

RECYCLING OF PLASTIC WASTES AS A CASTING MEDIUM AND RECIPE FOR ART SCHOLARSHIP

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ABSTRACT

As a result of the current economic mishaps in the country, inflation has penetrated every nook and cranny in the country. This called for a need to unearth new means and alternatives that are usable to help push forward the frontiers of art scholarship. Recycling is the process of transforming old or discarded products in new ways. The primary aim of recycling is to foster a healthy built environment; where the environmental wastes and/or degradation are reduced to nothing. The experiment carried out was to check how discarded plastic can be converted into a viable medium for casting; with the overall aim of advancing scholarship in art. The discarded plastic was heated till it melted completely and the solution got converted into a viable medium for casting. The result been given after pouring the solution into a mold established a validation that the plastic solution can easily be of good use for casting many a sculptural artwork; if well improved. The study was carried out using studio experiment, interviews and groupthink discussions, as well as authors' varying experiences and observations; with the intent to unravel an alternative for the skyrocketing casting materials especially for student-sculptors and professional sculptors who are liable to encounter difficulty in procuring the media that are used for casting many a sculptural piece, such as cement, plaster of Paris, resin, catalyst, fiberglass mesh, et.al all of which are already becoming appallingly extortionate in the present Nigerian market. This study did not only proffer a casting alternative for the students studying sculpture in Nigerian art schools and professional sculptors in the industry, it also reduces the non degradable wastes (in form of plastics) from the built environment and crusades for a healthier built environment.

KEYWORDS: *Recycling, Plastic Waste, Casting and Moulding, Environmental Healthiness, Art Scholarship.*

1.0 INTRODUCTION

In Nigeria, and few other parts of the world, like scholars in other disciplines, art scholars are statutorily required by National Universities Commission (NUC) as well as National Board for

Technical Education (NBTE) to produce required numbers of substantive works in each of the courses slated for each semester in tertiary institutions. In this plastic age, irrespective of how intentional one may prove, plastic of various species have a spot in the built environment (Thompson, *et.al.*, 2009).

Conceivably as a result of the fact that there is barely what humans would do without having to use plastic (Parker, 2019); ranging from nylon wraps for confectioneries, beverages, textile products, toothbrush, toothpastes, water, edibles, *et.al*. Junks are not friendly to the wellness of humans through whom the junks were created. Junks shrink the environment by snatching environmental space either through the pollution that usually ooze from the decadence of the municipal wastes or as a result of land space they occupy within the environment.

Further absurdity of environmental waste which is also regarded to as human waste, could be understood knowing it was the causal factor of the London 1854 Cholera outbreak. Consequently, wastes, which are an unavoidable phase in any fast growing habitable built environment (ESCAP: Ewijk, and Stegemann, 2020) must always be curtailed with effective measures as timely as possible; in order to contain possible environmental hazards that usually emanate from the pollution from landfills, streets, dumpsites, etc. The built environment, especially in Nigeria, has been experiencing its geographical space deploring to what seems to have possibilities of severely endangering lives and properties, if left untreated and/or unattended to. For example currently in Lagos and other urban cities in the country, the rainy seasons have been revealing the vulnerability and unpreparedness of few parts of the cities for the unpredictability phase of natural occurrences that may potentially endanger the built environment. As at the time of carrying out this study, there have been several cases of some urban cities within Nigeria been almost crippled by flood emanating from the downpour of marathon rain, as a result of poor drainage system, abysmal waste management system, tons of biodegradable and non biodegradable

wastes on landfills, dumpsites, streets and drainages, poor orientation of the mass about the dangers in dumping refuse carelessly within the built environment, *et.al*. Hence, there is a need for effectual ways to adapt non-biodegradable wastes such as plastic, glass pet bottles, *et.al* into something that can serve aesthetic relevance. In curtailing future environmental hazards on the fast growing population in the built environment, there is a need to orchestrate various strategies through which tons of wastes can be drastically reduced to nothing from the built environment. Among many measures efficient for curtailing and neutralizing the dangers embedded in environmental degradation usually caused by tons of wastes on landfills and dumpsites within the built environment is recycling. Recycling, however, is in phases. There are 3 facsimiles of recycling, they are: primary, secondary and tertiary recycling (Ecogreen, 2016). Tertiary recycling, also known as chemical recycling, manifests itself to be the process of breaking down objects/materials chemically or through heat process in order to produce something quite different.

Just in similitude of how the dynamism of art was at work during the coronavirus pandemic, when art also featured its textile facet to invent affordable *Ankara* nose masks in Nigeria and few other Africans countries to foster the precautionary measures during the pandemic period (Ajayi, and Seyi-Gbangbayau, 2021), the goal of this experimental research is to further inference how art adopts its creativity (Nathan, 2018) to play significant roles in the global pursuit for municipal wastes reduction and which was implemented by subjecting found discarded water tank plastic that is non-biodegradable and harmful in the built environment to a tertiary recycling that can make the trash be transformed into a teaching aid. The intent

was to create 3D Alphabets that could be used either as a teaching aid for early age pupils or for any industrial project.

2.0 LITERATURE REVIEW

2.1 Circular Economy vs Linear Economy

Each year, 90 billion tonnes of primary materials are extracted and used globally, with only nine per cent recycled (United Nations Environment Programme, 2019). Circular and linear economies although share similar objectives of zeroing both municipal and packaging waste from the built environment, however, their dissimilarity is that in linear economy, recycling is the core prototypical and recycling requires waste and that is what circular economy strives to completely choke out of existence (Andersen, 2006; Allwood, 2014; Lemille, 2019). That is to say, before recycling can be done, waste has to be in existence and waste is a term that is ostensive in circular economy. Circular economy thrives to insure that goods and product are produced in a way that is eco-friendly and not just for make-buy-use-and-recycle but having most products manufactured to be totally bereft of recyclable wastes. The core essence of circular economy is orchestrating innovative ways through which the longevity of objects, products, and/or materials can be guaranteed (Sachin, Achyut, Panda and Singha, 2011). The concept through which circular economy is achieved is recycling. Circular economy allows products to be refurbished and renovated for a guaranty to exist or function for more years. Whereas, the roles of art in augmenting science and technology to improve the global space by eroding tons of wastes from the built environment cannot be overemphasized just in validation of submissions from (Idiong, 2006; Ajayi and Siyanbola, 2020).

2.2 Recycling

Recycling is the process of transforming used or discarded products in new ways. Effectively, recycling is a measure through which environmental degradation is reduced.

Report shown by the web archive of Environmental Protection Agency (EPA), United States hypothesized that in 2013, through the impact of recycling and another phase of recycling called composting, about 87 millions of tons of municipal wastes were prevented from the built environment as against the over 15 millions tons prevented in 1980. Recycling is deeply rooted in national and/or global wealth, health alongside other environmental merits. It helps in eroding wastes from landfills, sewers, drainage, etc. And this is pertinent in a country where poor waste management system is the order of the day in the built environment of the 7th most populous in the world, Nigeria (Zafari, 2021; Bakare, 2021). In reducing the rate of raw materials needed, recycling helps in resuscitating a part or whole of a used item to be reused similarly or differently with a consequential result of reducing the rate of raw materials that would have been used on the first without recycling (EPA, 2020). Reduce, Reuse and Recycle are considered as the 3Rs of recycling. The primary aim of the 3Rs is to foster a healthy built environment; where the environmental wastes and/or degradation are reduced to nothing.

2.3. Plastic Wastes in the Built Environment

Plastic has already become a part and parcel of human existence almost every daily consumable is either packaged, served or coated with plastic one way or the other. And as the population increases,

the rate of plastics increases incurably. Every year, the landfills, dumpsites, roads, streets, drainages, beaches, oceans, et.al in the built environment of the most populous country in Africa, Nigeria, usually get tamed with nothing less than 70% of 32 million tons of biodegradable and non-biodegradable wastes; while about 2.5 million is considered to be plastics of dissimilar species (Magoum, 2020; Bakare, 2021). Hence, since plastics are classified as non-biodegradable, the effect of it in the built environment could jeopardize the healthy living of both human and animals. Therefore the need for initiatives and sustainable measures to reduce plastic wastes in order to augment the efforts of the Nigerian Federal Ministry of Environment to improve plastic waste management (Magoum, 2020).



Plate 1: A plastic-filled dumpsite within the built environment

Source: Authors' field survey



Plate 2: Another dumpsite full of plastic wastes

Source: google.com/imagesonwastes

2.4 Plastic Water Tanks: Uses, Merits, Demerits and Feats

Water is indispensable to human and animals; not exempting the environment as a whole. Ranging from farming, domestic chores, industrial activities,, building construction, et.al the role of water cannot be overemphasized. The necessity of water to man is what mandated the need for water storage in order to be able to curtail water scarcity. Hence, in the process of storing water for domestic and industrial uses as well as other usefulness linked to water, the most preferred storage apparatus for conserving water is plastic tank; a 20th century innovation that came into being to replace metallic tanks. Plastic tanks are more preferred as a result of the cost differences between the metallic and plastic tanks, the durability of the plastic tanks, colour choices, non-corrosiveness of the plastic tanks *et.al.* all of which are not peculiar to the metallic tanks. With the fast rising population in Nigeria and globally, the need for water and storage is inevitably pertinent.

Therefore, this will futuristically bring about more preferences for plastic water tanks and certain percentage of the plastic water tanks would crash and land in the built environment. However, for every good thing, there is the other side that may seem infinitesimally invisible; yet, more often than not, conspicuous to the creative catalysts –artists.

Plastic tanks are easily igneous, as they have low fire-resistance and having the potentials of imbibing heat which may weaken the stored water temperature and after a period of time, the plastic, having been weakened by weather attacks, especially, if exposed to reoccurring sunlight, may end up crashing. It is through this ordeal, many broken plastics usually end up in the built environment. As non-biodegradable as the plastics are, sooner or later, the broken plastics in the built environment could be harbor for species of wild creeping reptiles which could potentially endanger the dwellers in the built environment or the discarded plastics could eventually find its route into a nearby drainage and obstruct free flow of water into the drainages.



Plate 4: A view of collapsed storex water tank
Source: Authors' field survey

Meanwhile, in recycling plastics, there are different processes through which it can be achieved.

Recycling of non-biodegradable wastes such as plastic are phased in either primary, secondary tertiary and quaternary as theorized in (ASTMD, 2000 and Sachin, *et.al*, 2011)

2.5 Theoretical Framework

This experimental study is anchored on the formalism theory.

2.5.1 Formalism Theory: This theory gained its existence in 1905. It was propounded on the assumption that an artwork's value lies in the relationships it establishes between different compositional elements ranging from colour, line as well as texture which are to be exonerated above the notions, context and/or the subject matter of the artwork. This theory exonerates an artwork's form (physical shape, outlook, etc.) more than the thematic connection attached to the work. The most prominent exponent for this study is Clement Greenberg.

Just as its name connotes, formalism is a term having its derivation from form. Form manifests itself to be a shape or visible structure of a thing or a person. Form concentrates on both the length, breadth, and width of any shape or objects. These are major features formalism considers as important in determining the aesthetic relevance of an art piece.

Consequently, the relevance of the theory to this study is that the experiment deals majorly with form. As it is seen in Plate 5. The outcome of this experimental research comes in an alphabetical form; determined by the mould. The original form appeared quite novel and unaltered; which if exposed to further artistic doctoring, would unearth a more intricate form and aesthetically appealing.

3.0 METHODOLOGY

Being an applied research, this research takes place within a controlled studio setting; hence, this study purely gains its execution from studio experiment; by chronicling procedures and on site experience cum observations on improvising the skyrocketed casting materials with the use of discarded plastic items subjected to tertiary recycling, in order to establish a model that will instill a practicable knowledge on art students; especially those who specialize in sculpture. We have the plastic wastes as our experimental variable which we subjected to tertiary recycling through heating process

3.1 Plastic Heating Alternatives

There are different ways through which plastic can be dissolved into liquid or otherwise known melting. Few of the common ones are: the indigenous approach of using locally found fire woods while others are more of contemporary approaches ranging from the use of heat gun, oven, kiln, electric stove, among others. For this applied research, the indigenous approach of heating the plastic with the use of firewood was adopted by researchers. On the other hand, melting plastics to liquid can also be done chemically with the use of a chemical called acetone. Which unfortunately is skin irritant.

3.1.1 Experiment Terminologies:

Mould vs Mold: The terms have the same meaning with dissimilar literary origins. The former is an American English term while the latter is a term.

Mold vs Cast; In sculpture, sometimes, sculpting a model or any conceptual composition usually begins with temporary materials such as clay and equals, hence, it may be required the modeled piece be reproduced into a permanent form in order to retain

the piece, to avoid redoing it all over, hence molding and casting becomes a necessity. While a mold is regarded as the hollowed or negative created around a piece crafted for the purpose of creating carbon copies or mass production; casting manifests itself as the process of creating the positive form of a masterpiece using the mold through various casting media such as bronze, plaster of Paris, fibre glass, cement, improvised liquids, bonded bronze, et.al

Storex Plastic: One of the plastic manufacturing brands in Nigeria producing water storage plastic tanks of dissimilar sizes and forms.

3.1.2 Experiment Aids:

For the seamless execution of the experimental research, some items played significant roles to foster it. Such items are: Tools: Hack saw, Knife, Scooper, cement, Cast pot, Separator(oil), bristle brush, Scrapper, Glove, Eye protector (goggle), et.al

3.2 Results



Plate 5: The outcome of the mold casting with plastic solution

Being an applied research, the experiment which was carried out in an open space went almost cumbersome to inform the following discoveries:

- The cold format of the melted plastic cast came out with coarse texture which does not give a ready to use result. Hence, there is a need for post cast smoothening in order to give the intended shape.
- During melting there was an irresistible experience of bubble blast and raising of the liquid at high temperature which evidently did ignite hence endangered the sculptors to an extent; protective gear was what came to rescue.
- The research also did inform that if the firing could not maintain process of 150°Celsius to 180°C (385°F) one would experience lumps of undissolved plastic in the middle of the liquid. Hence, the heat has to be on high temperature to avoid lumpy plastic solution.
- The dioxin fumes from the melting of the plastic smell ostensibly and could be hazardous if inhaled for too long
- Ventilation is of importance during melting procedure as the first attempt of melting the discarded plastic was done in an enclosed studio which caused stuffiness and caused the entire studio to be choky and unhealthy.
- Indigenous materials used for the heating processes are economical compared to having to use contemporary means such as gas furnace and equals.
- The use of fume-filtering respirator is necessary while heating plastic for liquid solution. A nose cover was uses as alternative
- The mold is liable to be broken if care is not taken as a result of the heat

- There is a need to be around the heating pot to control the escape of fire from the firewood in order to curtail it from entering the main heatproof pot for ignition.
- The experiment also did inform that the mold used which was cement mold couldn't contend and absorb the heat hence, the mold got broken; hence it couldn't be reused.

3.3 Results from Interview and Groupthink Discussions

The study also interrogated the students of the department of Art and Design department, the Federal Polytechnic, Ilaro on challenges encountering the students academically. The tables below narrate their responses. The interview was organized over a period of 10 weekdays, with about 7 students interviewed randomly on a daily basis; totaling 70 students indiscriminately selected from about 129 students of the department. The respondents cover the 54.2% of the entire students' population in the department. The selection of the respondents varied as a result of the varying population of each of the levels.

Summary of interviewed students (respondents):

Table 1: Numbers of interviewed students

Level	Respondents		Number of selected respondents per class
	Male	Female	
ND I	27	3	30
ND II	23	4	27
HND I	4	2	6
HND II	5	2	7
Total	60	10	70

The results in table 1 show that 70 respondents were randomly engaged for the systematic groupthink discussion cum interview employed in receiving the students' feedbacks. The ND 1 students are the largest number of students interviewed (of course with 58 students, the level has the highest number of students in the department); so, 30 students were selected from the level while 27 ND II randomly selected students were also engaged in the groupthink discussion cum interview. Then 7 HND II and another 6 HND 1 students were also interviewed.

Table 2: Various challenges the students expressed as lethal to their academic productivity

Challenges	Frequency of Respondents	Percentage (%)
High Cost of Art Materials	35	50
Inadequate Electricity Supply	18	25.7
Congested time table	8	11.4
Inadequate Art materials succor during examination	9	12.9
Total	70	100

The table 2 shows the percentage of how the respondents identified four (4) varied critical issues as been lethal to their productivity academically. 50% of the respondents identified the high cost of art materials as a pressing factor they encounter and which dwindles their productivity level academically. Similarly, the 25.7% of the respondents identified inadequate electricity supply as critically absurd. Also, 11.4% of the respondents recognized the overwhelming lectures congested in the lecture time table as a major productivity

wrecking factor; while 12.9% of the respondents decried the aspect of students not getting art materials succors during practical examinations.

It is also of the researchers' opinion that improvisation in art disciplines is of utmost importance as a result of the already incurable skyrocketed art and building materials in the country which adversely has been affecting the productivity of students in art and other disciplines in environmental studies. One of the cases of students finding it difficult to cope is the case of the pioneering student of the sculpture option at the department of art and design, the Federal Polytechnic, Ilaro who almost dropped out as a result of the fear to cope with the hiked prices of art and building materials that would be instrumental for his studies. When interrogated, he lamented soberly how uneasy it has been to afford all the necessary materials for the course. The interview and its results were also in alignment with that of the groupthink discussion we had with few other students from the other two HND options as well as the ND 1 and 2 classes. All of the interviews and group think discussions unearthed complaints and lamentations about the uneasiness facing the students which dwindles their abilities to productively cope in this era of economic mishap that has been responsible for high end inflation and increasing detrimentally the standard of living.

4.0 FINDINGS, CONCLUSION AND RECOMMENDATIONS

4.0.1 Discussions of Findings

The findings/results from the experiment, which is still ongoing, establishes the fact that both melting and leaving the discarded plastic in the built environment are both dangerous. The former affect

the researchers directly while the latter affect mankind generally. The researchers are endangered as a result of the dioxin oozing from the heating process which is actually avoidable through the use of fume-filtering respirator. However, the discarded plastic wouldn't have been good to have littered the built environment; being non-biodegradable item which can jeopardize both the built environment and mankind generally. Similarly, as a result of the broken mould while separating the cold plastic liquid from the mould, the experiment also established the fact that the used concrete mold may not be reliable when planning for a mass production of a particle piece of artwork or item. Hence, it behooves to try another heat repellent mould such as wood; except the mould is only to be used for creating a piece or few units of the artworks.

It is also worthy of note that when considering large quantity of plastic liquid, the use of a larger heatproof pot is of importance; otherwise one has to be doing the heating in bits which may detrimentally cause wastage of time, energy, revenues, resources, et.al. The heat from logs of woods that will melt a small portion of plastic can also be used to melt few more plastics which will curtail time and other species of wastage.

Considering the results from the one-on-one interviews and the groupthink discussions, the researchers were prompted to come together and delve into various means and channels through which some of the materials could be improvised and still give similar and/or better results. This birthed this study and others to come.

4.0.2 Conclusion

This study has been able to put to pen a tertiary recycling in art aimed at converting the discarded

non-biodegradable wastes unearthed from the built environment to something of more significant and aesthetic use. Which validates another way art contributes its quota in ensuring a safer environment. It responded to both the hapless environmental degradation in the built environment of the polytechnic premises by mining the non-biodegradable wastes and dissolving them for a better use that would benefit the inhabitants of the built environment as well as responding to striking call of help from art scholars who are now finding it difficult to bear the cost implication of the required materials for their studies.

4.0.3 Recommendations

This study further advocated the need for both government and non-governmental organizations to be aware of the inconveniences students are facing currently in the country and the need to avail succour to students and schools studying practical and vocational disciplines like art and other disciplines in environmental studies.

With the present economic mishap in the country, art educators must rise up to the need to embrace the use of improvisation by their students since the contemporary materials are currently on the high end so as to make learning less cumbersome for the department. Hence, encouraging the use of improvised materials is of necessity which will bring down the cost of procuring imported materials

Similarly, there is a need for government and management of tertiary institutions offering art related courses to support the students with art materials both during examinations and coursework to augment them and improve their productivity level.

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