

TECNIQUES OF CLAY BODY PREPARATION AND CLAY BODY FORMULATION

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Abstract

The techniques of clay body preparation, and clay body formulations is important to note. The impact of prepared clay is key to the success of every pottery production. The techniques and method of clay body preparation and formulation should determined what to produce with the clay. Some potters and ceramics students in this present century produce pottery wares without considering the method, reasons and techniques used to prepare the raw material (clay). This paper define clay and classified clay into various groups and discusses basically the three methods of clay body preparation. It pointed out the advantages and disadvantages of the methods of clay bodies preparation. The paper also pointed out the kinds of clay and their uses, which include china clay, ball clay, earthenware clay etc. It further explains the process of clay body formulation and the functions of each body formulated.

Keywords; techniques formulation, preparation, earthenware

Introduction

Clay can be easily fund unprepared, the prepared and formulated clay bodies are manmade. They are formed from the blending together of different clay bodies or from the mixture of clay and other materials, such as bentonite, kaolin, grog and so on. Dickerson (2005) in his view maintain

that it will be difficult to separate man from the act of pottery production and believes that pottery production is one of the richest means of man's expression of artistic ideas. Pius (2006) defines clay as a natural materials found on earth's crust or rock characterized by plasticity when appropriate amount of water is added. Clay is therefore an earthy raw material known for its sticky-plastic nature. It is formed as a result of the alteration and breakdown of the parent's igneous rocks.

The existence of pottery depends largely on the widespread group of this earthly substance known as clay. The propriety of plasticity which is clays power to stick remains its greatest asset. This enables the clay to be reading kneaded and mounded while moist or wet into any desired shape. When clay is mixed with sufficient water, a mass which exhibits typical plastic flow is formed, meaning that clay has a yielded stress and a measurable mobility. Clays that are found on or beneath the earth surface are so varied in composition and properties that they need to be well studied before use.

The molecular structure and plastic quality together with other unique physical properties, makes it possible for clay to be desirably shaped especially when subject to sufficient pressure or altered by fire, it changes into a hard rocky material that makes it both functional and durable. According to Umoh (2022), clay is one of the oldest of all craft media and dates back to prehistoric time. It may be defined as the earthy mineral substance composed mainly of hydro-silicate of alumina which is plastic when it is in the wet state, hard when dry and rock-like when fired.

Clay is plentiful and found all over the world and is composed of alumina, silica and water. Approximately, clay has 60% silica, 34.5% alumina and 10% water. This formula can be broken down in the following way: one mole of alumina, two of silicon and two of chemically combined water. Awani (2010) state that clay is a basic raw material for ceramics production. It is an elementary rock which has been detracted and is made up of mainly clay substance, minerals, salt and impurities. However, clay is a type of soil, a mineral substance made up of silica and alumina which is plastic when it is in the wet state, hard when dry and rock-like when fired.

Clay can be classified into various type and they can be further classified according to their colours or geological origin; they are generally classified into two groups namely:

1. Primary or Residual clay
2. Secondary or transported clay

Residual clay these are those clays that are found their parent rocks, from where they are formed. They have not been moved from one location to another by force of nature such as wind, rain, extra and are naturally free from contamination and are generally more pure than transported or secondary clay.

Primary clay are relatively non-plastic when compared to secondary clay due to little or no fine grinding of clay particles which secondary clay experience during transportation from one location to another.

Secondary clays are clays which have been transported about 1000 years ago by wind, rain and so on. From its parent rock to another location. During its transportation, it carries wanted particles which form its plasticity; secondary clays are made up of clays from various sources; sediments from numerous sites get mixed up together with the presence of water and organic materials which ferment and help to form plasticity in the clay. Basically, any clay be used for pottery production must contain the basic properties of clay, which include plasticity, porosity and shrinkage.

Plasticity: Umoh (2022) it can be briefly defined as the property of stress under pressure without cracking and still retaining the new shape given to it after the pressure has been removed through drying and firing. Among natural materials, clay in the degree of its plasticity and it is this property which has made possible the building of various interesting pottery objects. Coarse grained clay are not as plastic as fine grained ones. They are said to be short which means it cannot stand much deformation or pressure without cracking. The clay may breakage. Umoh (2022) any clay that shrinks up to 20% or 2cm should be opened with fillers such as grog shreds, chamotte and so on to reduce the shrinkage rate to about 1cm to 1.5cm or 10% to 15% before use.

Water of plasticity: This is the amount of water that renders a clay lump workable or plastic and can be determined by subtracting the weight of bone dry lump from its weight at plastic state.

Weight of plastic body	25kg
Weight of bone dry	19kg
Weight of water of plasticity	$25 - 19\text{kg}$
Weight of water	6kg
Weight of clay	19kg

Factors that Promote Plasticity in Clay

- Fine grains of silica and shape of individual particle
- The amount of water surrounding individual particles
- The chemical bond around the particle of the clay
- The carbonaceous matter in the clay
- Ageing and ageing period
- Addition of well-aged clay to freshly prepared clay
- Bacteria acting to released colloidal gel during fermentation

Shrinkages in Clays: Umoh (2022) shrinkage of any clay simply means the lessening or reduction of the clay in length or volume during both drying and firing. Shrinkage is highly important characteristics in any clay in that clay that shrinks too much is bound to warp and break of th cause of drying and firing (Umoh, 2022).

There are two types of water in clay namely, the water that makes the clay workable or plastic known as the water of plasticity and the combined with alumina and silica to form pure clay, known as the chemically combined water or chemical water.

Dry Shrinkage: This is caused by the evaporation of water of plasticity from between the particle of clay. This varies with the fineness of the particle sizes and the dry shrinkage is measured at bone dry state before firing. The maximum shrinkage of any useful clay should not exceed 2cm or 20% and if found abnormal can be checked or reduced by the addition of silica (sand) or grog (Pius, 2006).

Fired Shrinkage: This occurs inside the kiln when the chemical combined water leaves the clay as a result of heat and its' measured at the end of firing.

Porosity: Pius (2006) the porosity of clay controls the water migration during drying and can be improved by the addition of sand, grog or any other filler. Fine grain clays have low porosity and high plasticity e.g. detonate. Large quartz grain clays on the other hand have high porosity and low plasticity e.g. Kaoline. The degree of porosity or water absorption shows the extent of maturity or verification of a fired body, thus the higher the firing range the denser the body and vitreous; therefore its absorption rate nears zero.

Clay body Preparation

Basically, there are three methods of clay preparation:

1. By soaking and marching
2. By soaking and sieving
3. By grounding and sieving

Marching: This is an ancient and traditional method of clay preparation. Clay is soaked in a container of water for days, weeks or months and gathered on the floor and marched with bear foot to mix the clay and remove unwanted particles after which they knead the clay for use.

Soaking and Sieving: This is the best method of clay preparation, clay is soaked in a container or bucket of water as long as possible. soaking of clay helps the clay and water to mix together and sieved to extract or remove unwanted particles from the clay, after which it is being fried in a dryer or an open cemented grand. This stage is being checked periodically in order not to allow the clay gets back to its bone dry state.

After the drying stage, clay is kneaded and wedged thoroughly to remove air pockets and ready for use. It can still be preserved by putting it in a plastic bucket that has a good cover to preserve the clay.

Grounding and Sieving: This method is different from other methods, thus has to do with drying of clay under the sun and grounding it with a grounding machine or pounding it with mortar and sieve with mesh to

reduce it to a really fine powder form. Water to the clay and mixed it to form wet lump. This lump must be kneaded together to remove air pocket before working with it (Amaechi, 2021).

Advantages of Clay Preparation by Marching

1. Not time consuming
2. Not stressful

Disadvantages of Clay Preparation by Marching

1. It is not good for wheel throwing
2. It is only good for hand building
3. After preparation it will still contain unwanted particles

Advantages of Clay Preparation by Soaking and Sieving

1. It can be used for any method of pottery product
2. It will give a good texture

Disadvantage of Clay Preparation by Soaking and Sieving

1. it is time consuming
2. It is stressful

Advantages of Clay Preparation by Grounding and Sieving

1. It is not time consuming

Disadvantages of Clay Preparation by Grounding and Sieving

1. It is less plastic
2. It can shatter in the kiln during firing
3. Its rate of shrinkage is high
4. It is difficult to control and molding

Types of Clays and their Uses

Pius (2006) there are different kinds of clay resulting from the different geological conditions in clay formation, these types of clay are:

1. China clay or Kaolin
2. Ball clay
3. Earthen ware clay

China Clay or Kaolin: This is the purest kind of clay containing little or no iron oxide as impurity. It is formed by the weathering the feldspar site, which is the parent rock. Kaolin is a very refractory kind of clay which when fired, gives an off-white colour and has a melting point above 1800C. It is therefore, used to increase the refractoriness in other materials.

Ball Clay: They are fine grained, black coloured secondary clays found in strata and known to contain large quantity of organic matters. They are highly plastic and when fired turns of white in colour. Although ball clays are not as pure as Kaolin but are refractory, free from iron oxide and other colouring impurities. Ball clay is used as admixture to increase the plasticity and workability of less plastic clay especially when white body is desired.

Earthenware Clay: These are the most common of clays to be found in nature. They contain high iron oxide with other mineral impurities in the raw state. They vary in colour from pink, red, brown and green to black depending on the location where they are found and when fired, turns pink, red, brown or black depending on the condition of the firing earthenware clays also known as plastic clays are basically used in modeling the throwing due to their high plastic content while the varying colours are required in decorating pottery.

Formulation of Clay Bodies

Pius (2006) clay bodies are preparation mixture of clay and other clay related materials made to meet specific purpose. They are formed from the blending together of different clays or from mixture of clay and order to produce the desired workability, or acceptable result, formulated clay bodies are not found in nature but are the result of man's technology of combining different earthly minerals referred to as modifiers. The formulation process starts with taking measurements of the materials, for instance your clay shrinks more than 1cm, after firing. Formulate a body that will shrink less than 1cm with Kaolin and grog. Soak the clay and 20% grog of the soaked clay, add to the soaked clay and mix it together with the water and sieve to remove unwanted particles from the clay, after which it is being dried in an open air cemented ground for drying process. This process is being checked periodically in order not to allow the clay gets back to its bone dry state.

Clay Bodies

Clay bodies are prepared mixture of clay and other clay related materials made to meet specific purpose. They are formed from the blending together of different clay or from the mixture of clay and other clay related minerals as feldspar, grog flint etc.

In order to produce the desired workability or acceptable result, clay bodies are not found in nature but are the result of man's technology of combining different earthly minerals referred to as body constituents.

1. Clay
2. Fluxes
3. Filler

Clay: Clay are plastic materials needed to provide plasticity in a body composition, for instance:

1. **Ball Clay:** is required to give plastic and improve green strength in clay bod.
2. **China Clay:** May be required when whiteness is needed in body colour and when refractoriness is needed in fired work.
3. **Bentonite Clay:** This is highly plastic clay formed from the weathering of volcanic ash. This is required to introduce plasticity in clay body.
4. **Fire Clay:** As the name implies it is high firing clay meant to give refractoriness and clay surface texture in clay bodies.
5. **Fluxes:** These materials help in encouraging fusion in clay body composition and reduce the melting point of other materials put together.
6. **Fillers:** these are not non-plastic materials added to clay bodies in order to cut down on plasticity and increase the melting point of the body. Example of clay body fillers are:
 - i. **Flint, Quart or Silica:** These are glass formers which serve as hardeness in clay body.
 - ii. **Grog:** These is already fired clay (bisque) grounded into powder form and used to improve body texture and workable.

Conclusion

Every method of clay preparation is suitable to some methods of pottery or ceramic production. Potters should know the method of which clay is

prepared before working with it. When a clay that is prepared for hand build is used for wheel throwing, such work may likely not survive. Clay formulation is the best for any clay that shrinks more and cannot survive firing. Clay bodies should be prepared and formulated based on the method the potter or ceramist is using for production.

Recommendations

1. Potters should know the rate of clay shrinkage before using it
2. Teachers should ensure that student prepare their clay before using.
3. Clays that shrink more is still useful if formulated
4. Potters should know the method used for any clay preparation before working with it.

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