

ADVOCACY FOR SUSTAINABLE ENVIRONMENT IN NIGERIA: RECYCLING OF CERAMIC POTTERY SHARDS

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ABSTRACT

This essay is triggered by the need to attain sustainable environment in Nigeria. Presently there is growing global concern regarding the indiscriminate dumping of domestic and industrial wastes of which ceramics makes considerable contribution. Improper management of waste products all over the world makes them harmful to humans, plants, animals and the environment. Appropriate disposal and management of ceramic waste products would be a right step towards providing a healthy environment in Nigeria. This paper focuses on and examines the recycling of porcelain wastes in the making of abrasives for the finishing of metal works and wood works, the assemblage of broken pottery shards for the creation of new artforms and the possible application of irretrievable porcelain in the industrial production of domestic cleaning powder. This essay, therefore, advocates recycling as a profitable option for sanitizing our environment, creating wealth from ceramic wastes and as a means of generating employment and revenue.

Introduction

Man's changing lifestyle and incessant quest for advancement are endangering his environment as evidenced in the apparent damages (depletion of ozone layer, green house gas emissions, deforestation, et cetera) to the environment. As some perceptive observers put it, the imprudent use of the natural environment due to ignorance, poverty, overpopulation and greed, amongst others, has led to the degradation of the environment. The charges (degradation) occur as people attempt to adjust their seemingly endless wants and desires for food, shelter, recreation, infrastructural facilities, and so on, to the land and other resources available to them (Omofonmwan & Osa-Edoh, 2008).

In Nigeria, the degradation and pollution of the environment result from two main sources, namely domestic and industrial sources. Daily, tons of household wastes are produced by families which constitute mountains of garbage at various dumpsites in urban and rural areas across the country. These unsightly and germ-infested monstrosities not only deface the environment, but also cause various

problems for humans, animals, plants and the environment (see figure 1).

The world has since moved into industrialization; we are living in an era of great innovations and high technology and the machine has become the instrument for mass production worldwide (Ebeigbe, 1990). Although the development essentially solved the problem of production, the massive production of goods also generates great amounts of by-products and wastes. Thus, apart from domestic wastes, industrialization is another source of the world's generation of substantial volume of sundry waste products most of which are non-biodegradable while others take years to decompose. For instance, plastics, for instance, take up to 500 years to decay (<http://www.recycling-guide.org.uk/facts.html>).

The biggest challenge facing nations worldwide, including Nigeria, is the problem of dealing with these huge wastes generated each day. This problem cannot be overemphasized given the magnitude of the damage being done to the environment (greenhouse gases, depletion of the ozone,

deforestation, filth, smog, et cetera), which result from these waste products.

The repercussion of continuous dumping of domestic and industrial wastes, obviously, has many disastrous effects (some of which are irreversible) on the environment. Thus, it has become necessary for all stake-holders to take decisive pro-active steps to address the problem of improper disposal of waste products to avoid further degradation and pollution of the environment. The onus is on every inhabitant of our planet, ceramic producers inclusive, to be mindful of their activities to ensure a safe and sanitary environment. To sustain a healthy life in harmony with nature, it is extremely important for manufacturers to develop various materials, products, and processes that minimize any harmful influence on the environment. These are responsibilities that must be taken seriously.

The main concern of this essay is not to apportion blames or undermine the efforts of the government, rather, the paper is focused on ways of solving the problem of sanitizing and protecting our environment, especially the problem of proper disposal of the excess pottery shards that emanate from wrecked earthenware pottery objects and the huge amount of broken glazed ceramic tiles, tableware, sanitary wares, and so on. It stressed specifically on how these waste products can be recycled in order to prevent health and environmental hazards. Various ways that some of these waste products can be transformed into raw materials for the production of polishing agents, soap from wood ash, the use of broken glazed ceramic tiles, the aesthetic application of pottery shards, the production of cleaning agents using porcelain shards, are discussed here in this paper.

Waste Management in Nigeria

There is no gain saying the fact that the waste situation in Nigeria, as evidenced by the numerous dumpsites in urban cities that present municipal waste and sewage disposal problems characterized by disposal

of various non-biodegradable household and industrial products, is grossly inadequate (Ogunsola, 2010). This reflects the need for improved waste management practices. The questions are: what measures have been instituted in Nigeria to combat this menace? How effective are they? What other methods apart from extant ones can be exploited to minimize, if not completely eradicate, the threat of environmental degradation?

Until recently, the Nigerian government, like in most developing countries, had not taken adequate measures towards environmental pollution or adequate protection of the environment. Government's major efforts in Africa, for many years as Adegoroye (1998) noted, was the provision of basic social amenities. In his words, "environmental protection was synonymous with conservation of natural resources, while concerns for industrial pollution control and hazardous waste management were treated as both esoteric and an attempt to slow down the pace of industrialization." It was not until 1988 when the scandal of the illegal dumping of toxic wastes of Italian origin rocked this nation that decisive measures geared towards environmental protection were taken.

Government has since put in place many instruments of intervention in pollution control. To mention a few: the Federal Environmental Protection Agency (FEPA), the National Policy on Environment, The Hazardous Waste Criminal Provisions Decree 42 (1988). Others are: the National Guidelines and Standards for Environmental Pollution control in Nigeria, the National Effluents Limitations Regulations S.I.8. of 1991, the Pollution Abatement in Industries and Facilities Generating Regulations S.I.9. of 1991, the Management of Solid and Hazardous Wastes Regulations S.I.15 of 1991 and the Environmental Impact Assessment (EIA) Decree 86 of 1992 (Ibid).

With so many regulatory laws and agencies, one would expect that the problem of environmental pollution would have been

adequately combated in this country by now. But, the contrary is the case as these laws appear ineffective because the problem has remained persistent and seems to be defying solutions to combat it. For example, in spite of the legal support and funding from the Federal Government of Nigeria, FEPA's level of achievement up to now is remote from her set objectives and goals because of the worsening rate of environmental degradation than what it was before the establishment of the organization (Omofonmwan and Osa-Edoh, 2008).

On their part, Echefu and Akpofure (2011) observed that a critical assessment of the various statutes and the framework for the Environmental Impact Assessment (EIA) process specifically, and the whole environmental regulatory process generally, shows that many of the statutes are very much inconsistent with intentions, especially in regard to the execution of functions. They also added that there is "duplication of functions and overlapping responsibilities in the processes and procedures guiding the execution of the various impact assessment tasks," thus, severe "bottlenecks and bureaucratic confusion are created in the process." The effect, they affirm, "is a waste of resources, financially and materially." In sum, what these remarks make clear is that the laws have failed to engender the desired results. Is it any wonder, therefore, that the challenges of environmental pollution and degradation have continued unabated?

As noted earlier, this paper focuses on the recycling of waste products, that is, some ways that ceramic waste products can be transformed into raw materials for the production of polishing agents, the use of broken glazed ceramic tiles for decorating floors, the aesthetic application of pottery shards and the production of cleaning agents using porcelain shards.

Prior to elucidating these issues, perhaps one need to ask: what are the benefits of recycling to the environment? Recycling is a serious business worldwide in post-industrial

nations, although most developing countries, Nigeria inclusive, are yet to fully imbibe the practice. For example, in Nigeria, government policies aimed at environmental conservation and protection, and agencies in charge of these tasks have continue to pay cursory attention to recycling as a feasible way of conserving energy and preventing the degradation and destruction of the environment. If fully exploited, recycling is a very viable option in this regard. Today many countries worldwide are reaping the benefits of recycling as an excellent way of saving energy and conserving the environment.

Statistics like these bring to the fore three very important facts. Firstly, it underlines the importance of recycling as an excellent way of saving energy and conserving the environment. Secondly, it highlights the urgent need for nations of the world to embark on more vigorous concerted efforts to ensure that their harmful non-biodegradable wastes are recycled in any way possible. Thirdly, it underscores the need to intensify public enlightenment to create awareness of the negative consequences of indiscriminate abuse and over-exploitation of the environment.

The need to protect our environment is worth stressing because as rightly noted by Adodo (2000), environmental problems are caused by the life style of human beings and human life is a product of the place where it exists. This is a pointer to the fact that people need to be sensitive about environmental issues in order for them to live in a healthy and secure environment. No time is more appropriate than now to emphasize that humans, need and ought to imbibe habits that would ensure their protection, as well as, the environment, animal and plant lives. Indeed, the environment is of great importance to human existence. Mbiti's insightful remark buttresses these facts. In his words:

If humans hurt nature, nature hurts them. Humans are the priests of nature, indeed of the universe. This is

a sacred trust given to them by God, who endowed them with more abilities than other creatures on earth. African religiosity is very sensitive towards the relation between nature and persons, even if today this sensitivity is getting lost in the money oriented exploitation of natural resources (Mbiti 2000)

Given the high level of environmental degradation being witnessed today, including the growing concern over the use of energy and pollutants in the production of ceramics, there is an urgent need to encourage production processes that have a minimum negative impact on the ecosystem and any measure that would help keep the environment clean, safe and healthy. This paper strongly believes that recycling waste products is one of such feasible measures. The advantages of recycling waste products are many. Apart from helping sanitize the environment, recycling is a practical way of transforming waste to wealth. For example, confirmed sources inform us, that one recycled tin can would save sufficient energy to power a television set for three hours, a single recycled glass bottle would save enough energy to power a computer for twenty-five minutes and one recycled plastic bottle would conserve an adequate amount of energy to power a 60-watt light bulb for three hours (<http://www.recycling-guide.org.uk/facts.html>).

In the art world, it is now an accepted and viable common practice for artists to create aesthetically pleasing art forms from mundane items including discarded objects that people no longer find useful. They “shop” from the refuse dumpsites and cabbage bins for rejected objects which they, in their ingenuity, transform and elevate to the dignity of works of art as exemplified in the famous art works by the legendary artist, Pablo Picasso (1881-1973). Picasso used found objects for one of his popular works entitled: *Baboon and Young*, and discarded bicycle saddle with handle bars which he assembled to make a bull's head in another. This specific sub-genre of

“found art” is generally known as trash art or junk art. These are works principally created from components that have been discarded and which often are obtained quite literally from the trash. Today, many organizations even sponsor junk art competitions (Ibid).

Ceramists are not left out in this practice of recycling waste to create wealth. In ceramic production, for instance, tons of pottery shards are amongst the waste generated. They result from broken fired (bisque and glazed) wares. Firing creates an irreversible chemical change in the fired clay which makes it impossible to return it to its plastic state and it remains perpetually non-degradable as it never decomposes and cannot be composted (Rhodes ,1974). Ordinarily, potters grind the shards into powder (grog) and add the resultant powder to plastic clay bodies to reinforce their tensile strength after firing. In a clay body, the grog creates pores that serve as avenues for air to escape from the clay during firing thereby preventing cracks and breakages in the fired wares. The use of shards as grog only takes care of a very minute percentage of the large volume that emanate from production processes and usually , there is still a great deal of this waste which are harmful to the environment which could be recycled as a practical way of ridding the environment of the nuisance.

Prudently, some concerned individuals have devised other ways to utilize surplus shards creatively. This paper discussed how this has been achieved in various ways. For example, the use of pottery shards in combination with various materials to create aesthetically pleasing art forms using the mixed-media technique, the use of porcelain shards in the production of polishing compound for cleaning tarnished metal products and as domestic cleaning agents and the use of broken ceramic tiles for designing floors of buildings .

Aesthetic Application of Pottery Shards

Particularly intriguing is the technique of using pottery shards in mixed-media works

such as the wall-panels and flower vases in which pottery shards and assorted materials (wood, metal, fabric, beads, pottery shards and the like) are combine to create an artform. This can be exemplified by a work created by Ebeigbe (2011) which she entitled: *The Royal Splendour*, an aquarium with the stand made from pottery shards (see figures 2a and 2b).

In an art exhibition brochure of Ebeigbe (2006), Professor Anao, a former Vice-Chancellor of the University of Benin remarked on this artist's use of pottery shards thus:

Firstly, that in nature nothing goes to waste. Everything has its uses even in its disintegrated state. It reminds us that nature actually recycles everything and turns waste into useful purposes. In working with waste, the artist has thus struck on a very important and enduring principle of nature... she underscores the importance of preserving our environment and corroborates the fact that the myriad non-degradable objects, in whatever media, that litter and pollute our environment can be transformed and transmuted into works of art that can afford people aesthetic satisfaction.

The materials and methods used for the production of Ebeigbe's art forms and the steps she takes to arrive at the results are quite simple. The materials used include, pottery shards, plywood, glue, pieces of wood sand, fabric, foam, nails, oil or enamel paint, frames, found objects, et cetera. The pottery shards are sorted according to shape, size and weight. These are first washed in soapy water and allowed to dry thoroughly before use on the panels which are nailed to the required size of plywood (3/4 size) to a corresponding size of wooden frame. Thereafter, she applies glue copiously to the framed surface of the plywood.

Different sizes of shards and any other materials or objects are placed on the glue in required patterns until the entire surface of the plywood is covered. All uncovered spaces between the shards and the objects are filled with powdered shards (grog) or sand mixed with glue to further reinforce the attached materials and to ensure that no part of the plywood is left bare. The reverse sides of particularly large pieces of shards are glued to pieces of foam or fabric before they are attached to the surface of the plywood. The finished work is allowed to dry (laid flat) thoroughly for about forty-eight hours before coats of paint are applied with a brush or sprayed over the shards. Another method of finishing the work is to paint or spray the entire surface or chosen areas with clear wood vanish if the natural colour of the bisque clay is desired.

Porcelain Shards as Abrasives

Another gainful way to change irreparable porcelain shards to a useful product is its conversion to abrasive powder (Ukweku and Emeriewen, 2010). Porcelain shards can be crushed and pulverized into fine abrasive grits. This is because porcelain is characterized by high strength and very low-absorption. In fact, porcelain is a ceramic clay body that is translucent, sonorous and non-porous. It is made at a single firing of kaolin, quartz and feldspar at a very high temperature to fuse into a glassy substance. Dictionary of Science and Technical Terms classified porcelain as "a high grade ceramic ware characterized by high grade strength, a white colour, very low absorption, good translucent and a hard glaze." The characteristics of porcelain which include refractoriness, high strength and non-porosity qualify it to be suitable after it has been pulverized into abrasive grits for the production of abrasives for finishing metal and wood objects and other products.

Abrasives are materials produced from extremely hard substances. Encyclopedia of Science and Technology (Vol. 1: 1976:10) defined it as:

a material of extreme hardness that is used to shape other materials by grinding or abrading action. Abrasive materials may be used either as loose grain or grinding wheel or as a coating on cloth or paper.

In this section of this paper, the use of irreparable porcelain, which is a ceramic product, as an effective material for production of abrasives is discussed. Porcelain ware when damaged and discarded will not be affected by weather or water because of its characteristic refractoriness, non-porosity, low absorption and therefore, non-degradable. The shards can still be very effective as abrasive when recycled no matter its age (Ukweku, 2010).

There are varieties of manufactured porcelain articles which include table wares, sanitary wares, kitchen fittings, decorative wares, ceramic electrical fittings, et cetera, being produced, used and discarded all over the world daily either because they have become old-fashioned or are damaged. Porcelain shards abound in almost every locality in our society which constitute hazard as non-degradable elements (Fig. 3). In order to keep our environment free of them, they can be properly disposed off by collecting and storing them for recycling into useful products such as metal polishing compounds, abrasive papers, abrasive cloths for metal and wood works finishing. For instance, Sam Ukweku, (one of these authors) in 2006 carried out a successful experiment on the use of porcelain abrasive grits combined with bee wax for the production of metal polishing compounds (Fig. 4). Reporting his findings, Ukweku (2006) observed that "polishing compound is the combination of abrasive grits and fatty substance. The fatty substance which could be wax or fats is usually the binder that holds the grits together." On her part, Shirley (1965) posited that "tripoli compound, a generally used polishing compound is a proprietary compound of Tripoli and fatty

materials." Tripoli itself is an abrasive material that exists naturally as earthy mineral. Wiener (1960:50) stated that "Tripoli is actually a finely granulated siliceous rock called silica" (Ibid). Tripoli is found in Missouri, Tennessee and Georgia in the USA (Ibid).

Polishing compound is the vehicle that delivers the cutting, smoothening and the lustrous effects achieved on metal surface during polishing operation (Ukweku, 2010). In an experiment, Ukweku crushed porcelain shards into small particles using hammer on a steel plate. The resultant particles were gradually and steadily reduced into grains of grits using a hand hammer. The grains were further pulverized into super fine particles with the use of the "SFINX" brand manual hand-grinding machine. And because the pulverized porcelain grits contained grains of different sizes, the material was sifted using sieves of different grades ranging from 120, 100, and 80 to 60 grades (Fig. 5).

The sifted grits were blended separately with bee wax to produce the polishing compound of various grits. The bee wax was first melted before a measured and weighted amount of porcelain grits was added, stirred vigorously before the mixture was poured into plastic container that serve as a mould. After the mixture had cooled, the solidified compound was separated from the mould. The porcelain polishing compounds were used to polish a variety of (Ferrous and non-ferrous) metal products and the results were satisfactory as the polishing gave the objects the desired sheen (Fig. 6). Most products of goldsmiths, silversmiths, brass-smiths and coppersmiths require polishing or burnishing before further finishing operations can be applied. This need can be taken care of by using recycled porcelain shards transformed into useful abrasive compounds. Therefore, pulverized or granulated porcelain grits when blended with fatty substance can effectively serve as polishing compound to achieve luster during polishing operation.

Moreover, if finely granulated porcelain grits are coated on paper or cloth can also serve as abrasive for abrading and finishing of metal and wood works. What is required is a strong bond or glue that can effectively hold the grits on papers or cloths. The fact that porcelain abrasive grits were used to achieve luster in polishing in metal, it therefore, can also be used as abrasive on cloth or paper because abrasion is needed both in polishing and smoothening processes in metal or wood works production. The stratification of porcelain grits ranging from grades 600-60 mesh sieves will produce various required grades of abrasive papers or cloths for metal surface finishing.

The Creative Use of Broken Ceramic Floor Tiles

The use of broken ceramics floor tiles has become a creative application of such shards that otherwise would have constituted a serious menace to the environment and a nuisance to the manufacturers, dealers and the consumers of the products and the general public. Because floor tiles are usually designed from the factory to align symmetrically during laying, when such tiles break into disorganized patterns, they are considered defective and useless. No industry takes the matters of breakages lightly as it constitutes a major economic lose. Dealers who after the purchase of wholesome sets of tiles, encounter breakages, bemoan it as a very serious economic lose. The creative use of such broken tiles has however brought some sort of welcome recourse that help reduce losses incurred and the worries associated with such accidents, to a manageable scale. Dealers now bag and re-sell wrecked tiles to those who need them for other uses. For instance, in this dispensation, broken ceramic floor tiles of various sizes, colours and shapes are artistically arranged to create tiled floors in variegated patterns that not only appeal because of the array of colours but also the abstraction achieved in the laying arrangement (Fig.7).

The patronage of this new order has given rise to a demand for broken ceramic tiles. Additionally, house developers who have cut-outs from tiles used in their housing projects now get returns from re-selling their off-cuts and scavengers of disused materials equally make money from broken tiles picked from the garbage sites, streets corners and all sorts of places. They collect every type they can find because all of them are useful. A very significant benefit arising from this development is the fact that it is helping to rid the environment of the menace of such materials. As it is not biodegradable, such use means giving the material a second economic value instead of being relegated to the status of waste products.

Recycling Pottery Shard for the Production of Detergent

Waste management in modern times has advocated recycling as a "key element," as it makes it possible to convert used materials and/or literarily useless wastes into raw materials for new products. Shards of pottery are typical wastes that can be transformed into useful raw materials, especially for the production of detergents. Non-synthetic abrasive detergents are usually made from pulverized materials that can abrade other materials. As pottery shard is characteristically hard of wearing, sharp and non-absolvent, it becomes very useful when properly reduced by milling into fine grains. It is often considered a second product line in the ceramic industry, especially when there happens to be a large casualty rate of bisque or gloss wares. The production process and equipment required for the production of detergent from pottery shards are not different from the conversional industrial equipment for ceramics. It merely entails crushing (pulverizing) milling, sifting and bagging. The market potential of abrasive detergent is growing quite rapidly in Nigeria as many modern homes use the products for cleansing of the kitchens, lavatories, floors, et cetera. The detergents have, in fact, been

identified as more effective than synthetic soaps (NOTAP, 2000).

As articulated by the Lagos Waste Management Authority (LAWMA), Nigeria, recycling, "prevents waste of potentially useful materials, reduces energy usage ...". One can aptly sum up the opportunity as giving the broken pot a second chance.

In sum, the benefits of recycling pottery shards to the environment can be enumerated thus:(1) it converts waste to wealth,(2) provides raw materials for metal polishing for industrial use, (3) provides raw materials for the production of detergents, and (4) recycling provides opportunity for artistic application for decorative purposes. In all these, it equally engenders job creation and revenue generation.

Conclusion

In these days and age when environmental management has taken recycling as the key element, this essay has looked at the potentials in the shards of pottery in the production of raw materials for other production. As the shards in their nature are non-biodegradable, recycling will therefore make a veritable option for their disposal. It

not only provides economic viability, it also creates employment opportunities. In the use of the shards for artistic production, the paper has demonstrated that nothing goes waste in nature as exemplified in the useful and creative ways that pottery shards have been used in the examples cited in this paper. These include: the processing of porcelain shards into abrasive grits for polishing and finishing metal and wood products and as detergent for household and industrial use, the creative use of pottery shards for decorative art forms and the use of broken ceramics floor tiles for both interior and exterior decoration of architecture in the modern Nigerian society.

On a final note, this paper advocates that government and private sectors should go beyond paying mere lip service to the existing laws on the environmental protection in Nigeria but should be more proactive in enforcing the laws to ensure a healthier environment for all. Industries and individuals should imbibe the tradition of recycling waste materials into useful means thereby ridding the environment of their menace, and also as a way of providing wealth and job opportunities to the populace.



Figure 1: A Dump site
Source: <http://news.bbc.co.uk/2/hi/africa/8595108.stm>



Figure 2a: The Royal Splendour (An Aquarium)
Source: Photograph by Sweet Ebeigbe, 2011.



Figure 2b: A Section of the Aquarium Stand
Source: Photograph by Sweet Ebeigbe, 2011.



Figure 3: Porcelain Shards.
Source: Photograph by Kennedy Eweka, 2011.



Figure 4: Porcelain Polishing Compounds
Source: Photograph by Sam Ukweku, 2011



Figure 5: Grounded porcelain Grits
Source: Photographed by Sam Ukweku, 2011



Figure 7: Floor Decorated With Broken Tiles
Source: Photograph by Joseph Ikeneri, 2011.



Figure 6: Metal Wares Polished With Porcelain Grits
Source: Kennedy Eweka, 2011.

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