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Low Fired Glazes Composed from Auchi Feldspar, Edo State, Nigeria

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ABSTRACT

Glaze is a vitreous substance fused on the surface of pottery to form an impervious decorative coating. Glaze can be compounded from various earthen materials in which feldspar is one of them. These feldspars were sourced from four major towns namely: Okpella, Iviukhwe, Weppa and Agenebode in Auchi, Edo State. However, the methodology adopted for this study is the field participatory investigation and studio experimentation in the identification and composition of low fired glazes. Also, the over dependence on foreign glaze types, high cost and high exchange rate among other factors militates against glaze usage in Nigeria. This study therefore seeks to put into focus in this chapter, the importance of this work. Findings revealed that feldspartic materials are available and suitable for the composition of low temperature glazes locally.

Introduction

The peoples of Africa, uniquely, are very rich in culture. The art of making pottery is as old as mankind. It has always been very much a part of the people's life, manifested in every aspect of their work, play and belief world. Many potters developed the art of pottery in terms of firing their wares into low firing employing several techniques of pot making among which includes pinching, coiling, humping, throwing and mould casting. Their products are used as storage of articles or vessels for carrying goods with little attention paid to glazing (Yusuff, 2018). An understanding of the concept of glaze which is however, described as the fusing of a thin glass-like coating on the body of a ceramic ware, normally, a glaze is viewed as a transparent highly glossy surface which indicates complete fusion of the glaze ingredients (Rhodes, 1998). Glazes are vitreous or glassy coatings, fixed on to the surface of ceramic wares (Otimeyin, 2015). Glaze, like clays are classified into categories according to their firing ranges, some of which are low fire glazes, medium-fire, stone ware glazes and porcelain glaze (Gregory 1995). There are different types of glaze which includes Salt glazes, Raku glazes, Ash glazes etcetera

The place of glaze in pottery making however, cannot be over emphasized because glazes give ceramic works good finishing. Pottery pieces produced by potters then, were often limited to low firing (bisque), few were exposed to glazing (Bryant, 2001). Fawet (1991) glaze actually took its shape during the industrial revolution of 17th century because there were ceramic industries that had well finished ceramic wares from well composed clay bodies and glazes that reflected the quality of ceramic articles in clear terms. Most of the commonly used glaze materials are derived from common feldspartic rocks and minerals, the three basic ingredients used in composing base glaze are feldspar, flint and clay. These glaze materials do not deteriorate either in the raw state or when mixed with water into slip. In other words, glazes or glaze materials can be kept indefinitely where immediate use is not required (Alasa, 2005).

The earliest ceramic wares were made entirely from natural clay, which consist of two main groups of minerals called kaolinites and fine clay (Worral 1975). These materials are noted for the different classifications of glazes by many scholars under raw glazes, lead glazes, leadless glazes, fritted glazes, slip glazes and soft glazes. However, low fired glazes, are glazes that contain barium, ranging in percents to 15% by weight, it helps to lower the temperature of the silica content in the glazes materials during firing (Irabor, 1996). Even at that, many ceramists particularly in Nigeria depended on the imported glazes for their works. This development has almost completely crushed down local innovation and formulation of glazes. In view of this, this work attempts compounding glazes and in this case low fired glazes composed from Auchi feldspar, comprising samples of Okpella, Iriukhwe, Weppa and Agenebode sites in Edo state, Nigeria.

Statement of the Problem

The importance of glazes on earthen ware body is so obvious, especially in a society like Nigeria where traditional pottery wares are finished in low firing, the problem is heightened by non-availability of glazes recipes in the country which encourage reliance on imported glazes of importance is also the problem of limited study on material prospect and production. Though, there is evidence of works done on Auchi feldspar in ceramic, none however has been configured as a low temperature firing glazes.

This impedes the growth and interest of ceramic practitioners. It also increases the cost of running some vibrant ceramic cottages in Nigeria. The idea of just stopping ceramic works at bisque level should be discouraged. Most ceramic practitioners lack the knowledge of where and how most of these materials are gotten from. This is an eye opener that feldspar is in abundance in Auchi since it is a major ingredient of glazes composition and it can be sourced locally

Literature Review

Glazes like clays are classified into three categories, according to their firing ranges. They are low fired glazes, medium-fire stone ware glazes, high fire stone ware and porcelain glaze. An understanding of the concept of glazes is however, of paramount importance in discussing glaze. These are already existing and considerable literatures on glazes generally. As such, it is apt to examine established literature on glazes and related materials.

Yusuff, (2003) poise that the place of glaze in pottery making, however, cannot be over emphasized because glaze gives the ceramic work a good finishing. The earliest ceramics wares were made entirely from natural clay, which consists of three main groups of minerals called kaolinite, montmorillonite and illite.

Lissaman (1975) in his study examines the nitty-gritty of ceramics. The work discussed ceramic materials and their usage. It also examines glazes decorations, ranging from majolica to scraffito. Speight and Toki (2004) observed that many variables are responsible for the failure of some recipes. They list them to include; glaze preparation, what has been fired before in the Kiln, bisque body types, fuel of the kiln, stacking of ware. These variables may have adverse effect on the glaze type. Gregory (1995) further discussed the different types kilns, fuel, materials and principles use for successful firing. Workings, drawing of many types of kilns are included and some new experimental kilns are illustrated.

Singer and Singer (1963) define glaze as the shining and usually transparent layer covering ceramic ware. They observed that glaze renders ceramic works impervious, mechanically stronger making it more inert and pleasing to the eyes. Kalilu, Akintonde and Ayodele (2006) observed the difference between ceramics and poetry. The study noted that, poetry is more related to material, product and process while ceramics is basically centered on material; though they are sometimes used synonymously. Poetry wares are useful for utilitarian, ritual and ceremonial purposes while ceramics are useful as household and industries. Ceramics is more durable than poetry, because the product is usually coated with glaze (silicon based glassy substance) and subjected to a relatively high temperature compare to poetry.

Alasa (2005) asserts that glaze material either in the raw state or when mixed with water into glaze, in other words, glazes/glaze materials can be kept indefinitely where immediate use is required. Wikipedia (2009) the industrial revolution of modern Europe in the 17th century, also known as machine age brought among other things, house hold ceramic objects with production and prospecting of glaze wares. The period actually marked that ceramic industries had well finished products and well composed clay bodies and glazes that reflected the quality of ceramic articles in clear terms.

Rhodes (1998) discusses the fundamentals of clay; its origin, chemical and physical nature, types, preparation, drying, firing and practical information of formulating, blending, colour adjustment, textures and glaze recipes. In a study, (Areo,2005) Identify the different classifications of glazes by many scholars under material compositions, properties and melting temperature. The study highlights these glazes and classified them under raw glaze, lead glaze, and leadless glaze, fritted glazes, slip glazes and salt glazes.

Irabor (1996) however, observes that low fired glaze are glazes that contains barium in the amount ranging from several percent to cover 15% by weight because it helps to lower the temperature of the silica content in the glaze materials during firing. Frank and Hammer (1991) observes that low fired glaze makes use of soft fluxes lead oxide, boric oxide, soda and potash. They stressed that with the exception of raw lead glaze is necessary to employ frits in low temperature glaze because the fluxing oxides are soluble in water.

Oyeoku (1998) based his own discussion on the tradition of pottery production dating back to some seven to eight thousand years. His discussion includes the development of pottery; its changing ideas based on the original techniques of ancient times (coil, pinch and mould) he identified the modernization that introduce kilns and grassroots workshops to the local potters. Wikipedia (2008) describes forming techniques as ways of making ceramics wares. The forming techniques described include slip casting and ceramic shell casting. Cardew (1969) in pioneer pottery stressed the making and production of pot forms and decorations by local potters has been on before, his encounter with the potter's wheel, kiln and glaze.

Survey of Feidspar sites in Auchi, Edo State

Clay	Location	Quantity	Uses	Market
Feldspar	Okpella	1.0 million tons	Plastics, Paper, Tyres, paints, Water Treatment, Fertilizers, Steel Fillers in tyres, Glass, Cement etc	Local and export
Feldspar	Iviukhwe	100 million tons	As above	As above
Feldspar	Weppa	Large quantity	As above	As above

Feldspar	Agenebode	Large quantity	As above	As above
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Source: (1st Nigeria Local Government Trade and Transition Fair 1992)

The above table shows the immense availability in the listed localities in Auchi, Edo State. The feldspar found in these localities is very good in quality and in quantity for ceramics and other utilitarian purposes.

Feldspar is used in almost all glazes, both low fire and high fire, it is often the principal flux; it is made up of an alkaline-portion (sodium, potassium, calcium and lithium).

Methodology

The methodology adopted for the study is bibliographical, field participatory investigation and studio experimentation. The bibliographical approach is done through consultation of relevant literature established on glazes generally, glaze composition, elemental contents of glaze recipes and silica contents of feldspar, particularly in books, journals, letters, magazines, periodicals, e-books and internet. The field work is a participatory investigation in which the fieldpartic rocks were located in the suburb parts of Auchi; Okpella, Iriukhwe, Weppa and Agenebode were the four sites. The studio experimentation is the process of using the studio to actualizing a finished product.

The researchers empirically identify, source and process the mineral resources with the two (2) assistant (staff) from the Edo state ministry of mines. The excavation requires hammer, digger, shovel, head pans, ball milling-machine to pulverize the mineral resources into fine particles. There after the samples were bagged in transparent polythene and brought to the studio for experimentation. Also, added are other fluxing and binding agents like barium carbonate, flint, kaolin, ball-clay, whiting, sodium carbonate, sodium bicarbonate and zirconium all bagged in a transparent polythene bags

Auchi Glaze Recipe Composition

The glaze formulation and composition was conducted in experimental manner. The experiment was basically empirical. Glaze recipe of Okpella, Iviukhwe, Weppa and Agenebode and other locally sourced oxides supported with imported materials that cannot be sourced locally were used. The analysis of the glaze composition and the firing processes and behavior were discussed in this section. These glazing agents were composed in batches, weighed in ratios. The studio experimentation involves preparation of the feldspartic dust with other glaze ingredients into batches. These batches of glazes were then compounded in their ratios.

Sample of Glaze Recipe Using Okpella Feldspar

Ingredient	Percentage composition
Okpella Feldspar	50%
Auchi Ball clay	10%
Auchi Flint	5%
Sodium carbonate	20%
Barium carbonate	15%
Total	100%

Okpella feldspar: 50, Auchi ball clay: 10, Auchi flint : 5, Sodium carbonate : 20 and Barium carbonate: 15

Sample of Glaze Recipe Using Iviukhwe Feldspar

Ingredient	Percentage composition
Iviukhwe feldspar	50%
Auchi Ball Clay	5%
Auchi Kaolin	5%
Barium carbonate	25%
Sodium carbonate	15%
Total	100%

Iviukhwe feldspar: 50, Auchi ball clay: 5, Auchi Kaolin: 5 and Barium carbonate: 25 and sodium carbonate: 15

Sample of Glaze Recipe Using Weppa Feldspar in Ratios

Ingredient	Percentage composition
Weppa feldspar	50%
Sodium carbonate	10%
Auchi Ball clay	10%
Auchi whiting	10%
Barium carbonate	20%
Total	100%

Weppa feldspar: 50, Sodium carbonate: 10, Auchi ball clay: 10, Auchi whiting: 10 and Barium:20

Sample of Glaze Recipe Using Agenebode Feldspar

Ingredient	Percentage composition
Agenebode feldspar	50%
Auchi Ball Clay	10%
Auchi Flint	10%
Sodium carbonate	10%
Zirconium	20%
Total	100%

Agenebode feldspar: 50, Auchi ball clay: 10, Auchi flint: 10, Sodium carbonate: 10 and Zirconium: 20

The samples of these batches were composed and milled using a ball milling machine in their percentages and then applied on bisque wares as compounded glazes and ceramic stains were added for colouration. The wares were loaded into a gas kiln and pyrometric cone 6 was used to measure and determine the maturity stages during firing and results determined.

Result

Sample of Okpella glaze recipe shows that the ratios of the fluxing agents, Sodium carbonate and Barium carbonate lowers the fusion point. The presence of ball clay, flint and whiting gives the alumina properties; glassy tendencies, vitrification, fusion, brightness, hardness which adheres to the body of the ceramic ware. The Okpella feldspar has high potassium content. Potassium by nature is an active flux; it is often used in clay bodies only where it has been used primarily as a deflocculant. It is at the lower temperature that potassium is most useful in the making of lead-free glaze, assisted by borax.

Sample of Iviukhwe glaze recipe shows that it is rich in Sodium as identify through the body of the glazed ware. The high presence of Sodium in the feldspar helped the viscosity of the recipe which did not run off the ware during firing. The feldspar is also good for earthen ware bodies and other clay body composition that requires high viscosity when properly mixed with other earthen minerals. It could help to achieve a specific type of clay for a particular purpose in ceramics, for example colour, texture, durability, strength, plasticity and temperature.

Sample of Weppa glaze recipe shows that it is crystalline in nature, the wares are translucent after firing, it has high silica content and would be good in the composition of transparent glaze.

Sample of Agenebode glaze recipe shows that the feldspartic content is very low as it requires a binder to be able to fuse on the body of a ceramic ware. The binder which is Auchi ball clay and Auchi flint helps in the composition which indicates that Agenebode feldspar among the other feldspars is the most preferable for the composition of low fired glazes.

Observation and Findings

All glazes composed from Auchi feldspar were fired in the gas kiln, which to some extent provided the same opportunity for the glaze recipes to mature. Okpella feldspar and Agenebode feldspar both matured at the same firing temperature of 900c while Weppa feldspar and Iviukhwe feldspar matured at a temperature of 950c respectfully. The maturing temperatures of all the glazes recipes are low fired.

The four feldspar type had a single home Auchi in Edo State, which can also be used to compose high fired glazes and porcelain. It is a mineral constituent that can be used for other ceramic purposes.

The Okpella and Agenebode feldspar are rich in potassium while Weppa and Iviukhwe feldspar are also rich in sodium.

The production of the low fired glaze will help the studio potter to have a good knowledge, workability and behavior of this particular glaze recipe. Are composed and used. This will reduce habit of just firing bisque of ceramic ware.

It will help the studio potter and students to know glaze and where the materials can be sourced locally in Auchi, Edo state.

This glaze batches in the four sites will also make fired piece impervious to liquid by making it durable, water tight surface and also give visual effect with the addition of stains (ceramic colouration).

It will also help in the area of youth empowerment and give room to hundreds of thousands of people in the area of employment.

It may help to resuscitate some small scale; private owned pottery studios in the country that have previously operated below their initial capacity or closed down, it will also encourage the use of low fired glaze in academic studio among ceramist and students of ceramic. It will encourage educational visit and may help in the establishment of an economically viable ceramic cottage industry.

Conclusively, Auchi is a home for other mineral resources, the large deposit of feldspar can encourage development if properly harnessed and managed to attract investors within and outside the shores of Nigeria.

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