been influenced by the increasing availability of industrial products with properties suitable for artistic applications. Materials originally developed for



manufacturing and construction have found relevance within studio practice because of their versatility, affordability, and capacity to produce unique visual effects. Among such materials, calcium carbonate, synthetic iron oxides, and polyvinyl acetate (PVA) possess characteristics that make them particularly attractive for contemporary painters seeking to broaden their creative possibilities.

Calcium carbonate has traditionally been used as a filler, extender, and ground preparation material in painting because of its fine particle size, stability, and ability to increase the body of paint formulations. Its ability to produce varied surface textures makes it particularly valuable in contemporary painting, where tactile qualities often contribute significantly to visual meaning. Synthetic iron oxides, on the other hand, are recognised for their excellent pigment stability, high tinting strength, resistance to weathering, and wide range of earthy colour variations. These pigments provide artists with durable and aesthetically pleasing colour palettes capable of producing subtle tonal transitions and expressive visual depth. Polyvinyl acetate (PVA), widely used as an adhesive and binding medium, contributes flexibility, strong adhesion, and film-forming properties that improve the structural integrity of painted surfaces.

Although these materials have individually attracted considerable attention in both industrial manufacturing and artistic practice, research examining their combined application as a unified painting medium remains limited. Existing studies largely discuss their independent functions, with little emphasis on how their integration may influence texture formation, tonal variation, surface stability, and artistic expression. This represents an important gap within contemporary painting research, particularly within the Nigerian context where locally available industrial materials offer opportunities for affordable artistic innovation.

The absence of comprehensive empirical studies on the combined use of calcium carbonate, synthetic iron oxides, and PVA limits the development of alternative painting systems capable of supporting contemporary studio practice. Greater understanding of their interaction could encourage artists to diversify their material choices while reducing dependence on commercially prepared paints. Furthermore, such knowledge would contribute to the growing discourse on sustainable artistic production by demonstrating how readily available industrial materials can be transformed into effective creative resources.

Against this background, the present study investigates the integration of calcium carbonate, synthetic iron oxides, and polyvinyl acetate as an alternative painting medium for achieving texture and tonal values in contemporary painting. Through studio experimentation and qualitative engagement with paint production stakeholders in Benin City, Edo State, the study seeks to evaluate the technical performance, aesthetic qualities, and creative possibilities associated with the combined formulation of these materials. In doing so, it contributes to ongoing discussions on material innovation, experimental studio practice, and the expanding boundaries of contemporary African painting.

LITERATURE REVIEW

Material experimentation has become a defining characteristic of contemporary painting, allowing artists to challenge conventional techniques and expand the expressive possibilities of visual art. Contemporary art encourages innovation through the exploration of alternative materials that reflect changing cultural, technological, and environmental realities (Smith, 2009). In Nigeria, this approach gained prominence through the Natural Synthesis philosophy developed by the Zaria Art Society, which advocated the integration of indigenous artistic traditions with Western artistic methods (Okeke, 1961; Beier, 1960). The movement continues to influence contemporary African artists who employ found objects, recycled materials, natural pigments, wood, and other unconventional media to develop distinctive visual expressions while preserving cultural identity (Kasfir, 2021; Oguibe, 2004; Enwezor, 2003).

The increasing search for affordable and versatile painting materials has drawn attention to industrial products with suitable physical and chemical properties. Calcium carbonate is widely recognised as a valuable filler and extender in paint formulation because of its fine particle size, chemical stability, and ability to improve paint consistency and surface texture. Cohen (2015) describes calcium carbonate as one of the most abundant



naturally occurring minerals, while Goward et al. (2009) emphasise its high stability and neutralising characteristics, making it suitable for enhancing paint body and producing textured surfaces.

Synthetic iron oxides have also attracted considerable attention because of their excellent pigment performance. Unlike naturally occurring pigments, synthetic iron oxides are manufactured under controlled conditions that ensure uniform particle size, colour consistency, durability, and resistance to environmental degradation (Cornell & Schwertmann, 2003). Their ability to produce a broad range of earthy colours has made them valuable in contemporary painting, particularly where tonal variation and permanence are essential artistic considerations.

Equally important is the role of binding media in determining the quality and durability of painted surfaces. Polyvinyl acetate (PVA) is increasingly recognised as a flexible, non-toxic binder that provides excellent adhesion and forms stable paint films. When combined with pigments and fillers, PVA improves cohesion while supporting the development of textured surfaces. Similarly, conventional media such as oil, acrylic, and tempera remain important because of their distinctive handling characteristics and capacity to produce varying degrees of colour intensity, transparency, and surface texture.

Although previous studies have examined the individual properties of calcium carbonate, synthetic iron oxides, PVA, and conventional painting media, limited attention has been given to their integrated application as a unified painting system. Existing literature focuses largely on their independent functions, leaving insufficient understanding of how their combined use can enhance tonal values, textural diversity, and artistic expression. This study addresses this gap by investigating the creative potential of integrating calcium carbonate, synthetic iron oxides, and PVA as an alternative medium capable of expanding the technical and aesthetic possibilities of contemporary painting.

METHODOLOGY

This study adopted an experimental studio-based qualitative research design to investigate the artistic potential of combining calcium carbonate, synthetic iron oxides, and polyvinyl acetate (PVA) for achieving texture and tonal values in contemporary painting. The design was considered appropriate because it enabled practical experimentation with the materials while exploring the experiences and professional perspectives of paint production stakeholders (Egonwa, 2012). The study was conducted in Benin City, Edo State, Nigeria, where paint manufacturing activities and contemporary art practice provide a suitable context for material experimentation. Purposive sampling was used to select twelve paint production stakeholders, including production managers, quality control officers, paint formulators, and technical personnel with extensive knowledge of paint production processes. Data were collected through two complementary approaches. First, seven studio paintings were produced using varying formulations of calcium carbonate, synthetic iron oxides, and PVA to examine their effects on texture, tonal variation, adhesion, and surface stability. Second, semi-structured interviews were conducted with the selected participants to obtain insights into the properties, applications, advantages, and challenges associated with the materials in paint formulation. The interview data were analysed using manual thematic analysis, whereby responses were carefully transcribed, coded, and organised into recurring themes reflecting participants' experiences and observations. The visual characteristics of the studio artworks were analysed through direct observation, with emphasis placed on tonal quality, texture, durability, and aesthetic expression. The integration of interview findings with studio observations provided a comprehensive understanding of the creative and technical potential of the proposed painting medium.

RESULTS AND DISCUSSION

Manual thematic analysis of the interviews generated five major themes: material compatibility, tonal value development, texture formation, technical challenges, and creative potential. These themes were consistent with observations from the seven experimental paintings, demonstrating the effectiveness of combining calcium carbonate, synthetic iron oxides, and polyvinyl acetate (PVA) as an alternative painting medium.

Theme 1: Material Compatibility

Participants generally agreed that calcium carbonate, synthetic iron oxides, and PVA interacted effectively to produce a stable painting medium. They explained that calcium carbonate increased the body of the mixture, synthetic iron oxides provided consistent pigmentation, while PVA improved adhesion and flexibility.

One participant remarked:

"The three materials complement one another. Calcium carbonate gives volume, the oxide provides colour, and PVA keeps everything firmly bonded to the canvas." (P3)

Similarly, another participant stated:

"The mixture behaves like commercial paint when the proportions are properly controlled. It spreads easily and dries into a stable surface." (P8)

These observations corresponded with the studio experiments, where the formulated medium demonstrated good workability and satisfactory adhesion throughout the painting process.

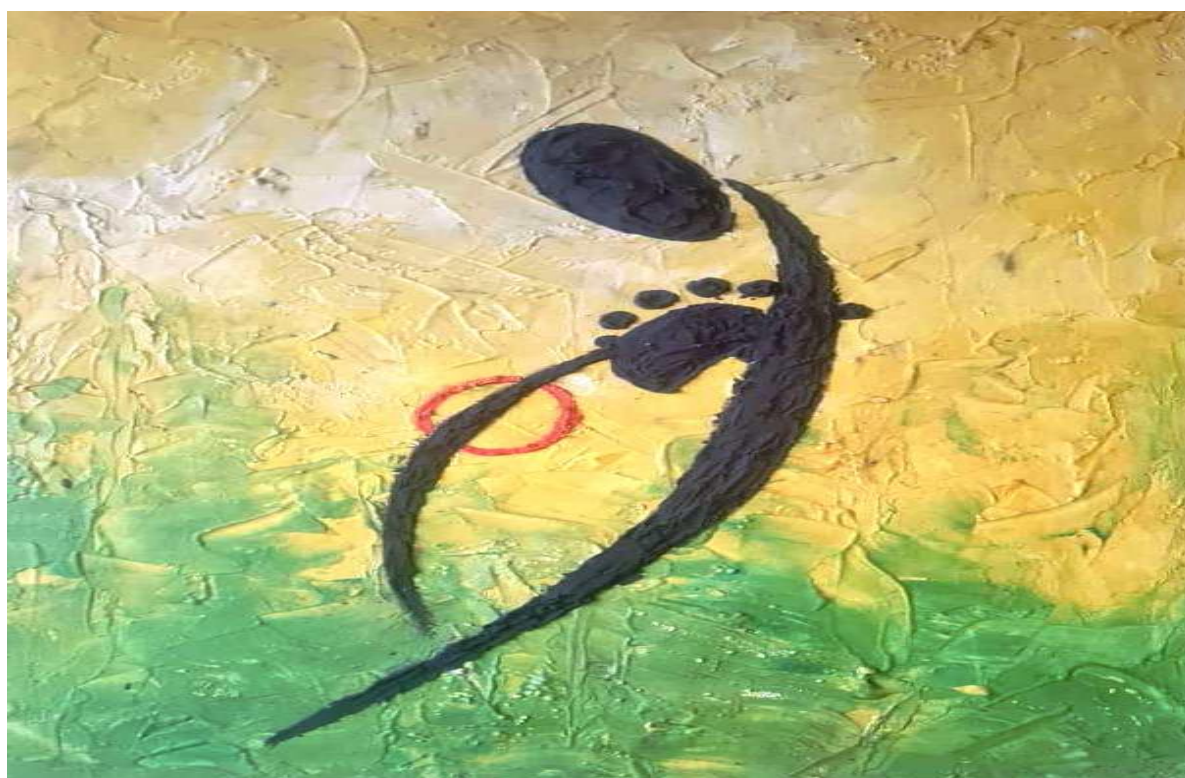


Figure 1. Affection

Discussion: The painting demonstrates the compatibility of the three materials through thick impasto application. Calcium carbonate enhanced the structural body of the medium, while synthetic iron oxides produced warm ochre tonalities that contributed to visual richness.

Theme 2: Tonal Value Development

Participants identified synthetic iron oxides as the principal contributor to tonal variation. They noted that gradual adjustments in pigment concentration produced a wide spectrum of earthy colours suitable for expressive painting.

According to one participant,

"Iron oxide produces natural earth colours that remain vibrant after drying, making it suitable for artistic applications." (P5)

Another explained:

"Different oxide concentrations create smooth tonal transitions without affecting colour stability." (P11)

The studio experiments confirmed these observations. Layering techniques produced subtle tonal graduations ranging from light ochre to deep umber, enhancing depth and visual perception.



Figure 2. Ecstasy

Discussion: Smooth glazing over a textured ground created gradual tonal transitions that enhanced depth while preserving surface harmony.



Figure 3. Celebration

Discussion: Controlled pigment application produced matte surfaces with subtle tonal gradation, demonstrating the versatility of the alternative medium.

Theme 3: Texture Formation

Texture emerged as one of the most prominent findings. Participants explained that increasing the proportion of calcium carbonate produced heavier paint consistency capable of supporting sculptural surface effects.

One participant stated:

"When more calcium carbonate is added, the paint becomes thicker and can hold knife marks without collapsing." (P2)

Another observed:

"PVA provides enough flexibility to prevent the textured surface from separating after drying." (P9)

Visual analysis supported these views, as the paintings exhibited textures ranging from relatively smooth finishes to highly pronounced impasto.



Figure 4. Dancers

Discussion: Contrasting smooth and heavily textured passages created visual rhythm and enhanced spatial movement across the composition.

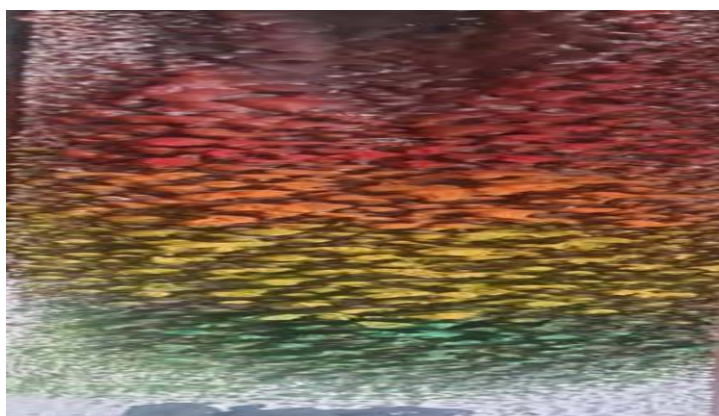


Figure 5. Growth

Discussion: Although a limited colour palette was employed, variations in texture and layering generated considerable tonal depth and visual interest.



Figure 6. The Maiden

Discussion: The granular texture demonstrates the contribution of calcium carbonate to surface character while maintaining colour stability.

Theme 4: Technical Challenges

Although participants acknowledged the effectiveness of the medium, several technical issues were identified. The most frequently reported challenges were cracking, inadequate adhesion resulting from poor material proportions, and insufficient drying time between successive applications.

One participant explained:

"Too much calcium carbonate weakens the paint film, but increasing the PVA slightly improves flexibility and prevents cracking." (P6)

Another commented:

"Allowing each layer to dry completely is essential because hurried applications reduce the quality of the final surface." (P4)

These findings corresponded with the studio experiments, where appropriate PVA-to-calcium carbonate ratios significantly improved surface stability.

Theme 5: Creative Potential

Participants unanimously agreed that the experimental medium offers significant opportunities for contemporary painting because the materials are readily available, affordable, and capable of producing distinctive visual effects.

One participant remarked:

"Artists should not rely entirely on imported paints when local industrial materials can produce equally impressive results." (P10)

Another stated:

"This medium encourages experimentation and gives artists greater freedom to create unique textures and colour effects." (P12)

These views were reflected in the final studio works, which demonstrated considerable diversity in tonal quality, texture, and aesthetic expression.



Figure 7. The Dancers

Discussion: The integration of acrylic with the formulated medium produced contrasting matte and glossy surfaces, enhancing optical depth and reinforcing the expressive possibilities of the alternative painting system.

FINDINGS

The study established that the integration of calcium carbonate, synthetic iron oxides, and polyvinyl acetate (PVA) provides an effective alternative painting medium capable of enhancing texture and tonal values in contemporary painting. The studio experiments demonstrated that calcium carbonate increased paint body and facilitated the development of textured surfaces, while synthetic iron oxides produced stable earthy tonal variations that enhanced visual depth. PVA functioned effectively as a binding medium, improving adhesion, flexibility, and the structural stability of the paint film. Thematic analysis of interviews with the twelve paint production stakeholders further revealed that the formulated medium is affordable, readily available, and suitable for artistic experimentation. Although participants identified challenges such as cracking and poor adhesion resulting from inappropriate material proportions, these were effectively addressed through proper formulation and controlled drying procedures. Overall, the findings indicate that the combined medium possesses considerable technical reliability and creative potential for contemporary painting practice.

CONCLUSION

This study explored the artistic potential of combining calcium carbonate, synthetic iron oxides, and polyvinyl acetate (PVA) as an alternative painting medium for achieving texture and tonal values in contemporary painting. Through studio experimentation and qualitative interviews with stakeholders in paint production in Benin City, Edo State, the study demonstrated that the integrated medium possesses both technical functionality and aesthetic versatility. The findings confirmed that each material contributes distinct qualities to the painting process. Calcium carbonate enhances texture and paint consistency, synthetic iron oxides generate durable earthy tonalities, and PVA provides effective adhesion and flexibility. Their combined application produced visually expressive surfaces ranging from smooth finishes to pronounced impasto while maintaining satisfactory structural stability. Beyond its technical performance, the study highlights the value of



locally available industrial materials in promoting innovation within contemporary African painting. The integration of these materials offers artists a practical and economical alternative to conventional painting media, thereby encouraging greater experimentation and expanding the creative possibilities of studio practice.

RECOMMENDATIONS

Based on the findings of this study, the following recommendations are proposed:

1. Artists should explore the creative possibilities of calcium carbonate, synthetic iron oxides, and PVA as alternative painting materials capable of producing diverse tonal and textural effects.
2. Art schools and higher institutions should incorporate studies on alternative painting materials into studio practice courses to encourage experimentation and material innovation.
3. Researchers should undertake further studies on the long-term durability, ageing characteristics, and environmental performance of the formulated medium under different climatic conditions.
4. Paint manufacturers and artists should strengthen collaborative efforts to develop standardised formulations that can support both artistic production and commercial application.
5. Future studies should investigate the integration of additional locally available industrial materials to further expand the technical and expressive possibilities of contemporary painting.

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