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Natural Pigments Vs Acrylic: Assessing The Viability Of Local Earth And Plant Dyes For Sustainable Painting In Delta State, Nigeria

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ABSTRACT.
Imported acrylic paints are the dominant medium in Nigerian art studios, but their high cost and petrochemical base restrict access for students and emerging artists. This study investigates the technical, economic, and facility viability of local earth and plant pigments as sustainable alternatives in Delta State. Using a mixed-methods experimental design, four pigments were sourced and tested: red laterite from Abraka, charcoal soot from Isoko, indigo dye from Warri, and palm kernel soot from Sapele Delta State, Nigeria. Twenty professional and student painters in Asaba and Warri used the pigments for four weeks. They compared them to commercial acrylic in terms of cost, color performance, binding, durability, health, and safety. The findings are threefold. First, all four pigments produced stable, lightfast paint suitable for earth tones, underpainting, and exhibition work. Second, the local pigments cost between ₦750 and ₦1,250 per 250ml equivalent, representing a 70.2% to 82.1% saving against acrylic at ₦4,200. A four-colour local set costs ₦3,750 versus ₦16,800 for acrylic. Third, the main barriers are facility-based: labor-intensive grinding, respirable dust, batch inconsistency, and absence of SON standards. The study concludes that local pigments are viable for 70% of studio practice and recommends curriculum inclusion, provision of grinding mills and dust extraction by estate managers, and national standardization to advance SDG 12 and Nigeria's creative economy.

Keywords: Natural pigments, sustainable painting, local dyes, acrylic paint, Delta State, circular economy, SDG 12, studio facility management, estate management

1.0 INTRODUCTION

1.1 Background

In a typical painting studio in Asaba, Abraka, Ozoro, Agbor, and so on, a student will open a 250ml tube of acrylic and use it sparingly. The tube costs ₦3,500 to ₦6,000. For a semester, a student may need 8 to 10 tubes. That is ₦32,000 to ₦60,000, which is more than many parents can pay. The result is dropped courses, shared paint, or students leaving art altogether. Outside that same studio, the environment provides color. The red soil of Abraka is rich in iron oxide. Isoko kitchens produce charcoal soot daily. Sapele palm mills discard black soot. The Warri market has sold indigo balls for cloth dyeing for over 100 years. These are not "waste." They are pigments.

1.2 **The Global and National Context.**

Globally, the art world is shifting. Acrylics are made from petroleum derivatives and synthetic binders. They create chemical waste and VOC exposure in studios (World Bank, 2021). In response, schools in the UK and India have revived earth and plant pigments as part of sustainable (Ellen MacArthur Foundation, 2020). In Nigeria, SDG 12 calls for responsible consumption and production. The National Development Plan 2021-2025 also prioritizes the creative economy and local content. Yet most Nigerian art departments still import paint and teach with imported materials.

1.3 **Problem Statement and Gap.**

We have cultural history: uli, nzu, indigo (Okeke-Agulu, 2013). We have a theory on sustainability. What we lack is empirical data from Delta State: What pigments exist? How much do they cost? Do they perform? Will artists use them? No study has answered these three questions with field and studio data. Existing Nigerian studies are historical or chemical. None has tested Delta pigments with 20 painters, costed them in 2026 naira, and linked findings to facility policy.

Imported acrylic paint dominates Nigerian art studios. A 250ml tube costs ₦3,500–₦6,000. A semester's 8–10 tubes to ₦32,000–₦60,000, which is unaffordable for many students. Delta State has accessible local color sources: red laterite, charcoal soot, palm kernel soot, and indigo, historically used for uli, murals, and cloth dyeing. This study fills the gap and tests their technical, economic, and facility viability for contemporary painting.

1.4 **Research Questions and Aim.**

This study aims to assess the viability of local pigments in Delta State. The questions are:

1. What local pigments can be sourced and processed for painting?
2. How do they compare to acrylic in terms of cost, quality, and artist acceptance?
3. What facility and policy support is needed for scale?

1.5 **Significance.**

For Estate Management, this is a facility issue: studios, dust, equipment, and safety. For Education, it is an access issue. For Policy, it is a local content and SDG 12 issue.

2. Review of Literature

2.1 Art Materials and Sustainability
2.2 Nigerian Pigment Heritage
2.3 Material Science: Pigment, Binder, and Lightfastness
2.4 Studio as a Managed Facility
2.5 Indigenous Knowledge Systems and Decolonizing

2.1 **Art Materials and Sustainability.**

The 20th century moved art from earth to the lab. Acrylic, invented in the 1940s, became dominant because it dried fast and gave bright colour. The cost was toxicity and dependence on imports. Recent literature argues for "decolonizing the palette" by returning to local materials. (Grosenick,2007. & Uzochukwu,2021.)

2.2 **Nigerian Pigment Heritage**

Igbo artists used uli for body and wall painting. Nsukka artists used charcoal and red earth. Urhobo and Itsekiri used indigo from Indigofera tinctoria for cloth and murals [Okeke-Agulu, 2013]. These pigments

were lightfast because they are mineral or carbon-based. Colonial art education replaced them with oils and acrylics.

2.3 **Material Science: Pigment, Binder, and Lightfastness**

A pigment gives color. A binder holds it to the surface. Traditional binders were gum Arabic, egg, and starch. Modern studios use PVA glue as a non-toxic acrylic substitute. ASTM standards are measured by lightfastness. Earth pigments like ochre and carbon black rate ASTM I, meaning excellent lightfastness.

2.4 **Studio as a Managed Facility.**

From an estate management perspective, a studio is a workplace. Grinding creates respirable dust. NUC Benchmarks require ventilation and PPE (NUC). Kazeem found that 68% of Nigerian tertiary workshops lack dust control. If natural pigments are adopted, facility managers must provide mills and extractors.

2.5 Indigenous Knowledge Systems and Decolonizing Materials

Scholars argue for "decolonizing the palette" to reduce dependence on imports (Grosenick, 2007; Uzochukwu, 2021). In Africa, independence pigments predate colonial art education (Okeke-Agulu, 2013; Nkiru, 2018).

2.6 Circular Economy in the Arts

The Ellen MacArthur Foundation and UNESCO link local material use to the circular economy and waste reduction in creative sectors.

2.7 Health and Safety in Art Studios

Grinding creates PM2.5 dust linked to respiratory (WHO, 2021; HSE, 2019). NUC and SON mandate and PPE. (2022,2019).

2.8 Cost of Art Education in Nigeria

Tertiary students face rising material costs (TET Fund, 2023; British Council, 2021). Material cost is a dropout factor in vocational courses (Oladokun & Ajayi, 2016).

2.9 Policy Context: SDG 12 and National Development Plan

SDG 12 and Nigeria's NDP 2021-2025 prioritize local content and responsible production (UN, 2015; FRN, 2021).

3. METHODOLOGY

A pragmatic, mixed-methods design, Jan–March 2026. Four pigments were processed to 100-mesh and used with PVA-cassava binder by 20 painters in Asaba and Warri. Data included cost logs, artist journals, 6-month lightfast tests, and focus groups.

3.1 **Research Philosophy and Design**

Pragmatism guided the study. We used mixed methods: experimental testing and qualitative interviews (Creswell & Poth, 2018).

3.2 **Study Area.**

Delta State was chosen for ecological and market diversity. Asaba is an administrative hub with art schools. Warri is a port city with textile markets and the palm industry.

3.3 **Pigment Sourcing and Processing**

1. Red Laterite: Collected from the Abraka riverbank. Sun-dried for 7 days.
2. Charcoal Soot: Collected from Isoko firewood sellers.
3. Indigo: Fresh Indigo era leaves from the Warri Textile Market, fermented 48 hours
4. Palm Kernel Soot: Collected from Sapele palm oil mills.

All materials were ground and sieved to 100-mesh. Binder was 3 parts PVA glue to 1part cassava starch paste.

3.4 **Participants**

Twenty painters: 10 professionals, 10 HND students. Criteria: 2+ years of experience, active studio. Purposive sampling.

3.5 **Data Collection.**

1. Cost Log: All expenses recorded in naira, Jan-March 2026.
2. Artist Journals: Daily notes on color, texture, drying, smell, dust.

3. Lightfast Test: Swatches exposed to direct sun for 6 months.
4. Focus Group: 2 groups of 10 to discuss adoption barriers.

3.6 **Data Analysis.**

Quantitative: Cost comparison and fade percentages. Qualitative: Thematic analysis [Braun & Clarke, 2006]. Themes were coded as Processing, Performance, Cost, Health, and Adoption.

3.7 **Ethics.**

Consent forms were signed. Sourcing sites were not disclosed to protect community access.

4. RESULTS

4.1 **Pigment Characteristics and Processing**.

All four pigments yielded usable paint. Red laterite produced a warm, opaque red. Charcoal and palm kernel gave carbon blacks with high tint strength. Indigo gave a deep blue, but required pH adjustment. The main challenge was processing time. Manual grinding averaged 2.4 hours per 250ml. The electric mill grinding averaged 18 minutes. Dust was visible during grinding. Artists reported sneezing without nose masks.

4.2 **Cost Comparison**: Local Natural Pigments vs. Commercial Acrylic Paint for 250ml Equivalent, Delta State 2026. We costed every item at 2026 market rates. Labor cost is ₦1,500 per day. Commercial acrylic paint from Asaba art shops averaged ₦4,200 for 250ml. It required no processing or binder. Red laterite costs ₦300 to collect and process, plus ₦650 for binder. Total: ₦950 per 250 ml. That is 77.4% cheaper than acrylic. Charcoal soot costs ₦150 to collect, plus ₦650 binder. Total: ₦800. That is 81.0% cheaper.

Indigo cost ₦600 due to fermentation labor, plus ₦650 binder. Total: ₦1,250. That is 70.2% cheaper. Palm kernel soot costs ₦100 to collect, plus ₦650 binder. Total: ₦750. That is 82.1% cheaper. A full four-colour local set of red, black, blue, and white kaolin costs ₦3,750. The acrylic equivalent cost ₦16,800. The local set saved 77.7%. Artists reported that 17 of 20 used local pigments for 80% of classwork and reserved acrylic for final highlights. Students said the savings meant they could complete more paintings per semester.

4.3 **Performance, Durability, and Artist Acceptance**.

For earth tones, skin tones, and landscapes, 18 of 20 artists rated local pigments as “excellent” or “good”. Drying time was 20-30 minutes, and 10 minutes for acrylic. Coverage required 2-3 layers versus 1-2 for acrylic. After 6 months, red laterite faded 4%, charcoal 3%, palm kernel 5%, and indigo 15%. All were within acceptable studio range except indigo in direct sun. Weakness: Local pigments could not produce bright fluorescent, neon, or metallic colors. They also lacked tube packaging and had a 3-month shelf life, 3 years for acrylic.

4.4 **Health, Safety, and Facility Issues.**

Twelve artists reported dust irritation during manual grinding. After we provided N95 masks and a small extractor, complaints stopped. Artists said, “If every studio has a mill, we will switch.”

5. DISCUSSION

Key Findings:

1. Technical: 2. Economic: 3. Facility and 4. Market.

5.1 **Technical Viability**

All pigments were stable and lightfast. Red laterite 4% fade, charcoal 3%, palm kernel 5%, indigo 15% after 6 months of sun. 18/20 artists rated them “excellent/good” for earth tones, slower drying, and 3-month shelf life. The pigments are technically viable. Their chemistry is similar to Renaissance earth pigments. The binder works. The lightfastness is good.

5.2 **Economic Viability.**

The cost data is the strongest finding. 77% saving changes who can paint. For a polytechnic with 100 painting students, switching 80% of coursework to local pigments saves ₦2.6 million per session.

70.2%–82.1% cheaper than acrylic. A 4-colour local set ₦3,750 vs ₦16,800 acrylic = 77.7% saved. 17/20 artists used locals for 80% of classwork.

5.3 **Facility and Estate Management Implications**.

This is the core contribution. First 2026 Delta empirical data. Reframes pigment adoption as a facility management issue. Links art, estate management, and sustainability.

Natural pigments shift the cost from materials to infrastructure. Instead of buying paint, schools must buy mills and extractors; state managers must budget for this. (1) Natural Pigment Lab + compulsory course. (2) Estate Managers: Risk register + PPE/ventilation. (3) SON/TETFund: Standards + Green Pigment Fund.

The studio becomes a small production unit. Manual grinding = 2.4hrs + dust. With Mills extractors' PPE, complaints stopped. No SON standard or packaging exists.

5.4 Cultural and Market Acceptance.

Artists and collectors valued the "local story." Three artists sold works made with local pigments at 15% higher prices because buyers liked the sustainability angle. Local pigments are viable for ~70% of studio work. Cost is cut by >70%. The constraint is infrastructure, not color. With mills, dust control, and standards, can be democratized and meet SDG 12.

5.5 Limitations.

The sample size was 20. Indigo color range is limited. No SON standard exists yet. Shelf life is short.

CONCLUSION

Local earth and plant pigments in Delta State are technically and economically viable for most painting work. They reduce cost by over 70%, reduce chemical use, and reconnect artists to local materials. The constraint is not color but facility: grinding, dust control, and standardization. With that support, local pigments can democratize painting and meet SDG 12.

RECOMMENDATIONS

For Federal and State Polytechnics: Establish a Natural Pigment Laboratory. Budget for one 2hp electric mill and dust extractor per department. For Estate Managers: Include pigment grinding in the studio risk register. Provide PPE and ventilation per NUC standards. For Standards Organization of Nigeria: Develop NS-Artist Pigment 2026 to regulate particle size, lightfastness, and labeling. For TET Fund, FMACCE, and SMEDAN: Create a "Green Pigment Fund" for artist cooperatives to process and package paint. For Art Departments: Make "Local Materials Studio" a compulsory 2-unit course.

REFERENCES

Adebayo, A. A. (2018). Maintenance culture and facility performance in Nigerian polytechnics. Nigerian Journal of Estate Management, 3 (1), 45-58.

Arokiasamy, L., Ismail, M., & Ahmad, A. (2011). The role of facilities management in enhancing employee productivity. Journal of Facilities Management, 9 (3), 219-233.

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. Qualitative Research in Psychology, 3 (2), 77-101.

British Council. (2021). Creative Economy in Nigeria: Mapping and Policy Review. British Council of Nigeria.

Creswell, J. W., & Poth, C. N. (2018). Qualitative inquiry and research design (4th ed.). Sage.

Ellen MacArthur Foundation. (2020). Circular Economy Introduction. EMF.

Federal Republic of Nigeria. (2021). National Development Plan 2021-2025.

Grosenick, U. (2007). Women artists in the 20th and 21st centuries. Taschen.

Haslam, R. A., et al. (2005). Contributing factors in construction accidents. Applied Ergonomics, 36(4), 401-415.

Health and Safety Executive. (2019). COSHH Essentials for Art and Design: HSG258. HSE Books.

International Agency for Research on Cancer. (2012). Wood Dust and Formaldehyde: IARC Monographs Vol 100C. IARC.

Kazeem, A. (2019). Facility management challenges in Nigerian tertiary institutions. Journal of Facility Management, 17(4), 342-356.

Lateef, O. A., Khamidi, M. F., & Idrus, A. (2010). Appraisal of maintenance management practices of Nigerian universities. International Journal of Sustainable Built Environment, 3(1), 52-61.

McCann, M. (1992). Artist Beware: The Hazards in Working with Art and Craft Materials (2nd ed.). Lyons & Buford.

National Environmental Standards and Regulations Enforcement Agency. (2011). National Environmental Protection Regulations. NESREA.

National Health Insurance Authority. (2022). Occupational Health Guidelines for Tertiary institution. NHIA.

National Universities Commission. (2022). BMAS for Fine and Applied Arts. NUC.

Nkiru, N. (2018). Indigenous pigments and body art in South-Eastern Nigeria. Journal of African Cultural Studies, 30(1), 89-103.

Nwosu, C. U., & Chukwu, J. (2020). Health and safety compliance in vocational workshops in South-East Nigeria. Journal of Vocational Education and Training, 72 (2), 245-261.

Oladokun, T. T., & Ajayi, C. A. (2016). Funding and facility adequacy in Nigerian tertiary institutions. African Educational Research Journal, 4 (3), 112-121.

Occupational Safety and Health Administration. (2020). Safety and Health in Arts and Crafts: OSHA 3349 US DOL.

Okeke-Agulu, C. (2013). Postcolonial modernism: Art and decolonization in twentieth-century Nigeria, Duke University Press.

Rossol, M. (2013). Health Hazards Manual for Artists (6th ed.). Allworth Press.

Standards Organisation of Nigeria. (2019). SON Standard for Artists' Materials SON.

Sparavigna, A. C. (2020). Airborne dust in art studios and schools: A review. Sustainability, 12(18), 7543.

Tertiary Education Trust Fund. (2023). Annual Report on Creative and Innovation Grants TET Fund.

TETFund. (2023). Annual Report on Creative and Innovation Grants. TETFund.

UNESCO. (2022). Reshaping policies for creativity: Culture as a global public good UNESCO.

Uzochukwu, M. (2021). Materiality and technique in contemporary Nigerian studio painting. African Arts, 54(2), 50-63.

United Nations. (2015). Transforming Our World: The 2030 Agenda for Sustainable Development UN.

UNESCO. (2022). Reshaping policies for creativity: Culture as a global public good UNESCO.

Uzochukwu, M. (2021). Materiality and technique in contemporary Nigerian studio painting. African Arts, 54(2), 50-63.

World Bank. (2021). What a Waste 2.0: A Global Snapshot of Solid Waste Management World Bank.

World Health Organization. (2021). WHO Global Air Quality Guidelines: Particulate Matter WHO.