UTILIZATION OF WILD RICE PLANT ASH FOR THE PRODUCTION OF CERAMIC GLAZE

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Abstract
Trial on wild rice ash to determine the possibility of producing ceramic glaze was carried out. A large bunch of fresh wild rice straw was collected and two sample glazes were made. One glaze type had its wild rice pretreated by soaking in water for two months before burning to ash while the second one was not pretreated. The two sample glazes were mixed with 5% bentonite clay and applied on bisque fired wares. The glazed wares were fired in a kerosene kiln to a temperature of 1120°C successfully.

Introduction
Nelson (1984) said that ash glazes were the first glazes used in ceramic production. This began from 1500 BC during Shang Dynasty in China. Since then ash glazes have continued to be the immediate ceramic glaze source material when other materials are not easily come by. Although, ash glazes do not presently have commercial application but they are of interest to studio potters.

Usually the ashes that are useful to ceramics are from trees, grasses and bones where the incombustible residue is composed of inorganic substances, mainly metals oxides and silica which they have taken up from the soil during their life time. The different parts of a plant will use or store certain group of minerals. Grass stems obtain most of their initial strength from silica, therefore making the ash refractory, (Fornier 1978). Some other ways by which ash can behave differently is possibly through the type of soil the plant grew from and period of time taken before the plant is cut for use. Kato (1962) in Cardew (1973) gave full analysis of chemical elements found in plant ashes internationally as shown in Table 1.

Not every part of the country abounds in great quantity of natural ceramics raw materials. Gashua, being part of Sahel Savanna is void of such; the only ceramic raw material found is bentonite clay (Alasa 2005). There is therefore the need to explore materials within the environment.

Wild rice is found during raining season in Yobe state. It is physically the same structure with domestic rice grown for food. It can easily be mistaken for rice where they grow together in the field but the seed is not commonly edible. It is a water plant that grows around the bank extension of River Yobe as well as any water logged place in the bush. It may not die on time when cut and soaked in water. Overtime the color changed from green to yellow and finally yellowish grey or ash color. At this stage, the chlorophyll in the plant has dissolved in water.

Although, the chemical component of wild rice may vary from one environment to

another due to the type of soil which may cause it to react differently (Fornier, 1978). Comparing the chemical analysis and mineralogical composition of wild rice ash in Column 5 of figure 1 and rice husk ash as displayed by Opoku and Garkida (2012) in table 2, it is found out that they are similar in composition of oxides present and molecular percentages.

Trial on wild rice ash to determine the possibility of getting glass former was carried out. The trial and error method is usually characterized by guesswork and vigor with various uncertainties (Adelabu, Ologunwa and Akinbogun 2012). However series of plant ashes have been tested. The colour ranges from dark blue to light ash colour especially the ash of wild rice shafts. The research went further to explore the possibility of producing ceramic glaze from the wild rice straw ash.

Methodology

Ebeigbe (2011) said that "cut and dry" method involves a random experimentation with glaze materials; this trial and error method is usually characterized by guesswork and vigor with various uncertainties (Adelabu, Ologunwa and Akinbogun 2013). It is a simple method commonly used by potters. This is the method employed in an effort to separate the colorant from the glass former. The glass- former is transparent, colorless and allows light to pass through the film. A large bunch of fresh wild rice straw (Figure 1) was collected and divided into two as sample A and B respectively.

Sample A was soaked in a plastic bucket of water for two months. Overtime, the color of the material changed gradually from green to yellow and from yellow to grey color. It was removed from the water and sun dried for one week. It was burnt to carbonized ash, calcined and washed in water. Sample B was just burnt to carbonized ash, calcined and washed in water. The samples were individually mixed with 5% bentonite clay and applied on bisque fired wares. The glazed wares were fired in a kerosene kiln to a temperature of 1120°C.

Results and Discussion

The products of sample A turned glassy, colorless and transparent (Figure 2) while the products of sample B also turned glassy but dark bluish in colour (Figure 3). Sample A can be a good glass former that can be added with colorant to produce a determined colour of ceramic wares. Sample B will still need some addition of oxide to produce a bright colour. This is quite cheaper as it is much available at the locality for use.

Conclusion

It is evident that wild rice can be employed in the production of ceramic glazes. The glazes made fused at a relatively low temperature thereby making them economically useful for commercial ceramics production.



Figure 1: Wild Rice



Figure 2: Glazed ware from sample A



Figure 3: Glazed ware from sample B

Table 1: Chemical Analysis of some Plant Ashes

Oxide	Column 1	Column 2	Column 3	Column 4	Column 5	Column 6
SiO_2	51.51	89.74	66.2	86.4	82.18	76.96
Al_2O_3	3.81	1.26			1.36	5.42
Fe_2O_3	4.53			0.4	0.42	1.06
P_2O_5	2.06	0.39	5.4		0.68	1.58
CaO	9.49	1.88	6.1	0.3	3.69	6.14
MgO	4.39	1.03	2.5		1.35	3.67
Na_2O	10.98	4.08	2.8		0.36	0.22
K_2O	9.49	1.20	11.5	4.8	2.48	2.55
SO_2			2.8		0.38	0.15
S			3.8			
TIO_2						0.22
MnO						0.67
Loss on ignition				8.1	6.20	1.40
Total	96.28	99.58	101.1	100.0	99.10	100.04

Source: kato (1962) in Cardew 1974; Pioneer Pottery. Longman Group Ltd. London

Colum 1 White Mahogany (Forestry Commission of New South Wales 1956)
Colum 2 Australian Turpentine (Forestry Commission of North South Wales 1956)
Colum 3. Wheat Straw, air dried (BC5 1959 sap)
Colum 4. Bamboo Sugar Java (Baurri 1st English Education 1901)
Colum 5. Rice straw ash Ware Bai (E Kato Interceram2 (1962) 110)
Colum 6. Thatching grass Abuja Nigeria Washed and calcined at 900°C (Overseas Geological Survey London1966)

Table 2: XRF analysis of Rice Husk Ash

Oxide	Mass %
SiO_2	80.85
Fe_2O_3	0.14
TiO_2	0.15
CaO	1.07
P_2O_3	1.37
K_2O	0.28
RuO_2	0.33
MnO	4.62
LO.I	12.5

Source: Opoku and Garkida (2012).

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