REVISITING CLAY PROCESSING AND DEWATERATING IN A THIRD WORLD SETTING

MORDI, E. K.
Yaba College of Technology, Lagos
emmakemona@yahoo.com

Abstract
Ball clay is an indispensable material to a studio potter. Research shows more than 50% water is needed for it to be converted into slip light enough to pass through mesh 60 or 80. It has also been observed that clay dewatering posses challenge to some studio practitioners. This is due to available methods which yield slow results or lack of funds to purchase relevant equipment e.g. filter press or the needed skill manpower to run them. This study investigates unconventional method of clay dewatering for studio ceramics. It juxtaposes it with some other known locally devised methods vis-à-vis drying time, quantity and cost. It discovers that this method is very cost effective, saves time and yields more workable clay than other methods. The study therefore recommends it as a preferred method of dewatering clay manually.

Introduction
Ball clay is central in studio ceramics because of its plastic nature. Also known as secondary clay, it sometimes comes with impurities such as twigs, gritty materials- gravel, coarse sand, rock fragments, and iron or lime nodules dried leaves and many more foreign bodies, which might have been picked up during its formative stages. These make the raw clay impossible to work with; especially for wheel throwing and could be injurious to the potter's hands if it is not properly sieved.

It is pertinent to note that ball clay requires about 100 -150% water equivalent to its dry weight to effectively disperse its particles before sieving. However, clays meant for throwing requires only 22-25% moisture content. It therefore means that over 90% of the excess water used for processing the clay must be removed before it can be suitable to work with. The research appreciates existing methods for removing excess water from clay. The most effective in terms of speed is filter press. However, this device is beyond the reach of an average local studio potter.

Other methods such as use of earthenware pots half buried in the ground, clay bats, clay bricks, cloth bag and drying clay in a frame have been adopted, but the study notes these methods take a long period to dewater clay into pliable homogenous mass. While Cardew, (1969:84) advices "filtration and evaporation" processes by using "settling pans, pots and trays" as means of dewatering clay, Opoku, (2004:12) suggests "drying clay with cloth and sand". Although both methods are directed at same goal, the approaches are dissimilar to one another in terms of equipment, cost, convenience and rate of dewatering. The goal of this study is to juxtapose both processes with a view to establish which is the most cost effective and yields faster workable clay within a short time frame.

This research becomes necessary because there is dearth of reportage of clay processing in a third world setting. Aside A Potter's Book (1976); Pioneer pottery (1969:80-6) and Industrial Ceramics (1984) by Bernard Leach, Michael Cardew and Singer and Singer respectively and probably few authors not referenced in study, clay processing is rarely found on table of contents of most ceramic books. Writers such as Cooper, E. (2000); Wensley, D. (2002); Peterson and Peterson, (2003); Speight and Toki, (2004), and Warshaw, J. (2005). This is so because,

unlike Nigeria and probably other third world countries, there are organizations that specialize in beneficiation and development as well as sales and supplies of ceramics raw materials.

It is pertinent to note that clay dewatering posses a big challenge to students studying ceramics and studio potters who lack the wherewithal to acquire needed equipment for the process. It is expected that the research findings, which are reported using the quantitative method would add to pedagogy as well as stimulate further studies in this area.

Methods of Clay Preparation: Pounding, Mechanized and Manual Techniques

Fatunsin, (1992:19) avers that ball "clay is not workable in its raw form and has to be processed to render it plastic; all extraneous matters are removed from the clay before it is worked into a pliable homogenous mass". In the same vein, Cardrew, (1967:80) warns that "if his clay is not good, all the potter's skill and knowledge will be in vain". The word "good" here means workable clay. This implies that the clay must go through process of beneficiation, which involves two major stages: watering and dewatering. The study understands that choice of a particular method of clay beneficiation is a function of the type of product intended. The beneficiation process of materials meant for industrial ceramics is not same as that of studio, neither is it same as the traditional potter's earthenware vessels. For the sake of clarification, this study shall explain some of these processes.

Pounding Method

Speaking about traditional potters, Fagg and Picton, (1970:10) say: "The potter first prepares her clay simply by pounding the selected earths with water". This process eliminates lumps breaks down body particles and mixes the clay with water to make it pliable. Fatunsin, (1992:19) explains further:

> Two major methods of clay treatment have been identified (a) the wet method, which involves pounding the raw wet clay and then soaking it in a big pot before further treatment; and (b) the dry method, where the clay is dried pulverized and sieved before further treatment. Generally two different types of clay are mixed together to make a pot, but each one is treated separately before mixing. First, the surface to be used is sprinkled with water, then the clay is kneaded manually on a platform or granite surface and all extraneous matter removed after which the required amounts of the two types of clay are mixed.

This technique of clay processing is suitable for traditional pottery which does not require high temperature firing. The clays are suited for the production methods and products intended as well as open firing systems. On the other hand, a better or more sophisticated approach is required for clays meant to be used for throwing or casting.

Clay Washing (Mechanized)

Cardew, (1969:80) asserts that "There are two main ways of preparing bodies, the dry and the slop with many possible combinations of the two" He further says: "which of these you choose will depend on your materials, on the amount of mechanization you want to provide." Washing can be mechanized or manual techniques. Mechanized methods involve the following procedures (Figures 1-7) as sighted in Walker Ceramics, (2013:7).

Every potter's desire is to dewater his freshly sieved clay within hours. The industrialized approach described by Walker Ceramics offers just that, but requires heavy duty machinery; large facilities which might be sited on acres of land; trained personnel to operate the equipment; and provision of power to run the facilities. The estimated cost of setting this up will be in the neighborhood of sixty to seventy million naira or more. A local potter may not have the capacity to mobilize such funds hence the need for a cheaper alternative.

Clay washing by Hand

Clay must always be in aqueous (slip) state before it subjected to screening. This is irrespective of the technique to be used for sieving. While mechanized method involves use of blunger for clay dispersion in water as seen in figure 2, manual process requires use of wooden implement for mixing clay in a plastic bucket.

Whereas, industrial method makes of use of filter press as seen in fig 6, manual technique as described by Cardew employs "filtration and evaporation" processes. Cardew, (1969:84). However, Cardew cautions:

> Evaporation alone produces a crust of hard or even dry clay on the surface, leaving sloppy mass underneath. If these two are now mixed together, the resulting body will be both lumpy and short-a state from which even prolonged kneading or pugging will not be able to recue it. Filtration alone (even if assisted by pressure) soon reaches its limit, because the plastic clay forms a water proof skin on the filtration surface. If the plasticity and homogeneity of the body are to be properly taken care of, the stiffening process is bound to take considerable time and must be done in two or three stages.

Following this understanding, Cardew recommends: The first stage of thickening slip should be "From the ball-mill or blunger the slip is run into settling pans or large porous pots and left there for some weeks to thicken". In the second stage Cardew advices:

> When the slip has reached a 'sloppy' state, on the borderline between a liquid and a solid…the body is poured out- or rather slopped out- onto shallow trays built of porous bricks or tiles (or onto filter cloths laid on these), and is completely covered over with other porous bricks…. After a few days or weeks (according to the climate) the trays are opened.

Even after a couple of months Cardew describes the clay at this stage as "sticky solid, not yet firm enough for kneading and throwing" but ready for the third stage. For this stage, Cardew submits: "A tray of dry porous bricks or tiles be laid out on a table, and the clay spread over it either as individual lumps or in continuous bea, and again covered with more tiles to protect it from evaporation. If the tiles are dry, this last process will take only a few hours". Dr. Ladi Kwali Pottery Centre, Suleja – founded by Cardew himself in the 1950's uses this technique. The technique is effective, but takes about three to four months under good weather condition to fully dewater clay slip into plastic state.

Methodology

This section of the study reports the improvised method showing the various steps taken to achieve the desired goal. For the sake of convenience it juxtaposes the improvised method with Cardew' in table form. It is pertinent to say that both tests were carried out during the dry season. The research processed and dewatered 200 kilos of ball clay using the two methods simultaneously.

Improvised Method

The first step is to clear surface of a flat ground. Create a bucket by excavating two-three inches top soil. Build shallow fence with the excavated material. Obtain two pieces of new cotton fabric or old bed sheets, large enough to cover excavated area (See Fig 9). Fill the trough with clay slip and cover with the second piece of fabric (See fig 10)

As opposed to filter press, the potter depends on natural forces alone i:e moisture evaporation through heat radiation and earth's suction power of water in the clay. While the first fabric separates clay slip from making contact with the soil, at same, it allows same to absorb moisture from the clay. The cover fabric prevents unwanted flying particles from making contact with the clay: at the same time, it allows moisture evaporation from the slip through capillary action which heat of the sun induces.

Discussion

The two specimens containing equal amount of water but subjected to different dewatering process showed different results. It was observed that the improvised method lost its water content about 4times faster than Cardew's method. This could be attributed to the fact that this method takes advantage of osmosis, since it is situated on the ground: unlike Cardew's method which is in the ground.

The trough has wider surface area which thin' out its content and facilitates quicker suction of moisture into the ground and edges and at the same time allows moisture loss from the top through heat radiation. This is in opposition to Cardew's method which is somewhat enclosed in the ground: therefore has smaller surface area for air or heat of the sun to impact on. In addition, the concrete

walls are easily saturated with water because the surrounding earth is already humid, thus will be difficult to absorb more moisture.

The unconventional clay preparation method which this study proposes is generally pocket-friendly; no dependence on electricity, skilled labourers, automated technology or investing in permanent structures. Unlike Cardew' method, it does not require building permanent specialized facilities such as concrete walled troughs, special terracotta tiles and building semi-permanent drying beds. The proposed method is mobile, can be practiced almost anywhere pottery is practiced at a very minimal cost. This makes it the most pocket friendly method for now.

The method is 100% manual and therefore does not require use of automated technology which depends on electrical power. The non dependence on electricity cuts off power related issues such as irregular power supply and charges. Neither does it require training special personnel to operate clay mixing machines nor equipment maintenance as well as payment of workers monthly salaries.

The dewatering time is much shorter than other methods except filter press. It yields more workable faster than other methods. It can be practiced anywhere and all year round irrespective of weather conditions; except in flooded areas. The drying process would be slower during wet seasons; however, it is believed that drying will continue as long as the adjourning area is not flooded.

Conclusion

The process of dewatering clay industrially could be very expensive in terms of manpower, facilities, and space acquisition. However, the improvised approach as practiced by Cardew and Leach take too long a time to remove 70-80% water content of the slip before the clay can become malleable for use. More so, it requires fabricating implements such as clay tiles, construction of "elaborate' troughs covered with corrugated roofing sheets in order to keep rain and direct sunlight from impacting on the clay slip. Although this method of clay dewatering may be cheaper in comparison with the industrials, it still is beyond the reach of an average studio pottery. More so, it takes too long a time to achieve the desired objective.

The implements used are bulky and fairly expensive to replace when damaged. The clay tiles get saturated easily with water thereby reducing its absorbency power to near zero level and unable to perform the function required of it efficiently and timely. The process of re-drying the clay tiles in the sun takes a long time thereby affecting productivity adversely as the potter has to wait for them (tiles) to dry out before reusing. However the new improved method is not just quicker, it is far more cost effective and requires near zero skills to practice. The fact that the fabrics used for it can be moved anytime, anywhere and easily replaceable makes it the cheapest and most convenient method so far for studio ceramics.

Fig. 1: Raw clay arrives from the quarry and is loaded into a crusher and then conveyed to the storage bins

Fig. 2: Crushed clay is then loaded into a blunger where other raw materials and water are added and mixed until a slurry is formed

Fig. 3: Slurry is pumped out of blunger and passed over powerful magnets which remove metallic elements

Fig. 4: Clay is passed through a sieve to remove oversized particles. It is then pumped into large storage vats called arks for further processing

Fig. 5: Pumps and network of pipes feed the slurry into high pressure filter presses

Fig. 6: The time that the slurry remains in the filter press will vary according to the clay body. The moisture content is reduced to about 22%. The clay is removed from the press in the form of cakes weighing 20-45kg

Fig. 7: the cakes are stored for aging and then fed through a de-airing pug mill which removes any air and homogenizes the clay. The extruded clay is cut into 10kg and 12.5kg and bagged into long life polythene bags

Fig. 8: Mixing clay into slip in a plastic bucket

Fig. 9: Pouring clay slip into the trough

Fig. 10: Half covered clay trough awaiting additional clay slip

Fig. 11: Clay trough filled with slip covered with cotton based spread sheets set and left to dry

Table juxtaposing the two methods

Days	Improvised Method: 10'× 7'.	Cardew's Method 2'× 4' Cement Wall Trough
Day 1	250 litres slip poured into shallow excavated trough and covered with fabric.	250 litres slip poured into clay trough
Day 2	Sedimentation occurs as excess water gathers on top fabric. Decrease in volume of slip.	Sedimentation occurs, excess water gathers on top of slip. Slight reduction in overall volume.
Day 3	Sign of little water seen on top of fabric. Significant reduction in slip volume.	Much water remains on top of the slip. Minimal reduction in volume.
Day 4	No sign of water seen on top of cover fabric. Slip has lost over 50% volume. Slip is sloppy	Excess water is still conspicuous. Slight reduction in overall volume.
Day 5	Slip is stiffer. Can register prints significantly.	Reduction of water level. Clay seems to have sediment a little more.
Day 6&7	Sloppy clay hardens: requires little effort to print on.	Further reduction in water level to about ¾ inch above slip level.
Day 8-10	Cover cloth removed. Edges hard but not dry, enough to knead. Approx 50% harvested.	Specimen has almost lost all surface water. Just becoming soft paste.
Day 11	Remaining clay is harvested for kneading	Still in soft paste consistency
Day 26		Specimen attains stiff mud thickness. Very sticky, cannot be handled directly.
Day 30		Stiffer, shows early signs of surface cracks.

References

Cardew M. (1969) Pioneer Pottery. New York, St. Martin's Press Incorporated.
Chappell James, (1977) The Potter's Complete Book of Clay and Glazes. New York, Watson-Guptil Publication.
Cooper, E. (2000), Ten Thousand Years of Pottery. London: British Museum Press.
Fagg and Picton, (1970) The Potter's Art in Africa. London, Trustees of The British Museum.
Fraser H. (1973) Glazes for the Craft Potter. London, Pitman Publishing.
Hammer, F. (1975) The Potter's Dictionary. New York, Watson- Guptil Publishing.
Kenny, J.B.(1949) The Complete Book of Pottery Making. London, Isaac Pitman and Sons Limited.
Leach, B. (1976) A Potter's Handbook, London, Faber and Faber.
Opoku, E. V. (2004) Recognition and Processing of Clay. Ashakwu Journal of Ceramics.
Peterson and Peterson, (2003) The Craft and Art of Clay. London: Laurence King Publishing.
Singer and Singer, (1984) Industrial Ceramics, London. Chapman and Hall.
Speight and Toki, (2004) Hands in Clay. New York: McGraw-Hill Publishers.
Warshaw, J. (2005) The Pottery Handbook. Devon: D&S Books Ltd.
Wensley, D. (2002) Pottery; the Essential Manual. Kent: Focus Publishing.

Internet Source

Walker Ceramics (2013) Pottery and Ceramics Handbook. **www.walkerceramics.com.au Retrieved 01/09/2015**