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Adeta Alamoyo Algorithmic Wares Firing from Wastes

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Abstract – This study is on wares firing of Ilorin indigenous pottery, precisely those from *Alamoyo* lineage of *Adeta* community. The *Alamoyo's* are noted for open firing of wares, mostly culinary. This firing practice has been mastered for ages, passed on from one generation to another and still contemporaneously operational. Its operation is uniquely uncommon; adopting demolition or construction wastes as kiln and agriculture or horticulture wastes as fuel for firing wares. These wastes includes used concrete stones and used metal roofing sheets; others are sawdust, maize sheaths, locust bean pods, off-cut planks, granulated or crumb wood barks, mated fan, coal ember and joysticks. Wastes adoption as kiln and fuel materials by the *Alamoyo* potters of *Adeta* community is though, a recent phenomenon. The thrust of the study however, is hinged on wastes source and its firing algorithm. Findings revealed wastes accessibility and availability, significantly at no cost, maturation of wares in two hours and less smoke emission. It is therefore, hoped that the study will serve as wastes improvisation template on firing for informal and formal institutions and hopefully provoke further studies on *Adeta Alamoyo* pottery.

Keywords – *Adeta Alamoyo,* wares, wastes, firing and algorithm.

I. INTRODUCTION

Adeta is an ancient settlement of Ilorin[1] Nigeria, geographically bounded by *Gambari* to the north central, *Fate* to the north east, *Gaa-Akanbi* to the south east and Garage to the south south. *Adeta*[2] like Nigeria falls within latitudes 4° and 14° north of the equator and 3° and 14° east of the Green Meridian [1, 2]. Veraciously, *Adeta* is situated in Ilorin south local government with headquarter in *Fufu*; one of the three local government headquarters with the appellation Ilorin in Kwara State [3, 4]. As true Yoruba, the people pride themselves in creative vocations, which include mat weaving, cloth weaving and dying, brass casting and pot making [5]. Apart from being a major gateway connecting suburb of the city to the main land, *Adeta* is one of the prominent centres of pottery in Ilorin; which flourished up till the wake of the twenty first century, but never made the list of pottery centres in the country [6].

Like other traditional vocations, pottery practice in the area is today hampered by contemporary vices like incursion on clay reserves, thirst for imported wares, plastic alternative and quest for white collar job [7, 8]. Luckily the tradition is still kept alive, though low keyed by aged but passionate members of the *Adeta Alamoyo* lineage [6]. *Alamoyo* compound is one of the prominent lineages of *Adeta* community noted for practicing what can be called black culinary dish pottery, finished in open fire; an unconventional form of firing wares in contemporary times. This firing practice among the *Alamoyos'* has been mastered for ages, passed on from generation to generations and still operationally trendy; regardless of modern tendencies, recognizing and identifying the trio of clay (green-ware), kiln, and fuel as fundamentally paramount to a successful firing exercise.

Clay is no doubt a cheap, abundant and deceptively simple substance that is characteristically soft, pliant, plastic and impressionable, adjusting to moulding, pounding, flattening, rolling, pinching, coiling, pressing, throwing, casting, scoring, shredding, piercing, stamping, extruding, cutting and shape into small objects or massive architectural forms, otherwise known as

green-wares in their unfired state [9, 10]. While kiln is the equipment for burning; it is an enclosed chamber systematically heated to completely dehydrate clay wares into ceramics [11, 12]. Fascinatingly, kilns are diversely categorized, both in form and development into structured and unstructured. Structured kiln being the latter, houses the likes of open top updraft, closed top updraft and fire chambers. Apparently, the former is unstructured kiln, conglomerating the likes of open bonfire, open pit firing and mud wall pits [12].

II. Review

Synoptically, fuel is anything that can give requisite heat emission in firing; primo by twig or straw and grass vegetations with advancement in solvents like kerosene, petrol, diesel and gas, and electricity being it latest. Indigenous contributions to wares firing cannot be overestimated, sadly it documentation is still inadequate; though few publications are apparent in the works of Ibegbami [13, 14], Igwilo [15], Ogunsina [16], Ojie [17], Kalilu, Akintode and Ayodele [18], Oyelola [19], Areo and Areo [6] and Akinde [20]. Other apparent firing literature materials are further examined as thus.

Fatunsin [21] observed open air firing and kiln firing as the fundamental approaches to wares burning. It however, stressed pot kiln and circular mud wall kiln as Yoruba main kiln categorization. The book noted vertical and horizontal as the two variations of circular kiln. It put the dimensions of the horizontal kiln at 6cm high, 2m in diameter with several openings at the base ranging between four and six. While that of vertical kiln is put at 28cm wall thickness, 1.3m high, 1.5m diameter and 2m circumference, partitioned at the middle with an opening separating top from bottom. The book concluded with a view that, the firing process is rigorous though; successful firing is subject to good weather and sufficient fuel.

Oyeoku's [22] quest for fuel efficiency, effective chamber and seamless heat utility in firing, brought to fore an experimental construction of up-draught Beehive kiln. The experimentation adopted local material and technique, simulating the beehive technology. Having been tested, the constructed kiln was adjudged successful; considering time vantage and better fuel conservation compared to existing ones. The work is indeed an inspiration for upcoming ceramists and ceramists alike.

Rhodes [23] captures the transformation of plastic clay and argues that, its chemical and physical durability (hardness, rocky and impervious) was subject to firing. It recognizes 100^{o}C as the first firing change in clay. While at 350^{o}C, the chemically combined water in clay is driven off and becomes completely dehydrated at 500^{o}C. Its quart inversion is put at 573^{o}C and putting oxidation at 900^{o}C. Vitrification (hardening, tightening and partial glassification) of clay varies from clay to clays, the book noted. For instance, at 1000^{o}C red clay fires to hardness, while kaolin fires to maturity at 1250^{o}C.

Fournier [24] observed firing as *in situ* and indispensable to pottery/ceramics. It further clarified on the series of heat occurrences during firing; putting evaporation of all free water at 100^{o}C and drying of clay at 200^{o}C. At 300^{o}C absorbed water is driven off, 600^{o}C is noted for carbonization organic content in clay, while at 700^{o}C clay turns ceramic. The book recognized 800^{o}C for expansion, while 900^{o}C, 1000^{o}C, 1100^{o}C and 1200^{o}C are respectively for clay sintering, contraction, carbonites dissociation and cristobalite. It finally put vitrification of primary clays at 1400^{o}C and that of secondary clays at 1300^{o}C; concluding with the fact that wares success is premised on the generated heat during firing.

Aiken [25] observed that crop production has hitherto been quintessential to human civilization. Recent revelations show rise in crop productions, as a result, of human growing population, changing consumption habits and adoption as essential derivative of fuel. Akinde [12] on the other hand, touched on the history and the various kind of kiln firing with emphasis on open firing significantly in September. It noted that wares renditions to permanent finish in ceramics, be it domestic or industrial; ultimately remain within the purview of firing. It further argued that the latter development had tremendous impact on civilization around the world. The study consequently affirmed the novel potentiality and possibility of firing conjecturally in September, regardless of rain preponderant falls.

III. Problem, Conceptualization and Justification

Revered as the above literature materials, it is apparent that none of the scholarly writings, worked on *Adeta Alamoyos'* kiln or fuel ingredients or its recipe algorithm. It is on the latter premise that the study base it investigation; hinging its conception on "necessity mother of invention, fathered by technology." This concept is exemplified in *Adeta Alamoyo* integration and adoption of wastes for firing. Waste is however, any substance that is discarded or rendered worthless, defective and useless after primary use [26, 27]. Its types give rise to the trio of solid, liquid and gaseous wastes, while its sources are typified and encapsulated in municipal solid wastes (MSW) and environmental impact wastes (EIW). Municipal solid wastes are instanced in house

hold/domestic waste, industrial waste, agricultural waste, demolition/construction waste and mining waste. Environmental impact wastes on the other hand, play host to hazardous waste and non-hazardous waste [28, 29].

Waste generation to a very large extent is an inevitable integral of human activities, which requires universally holistic resolve on its management. Apparently wastes management, in recent times can be said to be a work in progress with acclaimed and increasing improvement across the globe [30]. The latter view is coupled with the fact that, waste producers in recent times are willing to pay when payment is required on wastes disposition [30]. Nonetheless, wastes inefficient production processes, which to a certain degree is a vital loss of resources [31], has been a veritable avenue that the *Alamoyos'* took advantage, adopting demolition/construction and agriculture/ horticulture wastes [32, 33].

The demolition/construction wastes are employed for kiln and its apparatus, while the agriculture/ horticulture wastes are basically for fuelling and in this case both wastes source are categorized into two of reusable and non-reusable. The reusable wastes are used concrete stones, used metal roofing sheets, matted fan and joysticks, functioning as kiln building blocks and apparatus. While, the non-reusable wastes are sawdust, maize sheaths, locust bean pods, off-cut planks, granulated or crumb wood barks and charcoal embers, all functioning as fuel. These wastes were principally employed in this firing exercise for their durability and combustibility; coupled with their perennial availability and accessibility, justified by some worth no cost, fast maturation and low smoke emissions.

IV. Materials Algorithm and Discussion

These materials are placed in algorithmic format to allow for concise clarity of discuss. Consequently, examining *Adeta Alamoyos'* kiln and fuel algorithm of wares firing from wastes becomes expedient and to do this account of the conjectural firing before, during and after was taken for the record and for the benefit of prospective initiates. The exercise algorithm is preferentially identified as wastes sourcing, kiln setting, fuel bedding, wares staking, fuel spicing, igniting and fanning, kiln covering, fire partial stopping, wares drawing, blacking and bathing, final fire stopping and wares displaying. Its algorithm is further detailed in a flow diagram (Figure 1) below.

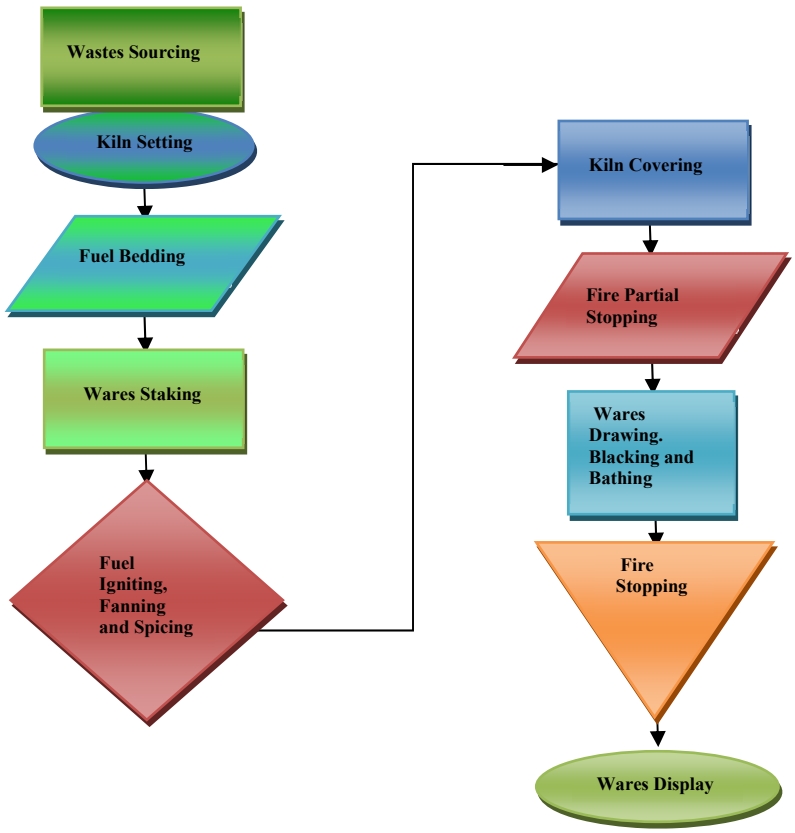

Figure 1. Adeta Alamoyo wastes firing algorithmic flow diagram

The above flow diagram no doubt, gave a graphical or visual insight into the procedural progressions of *Adeta Alamoyo's* wastes firing exercise. Hence, elucidating on the aforementioned algorithm as identified earlier becomes germane at this juncture.

A. Wastes sourcing

Collection and collation of wastes is of paramount essence to this exercise and it is the very first thing to do after the wares most have been sun dried or dehydrated. It is important to note that the wastes in this case are categorized into reusable and non-reusable. The reusable wastes are concrete stones, used metal sheets, matted fan and joysticks; they were sourced differently from diverse sources. Stones and roofing sheets were sourced from demolished dilapidated buildings free of charge. The stones are man-made concrete casts (aggregation of water, sand, cement and gravel or granite) from pillars, beams or decking of collapsed buildings. While, the roofing sheets may be metal or aluminum fabrication, but for longevity and sustainability in fire, metal sheets appears most preferred by the *Alamoyos'*. On the other hand, joysticks were sourced from saw mill and tree branch, while matted fan was sourced from used personal belongings.

It is worth noting that any light weight flat surface material can be employed as fan; it may be metal, aluminum, plastic, wood or vegetable The adopted fan in this exercise was made from vegetable straw; originally meant as cover for trinket box before it conversion as fan. The stones may number between twenty five and thirty and even more depending of the size and quantity of wares to be fired. The joystick is a peer of two wooden structures; one of the peer can be likened to an armless cricket bat, while the other peer can be likened to a wand or herders club (a shorter version though). A peer of joystick is enough for a one man exercise, it multiplicity is often subject to the number of potters on duty. In the same vein, the size and quantity of the used metal sheets is also informed by the volume or quantity of wares to be fired. These materials are stored for future use as a result of their reusability; having the tendency of spanning up to five (5) years and even more, as the case may be (Plates 1-4).

Plate 1. Concrete stones

Photograph generated from the field research.

Plate 2. Used metal roofing sheets

Photograph generated from the field research

Plate 3. Mat fan

Photograph generated from the field research.

Plate 4. Array of joysticks

Photograph generated from the field research

The non-reusable wastes adopted are horticulture byproducts, functioning as fuels, as a result of their combustibility. They are respectively itemized as sawdust, maize sheaths locust bean pods, off-cut planks, granulated wood barks and charcoal embers. These waste materials are sourced from three major hygienic outlets. First is from those who prospect locust beans. Second are maize sellers, significantly those who prospect roasted or boiled maize or corn, while charcoal embers are sourced from food canteen operators. And the third outlet, are sawmills, which play hosts to diverse kinds of logs of woods, planks and barks. To these outfits, pods of locus beans, sheaths of maize, embers of charcoals, sawdust of wood logs, off-cut of planks and granulated barks of wood logs (Plates 5-10) constitutes menace to their business and as such requires to be disposed or discarded in the pits, burnt or given out at no cost, as give away as in the case of this exercise.

Plate 5. Sawdust

Photograph generated from the field research.

Plate 6. Maize sheaths

Photograph generated from the field research.

Plate 7. Locust bean pod

Photograph generated from the field research.

Plate 8. Off-cut planks

Photograph generated from the field research.

Plate 9. Granulated wood barks

Photograph generated from the field research.

Plate 10. Charcoal embers

Photograph generated from the field research.

B. Kiln setting

The *Alamoyo* open kiln is similar to a typical Yoruba horizontal kiln as described by Fatunsin's (1992), putting its dimensions at 6cm high, 2m in diameter with several openings at the base ranging between four and six; but differ in terms of material and manipulation. To set the kiln up, certain major steps must have been put in place before hand. The steps include sufficient dehydration or sun drying of wares and acquisition and storing of all fuelling ingredients in tentative storage facilities. Thereafter, the kiln setting becomes necessary and germane; apparently, the kiln has dedicated spot demarcated for the singular purpose of firing. It is usually a large expanse of open space within the family compound as the case with the *Alamoyos'*.

The dimension of the kiln spot is not constant but varies significantly in diameter, which may increase or reduce depending on the volume or quantity of wares to be fired. The kiln spot on a free day is a hip or assembly of concrete stones and any time there are wares to be fired, the kiln spot is prepare to accommodate impending activity by dissembling or unhip the stones; arranged systematically close to one another forming a formidable circular wall, with evidential ash markings within the circular chamber (Plates 11-12).

Plate 11. Stones unhip for open firing

Photograph generated from the field research.

Plate 12. Kiln circular wall

Photograph generated from the field research.

C. Kiln bedding

Bedding, just as the name suggested, is a specially befitting arrangement, specifically for the comfort of its host (green wares). In this case, kiln bedding was done in layers by the duo of Taiwo Aliu and Awele Abidini (*Alamoyo* potters). The layers were stylishly and methodically done, perhaps as a result of their fuelling composites or compositional structures. The composites are wastes derivative from horticulture and base on their combustible nature, they are classified as non reusable wastes. All the bedding ingredients from sawdust to granulated wood barks must and have been sourced and dehydrated or sundried for several

days before the exercise. Having satisfied the latter observation, dry sawdust is poured inside the circular chamber and spread to cover the entire surface as the bedding first layer.

Subsequently, the dry maize sheaths were distributed evenly on the same bedding surface as it second layer. Locust bean pods on the other hand, were simultaneously laid on the top of the dry maize sheaths as third layer. Thereafter, the off-cut planks were carefully laid suspended on the trio of sawdust, pods and sheaths and the kiln circular wall (concrete stone casts) as the bedding fourth layer. The kiln bedding was crowned with a fifth layer, pouring or sprinkling the entire bedding surface with granulated wood barks (Plates 13-18).

Plate 13. Spreading dry sawdust

Photograph generated from the field research.

Plate 14. Adding dry maize sheaths

Photograph generated from the field research.

Plate 15. Dry locust bean pods addition

Photograph generated from the field research.

Plate 16. Methodic placement of off-cut planks

Photograph generated from the field research

Plate 17. Wood barks pouring on off-cut planks

Photograph generated from the field research.

Plate 18. Distributions of barks on planks

Photograph generated from the field research.

D. Wares staking

Staking in any kind of kiln is always a very sensitive exercise that requires utmost care and high level of meticulousness. The *Alamoyos'* are not averse to being meticulous and careful, especially during wares loading or staking. It is their belief that, a well loaded staking session on a well bedded kiln is a pointer to a hitch free and successful firing exercise. This loading session was a one woman show, and it was done by Taiwo Aliu. She commenced staking with a blackened fired ware, placing the rim of the fired ware face down and its base forming a solid dome. This fired ware was placed at an angle on the rear edge of the prepared kiln bed, serving reinforcement and thermal shock absorber for its assembled array of green wares. The green wares, major culinary dishes, numbering up to forty five (45), their lid covers inclusive. They were staked by hand together touching each other at angle 90^{o}, forming a kind of union or some worth rotunda. (Plates 19-20).

Plate 19 Fired/green wares staking preamble

Photograph generated from the field research.

Plate 20. Wares staking in progress

Photograph generated from the field research.

E. Fuel igniting, fanning and spicing

Immediately the wares have been successfully staked to the satisfaction of the potter or potters as the case may be, in individual, communal or lineage firing. Three things often take place in quick successions, they are fuel ignition, fanning and spicing. Worthy of note, is the fact that, the kiln bed whose composites are horticulture waste were usually ignited at the base where the lightest materials are domiciled and progress gradually to the heaviest material at the top. To get started, charcoal embers were collected from a nearby food canteen by Taiwo Aliu with shovel. The embers were concentrated on a spot where dry maize sheath and locus bean pods are located below the off cut planks. With the arrival of the embers at the spot where the light weight combustibles are, the materials immediately generates smokes and later fire, with persistent fanning of the spot. The fanning was done with the aid of a matted trinket box cover. While the fanning is still ongoing, the ignition was spiced with sawdust and locus bean pods at the top and by the side of the staked wares, for eventual fire saturation (Plates 21-23)

Plate 21. Introduction of embers in the kiln

Photograph generated from the field research.

Plate 22. Fanning ember for ignition

Photograph generated from the field research.

Plate 23. Apparent spicing with combustibles

Photograph generated from the field research.

F. Kiln covering

The kiln covering in this case implies two things; kiln preheating and full heating. Kiln covering commenced, the very moment it becomes imminent that, the bedded combustible wastes had caught fire and the fire had obviously started saturating the kiln bed. Pre-heating is the first phase of the kiln covering and it is often strategically done with the aid of a used metal roofing sheets numbering about seven (7) with varying dimensions by hand. The used metal sheets employed were placed on each other, one after the other, until it was some worth compactly closed; covering the entire base of the kiln and leaving it top most part open for about fifteen (15) minutes before its eventual closure. The eventual closing or covering of the kiln implies the beginning of a full and intensive heat, which takes an average of one (1) hour or sixty (60) minutes (Plates 24-25).

Plate 24. Kiln pre-heating

Photograph generated from the field research.

Plate 25. Kiln full firing

Photograph generated from the field research

The latter stage, according to Madame Taiwo Aliu is the most dread session of the whole firing exercise. In her words, she observed thus;

Iya Mapo olojuti

Mother goddess of fire is shameless

The take from the above submission is, the unreliability of fire mother goddess in firing sanctity, which strongly depends on chance or luck and as such, results may be favourable or unfavourable.

G. Fire partial stopping

After one (1) hour of intensive firing, by which time the flow of heat energy generated from the fuel must have saturated and fused with the wares in the. The kiln is then, partially stopped, uncovering its metal sheets covering. The tool or apparatus deploy for this exercise is the joystick(s), it is often use to load and remove the metal roofing sheets covering of the kiln during firing. At this time the firing temperature of the kiln is adjudged beyond 573^{o}C; a stage at which quartz crystals in wares undergo a change known as alpha to beta quartz, which is reversible; changing beta to alpha quartz, upon cooling and resumes its original crystalline form and size, reaching red heat at 750^{o}C and beyond (Plate 26).

Plate 26. Uncovering the kiln

Photograph generated from the field research.

H. Wares drawing, blacking and bathing

Joystick(s) play a very important role in the drawing, blacking and bathing of wares in the *Alamoyo's* firing process; being the only and most appropriate apparatus employed for this exercise. Interestingly, the trio of drawing, blacking and bathing were often done simultaneously or in quick successions by the duo of Madame Taiwo Aliu and Madame Awele Abidini. Drawing, which is the removal of the heated wares from the partially uncovered kiln, is the first step that was taking. It was followed by blacking, which involves placing of the drawn wares from the kiln on finely prepared sawdust and immediately buried in; the thermal reactions

between the heated wares and the sawdust generates a kind of carbonization, which gives black colouration on the surfaces of wares individually.

Thereafter, the blackened wares are dipped and turned inside a concocted liquid made from locus bean pods, one at a time, which gives the blackened surfaces of the wares a kind of permanence. The drawing, loading and bathing of wares were done twice or thrice before certified satisfactory; the processes were by thrusting the sharp edge of the wand inside the concave surface of each ware and braced by the flat surface of the bat. In all, the three exercises took sixteen minutes. (Plates 27-28).

Plate 27. Wares blacking with sawdust

Photograph generated from the field research.

Plate 28. Wares blacking and bathing

Photograph generated from the field research.

I. Fire stopping

Fire stopping is the penultimate stage of the entire firing exercise. By this time, the kiln is totally uncovered and the wares in the kiln had been drawn, blackened and bathed and carefully arranged near the kiln area to cool dawn. Apparently, the kiln chamber is only left with residue of the off-cut planks charcoal embers. Then the hip blackened wares were consequently reloaded in the kiln chamber for final wares steaming with the aid of the joysticks. At interval the position of each ware is changed for proper and even steaming saturation. Turning wares were primarily done with the aid of joysticks and it is often done repeatedly at the pleasure or discretion of the potter, while the blackened wares were eventually drawn out of the kiln chamber the moment they showcase satisfactory tendency. The exercise took twenty three (23) minutes (Plates 31-34).

Plate 30. Residue charcoal embers

Photograph generated from the field research.

Plate 31. Turning of blackened wares

Photograph generated from the field research

J. Wares displaying

Having come to the realization of a successful outing, the potters acknowledged fire mother goddess (*Iya Mapo*) and gave credence to her, recognizing the evidential favour they received, in that, not a single one of the wares, they put to fire got damaged or cracked. Thereafter, the wares are drawn out finally from the kiln, allowing the wares to cool down for a while as a result of their apparent high heat temperature and subsequently showcased to prospective clients for appreciation and possible acquisition (Plate 32).

Plate 32. Wares display for client

Photograph generated from the field research.

V. Conclusion

Interestingly, the thrust of this study is hinged on improvisation or better still diversification, which is often born out of necessity. A phenomenon the *Alamoyos'* took advantage, by subjugating and manipulating demolition waste and horticulture waste as kiln apparatus and fuel respectively in their open firing. *Alamoyo* wares firing algorithm is articulated in ten (10) phases, simplified in a flow diagram; which gives cross sectional expose of the entire exercise in a jiffy. Though, this kind of operation account for only one percent (1%) of the potting population [34]. Their wastes adoption has significantly, proven to be resourceful, efficient and result oriented, firing wares to maturity in approximately two (2) hours with low smoke emission.

The process no doubt, has attested to wastes viability as effective firing ingredients for culinary dishes, which are perennially available and accessible for free. By this improvisation, the *Alamoyos'* have indeed contributed their quota to the global call for wastes management; helping in harnessing or mopping up supposed demolition and horticulture wastes from the streets of *Adeta* and its environs, as fuels in wares firing. It is therefore, hoped that, the lessons learnt from this study, will come handy in advancing the process through materials integration, characterization and temperature accuracy of it firing both in formal and informal institutions around the globe and possibly provoke further studies on *Adeta Alamoyo* pottery.

Notes

1. Ilorin is the capital city of Kwara State and the 7th largest city in Nigeria going by the 2006 census exercise, which put her population at 777,667 peoples.

2. The geographical distribution or cardinal point of *Adeta* in reference to her surrounding was relayed by Zuluqurnain Babatunde Zuluqurnain, a former student of mine, who incidentally is an indigene of Kwara state and a resident of Ilorin south. He had lived in the area, all his life and he is very conversant with *Adeta* and its environs.

3. *Alamoyo* lineage has practice culinary pottery at No.78 Odiolowo, *Adeta* for ages and has passed it on to at least three generations. The practice thrived and flourished up till the wake of 21 century, with commissions and bookings from clients as far as Maduguri, Kano and Kaduna *etcetera*. These practitioners are aging, it is however, their hope and prayer that their grand children take after them and possibly advance the practice, since their own children have left home for greener pasture in the city.

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