Exploring the Potentials of Ibule-Soro Clay for the Formulating of Mid-Temperature Decorative Slip Glazes

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ABSTRACT

Traditional potters and studio ceramists in Nigeria have restricted access to refined and affordable glazes which impedes pottery decorative practices to a confine where only biscuit and terracotta wares are made without glaze. This study investigates the effects of different slip compositions on pottery wares, focusing on Ibule-soro clay as a low cost effective decoration alternative for local pottery. It explores three locally available materials such as Ibule-soro Ball-clay, Iron oxide and Ijero-Ekiti feldspar. These materials were collected, processed, made into tri-axial blends and applied as pottery surface coating materials. Heat treatment tests was carried out and visual assessment was made, which reveals that slips made with right mixture of Ibule-soro clay, feldspar and iron oxide will fuse as decorative slip glaze when fired at 1170^{o}C mid-temperature.

Keyword: Ball clay, Triaxial, mid-temperature, slip and glaze

INTRODUCTION

Decoration is an integral part of any well finished pottery. This is because it enhances the form as well as embellishes the surface. Decorations can be applied at any time, either during the making process or after firing. It is noteworthy that different styles and methods have been used to enhance pottery appearance at different times over the globe. When a desired shape is achieved slip or glaze decoration can be applied to enhance the surface appearance of pottery. Alasa (2005) describe glaze as a glassy coating on pottery compounded from earthen mineral substances which after processing are mixed with water, thoroughly blended and coated to ready biscuit ware and subjected to intensive heat treatment in a kiln. While Steve (2013) simply define slip as liquid clay. Slipware is a type of pottery identified by its primary decorating process where various colours of slips are placed on leather- hard readymade pottery surface. This implies that ordinary ball clay can be made into slip for decoration which after firing often appear simple, matte or glossy. Slip decoration in England according to Wondrausch (2001), has its traditional origin back in the 17th century, Staffordshire pottery where master potters Thomas Toft perfected the technique of slip trailing. Aside slip trailing, other slip designs just like glazing can be applied in many ways, such as pouring, dipping, painting, spraying and sponging.

A coloured or sometimes multiple coloured slip can be applied and fired in pottery. When earthenware are decorated with coloured slip, they can be further coated with low or mid-temperature transparent glaze to give a glossy effect. Slip colours are gotten from oxides such as iron, copper, cobalt, manganese and other stains. These materials are mixed at different percentages to form colour palette of slips. Several layers of slip can be applied while the pot is still green; a coat of white or coloured slip can be applied to improve appearance either by smoothen rough surface, hide unwanted background colour or create an effect to contrast the background colour. Anderson (2000) suggest that slip can be applied on both greenware and biscuit, but at best on leather hard greenware before firing. A complete slip is normally of thicker consistency when applied on greenware than slip made to be applied on biscuit pottery. This is because the shrinkage between the slip and the pottery may differ especially when applied on biscuit which may result to flaking or peeling off.

Pottery is an ancient tradition that has gone across the length and breadth of Nigerian before the advent of machine and has undergone changes. The interaction of Nigerian local pottery with different cultures and technological practices in the use of materials, styles of production, processes and forms has significantly influenced the contemporary practice. The excellence of pottery, beauty of its form and their uses cut across all parts of Nigerian societies. Akinbogun and Fadairo (2009) assert that judging from the favourable climate and raw materials available in the country, raw materials should not be in the list of challenges confronting the pottery studio practitioners. Unfortunately, the government misplaced priority, deficiency of mining infrastructure and raw material processing facilities hinder pottery practice in the country. The cost of processing raw materials into useful glazes and purchasing of imported refine glazes and oxides discourages local potters, making it impossible for local potters to compete favourably. Consequently, pottery decoration gets confines to other alternatives like acrylic paints or left unglazed (Irabor, 2009). Slip decoration would have been a better cost effective alternative but method have not been adequately utilized.

This study is an experimental research aimed at developing decorative slip from Ibule-soro ball-clay as alternative coating for local pottery. This research offers easily accessible slip decoration at lower production cost for potters in Akure and its environs. The result would encourage cottage potters to reduce their dependence on expensive imported glazes and boost local practice.

MATERIALS AND METHODS

In order to compare the outcomes of different clay slip as decoration, this study conducted a visual assessment using triaxial blends of clay, feldspar and iron with water to form slip samples to be subjected to heat treatment at mid-temperature of 1170^{o}C in order to examine the slip glaze behavior on pottery surface.

Materials

Clay ($Al_2O_3.2SiO_2.2H_2O$) is a basic raw material used in pottery which is readily available in many forms. It is essentially silica, alumina and water with small amount of other elements such as calcium and iron in varying proportions depending in the location and nature of the parent rock. In glaze formulation the type and amount of clay needed in a recipe is determined by the type of glaze that is required. The ratio of clay in a batch will aid the suspension of the particles in the slip, thereby preventing immediate settling at bottom of container. Clay required for this study was sourced from a clay site in Ibule-soro.

Feldspar is a generic term for a group of minerals, which contain silica and alumina with alkalis in different proportion (Anjonrin, Akinbogun & Kashim 2014). Mimi (2024) identify Potassium and Soda feldspars as most used in ceramics. Feldspars are minerals consisting of alumino-silicates of sodium, potassium and calcium which constitutes a significant component of igneous rocks and their occurrence in nature is widespread. Feldspars are important components in clay bodies and glaze; as their primary function is to supply fluxes to the formulation. They are naturally occurring minerals determined by the predominant alkali metal element present in the location. Potassium feldspar is the silicate tetrahedral and aluminum tetrahedra bound with potassium ions while Soda feldspar is the silicate tetrahedral and aluminum tetrahedra bound with sodium. Rogers (1991) reveals that both are often used interchangeably with very little noticeable differences. He further reiterates that Soda feldspar has a slightly lower melting point than Potassium feldspar.

Colouring Iron Oxide: Iron Oxide is a compound composed of iron and oxygen (Cornell & Schwertmann 2003). Iron oxides are prevalent in nature, mostly found in sedimentary rocks with alternating layers of iron rich minerals. Iron oxides are present in all ceramic materials at different percentage as colourant. Iron under oxidizing condition of firing will give a reddish colour, while in reduction firing environment the oxide will give grey with range of yellow, green and blues in between.

Methods

Step 1: Sourcing of raw materials. Ball clay required for the formulation of slip glaze was sourced in Ibule-soro, few kilometers away from the Federal University of Technology, Akure campus. The clay sample collected was processed through levigation. The refined clay was drained, dried and kept. Other materials such as iron oxide and feldspar were purchased. Ijero Ekiti Feldspar was purchased in powdered form and was further pulverized using the ballmill. While all ready processed iron oxide from Ifan was purchased in the local market.

Step 2: Producing ceramic test pieces. A total of 50 tiles were produced and labelled for the slip glaze sampling test. The tiles were shaped using the slab method.

Step 3: Preparing of slip samples that will melt at 1170^{o}C Tri-axial blend sampling method was adopted. In order to achieve this, three different materials were put together in different ratios in order to determine the eutectic point of melt. This process is referred to as Ternary or Tri-axial blending technique. It involved Ibule-soro clay, Ijero feldspar and Ifon iron oxide. 36 blends of slip glaze samples were composed. A digital scale was used to weigh each material sample in accordance to the percentage allocated in the blend of the different materials. The slip samples were applied as coat on the prepared labelled test tiles. Table 1. The tri-axial blend of slip glaze materials.

Table 1: Percentage composition of materials for tri-axial blend

S/N	Slip glaze samples (%)		
	Ball-clay	Feldspar	Iron oxide
1	80	10	10
2	70	20	10
3	70	10	20
4	60	30	10
5	60	20	20
6	60	10	30
7	50	40	10
8	50	30	20
9	50	20	30
10	50	10	40
11	40	50	10
12	40	40	20
13	40	30	30
14	40	20	40
15	40	10	50
16	30	60	10
17	30	50	20
18	30	40	30
19	30	30	40
20	30	20	50
21	30	10	60
22	20	70	10
23	20	60	20
24	20	50	30
25	20	40	40
26	20	30	50
27	20	20	60
28	20	10	70
29	10	80	10
30	10	70	20
31	10	60	30
32	10	50	40
33	10	40	50
34	10	30	60
35	10	20	70
36	10	10	80

Figure 1. Slip glaze samples on tiles

Step 4: Heat treatment on test tiles. The samples were loaded in a test kiln and subjected to heat treatment in order to examine the behavior of the slip on the body of the ware. See Figure 2 below

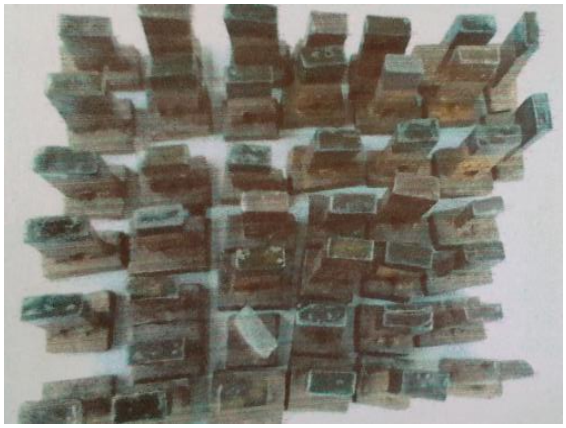

Figure 2. Samples of tiles after heat treatment

RESULTS AND DISCUSSION

The findings of this study are presented according to the different stages of experimentation. Table 2 below shows the assessment of slip glaze samples produced using blends of Ibule-soro clay, Ijero feldepar and Ifan iron oxide fired at 1170^{o}C. The slip glaze compositions were made in percentage ratio such that total weight of each composition would be equal to 100grams. The three materials in each blend was measured in grams.

Kiln Used: Electric

Measuring instrument: Thermocouple

Date: 16th July, 2025

Table 2: Result of slip glaze samples after heat treatment at 1170^{o}C

S/N	Slip glaze samples (g)			Observation
	Ball-clay	Feldspar	Iron oxide	
1	80	10	10	Matt
2	70	20	10	Matt
3	70	10	20	Fused slightly
4	60	30	10	Mattt
5	60	20	20	Fused slightly
6	60	10	30	Fused slightly
7	50	40	10	Matt
8	50	30	20	Fused
9	50	20	30	Fused Smoothly

10	50	10	40	Fused Smoothly
11	40	50	10	Fused Smoothly
12	40	40	20	Matt
13	40	30	30	Matt
14	40	20	40	Matt
15	40	10	50	Crazed
16	30	60	10	Matt
17	30	50	20	Matt
18	30	40	30	Matt
19	30	30	40	Matt
20	30	20	50	Matt
21	30	10	60	Fused Smoothly
22	20	70	10	Matt
23	20	60	20	Matt
24	20	50	30	Fused Smoothly
25	20	40	40	Slightly Melted
26	20	30	50	Matt
27	20	20	60	Fused Smoothly
28	20	10	70	Fused Smoothly
29	10	80	10	Fused Smoothly
30	10	70	20	Matt
31	10	60	30	Fused Smoothly
32	10	50	40	Fused Smoothly
33	10	40	50	Fused Smoothly
34	10	30	60	Fused Smoothly
35	10	20	70	Fused Smoothly
36	10	10	80	Matt

Source: Author's research, 2025

Based on the result recorded from the test samples fired at 1170^{o}C, the appreciable samples were selected and considered for firing at 1180^{o}C in possibility of obtaining glassy coating of slip glaze on pottery. The samples subjected to retrial were 9, 10, 11, 21, 24, 25, 27, 28, 29, 31, 32, 33, 34 and 35. See below the behavior of slip glaze on the test tiles fired at 1180^{o}C

Table 3: Assessment of slip glaze samples fired at 1180^{o}C

S/N	Slip glaze samples (g)			Observation
	Ball-clay	Feldspar	Iron oxide	
9	50	20	30	Fused Smoothly
10	50	10	40	Fused Smoothly
11	40	50	10	Fused Smoothly
21	30	10	60	Glossy Partially
24	20	50	30	Glossy
25	20	40	40	Glossy
27	20	20	60	Glossy Partially
28	20	10	70	Glossy Partially
29	10	80	10	Fused smoothly
31	10	60	30	Fused smoothly
32	10	50	40	Fused smoothly
33	10	40	50	Fused smoothly
34	10	30	60	Fused smoothly
35	10	20	70	Fused smoothly

Source: Author's research, 2025

From the above table, it shows clearly that the mixture of Ibule-Soro clay, felsapar and iron oxide could be used as slip glaze ingredients for the coating of ceramic wares. Samples 9, 10, and 11 fused smoothly. This indicated that the mixture of of Ibule-Soro clay at at 5%-4% needed to be fired at higher temperature in order to obtain a glossy finish. The addition of more flux can help to lower the melting temperature of the three samples. This implies that Ibule-Soro clay needs more than 60% of feldspar and iron oxide to produce a glossy slip ware. The following test samples 21, 27 and 28 came out partially glossy. While samples 29, 31, 32, 33 and 35 fused smoothly to the tiles. This surface finish can be used for the embellishment of decorative wares that do not required glossy surface finishing. Sample 24 and 25 came out beautiful, glossy with little patches of greenish colour on its surfaces. This indicated that the Ibule-Soro clay would require 80% of the mixture of feldspar and iron oxide to produce slip glaze of glossy finish at 1180^{o}C.

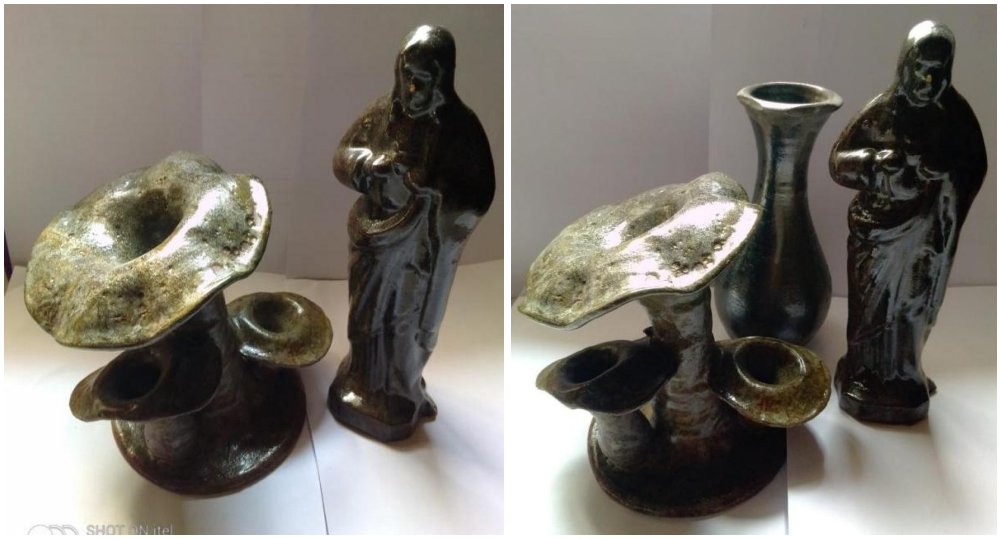

Figure 3. Products coated with the glossy samples

CONCLUSION

This investigation has unveiled the potential of Ibule-Soro clay for the production of slip glaze within the mid-temperature range. The end results from the firing conducted using electric kiln shows that 20% of Ibule-Soro clay would require 40%-50% of feldspar and 30%-40% of iron oxide to produce good melt at1180^{o}C. The glazes produced were suitable for the decoration of decorative wares.

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