International Academic Research Consortium Journals (IARCJ)
International Journal of Food Science, Tourism & Home Economics
ISSN: 2360-9317. Volume 8, Issue 5
PP 32-44, November, 2024
DOI: 427251-39265-0852
arcnjournals@gmail.com
https://arcnjournals.org

EVALUATION OF PHYSICAL PROPERTIES OF ECOLOGICAL BRICKS MADE FROM TAILOR WASTE FABRICS, DISCARDED GARMENTS AND THE PROTOTYPE LAMPSHADE PRODUCED

ODUMS, Chinonso, Princewel; SOMBO, Seember, Shukura & AIZE, Deborah, Enene
Department of Family and Consumer Sciences
College of Food Technology and Human Ecology
Joseph Sarwuan Tarka University, Makurdi-Nigeria

***Abstract**: In the pursuit of sustainable development and innovative solutions being crucial to bridge the gap between current practices and a more sustainable future, one area ripe for exploration is the repurposing of waste materials to create functional and environmentally friendly products. Textile wastes such as discarded garments and tailor wastes, have always been a significant environmental burden, contributing to landfill overflow and resource depletion. The premise of this study lied in the recognition of two pressing challenges; the abundance of textile waste and the imperative to adopt sustainable practices. Evaluation of physical properties of ecological bricks made from tailor waste fabrics, discarded garments and the prototype lampshade produced. The study was guided by four research objectives. Prototype samples of waste fabric bricks were prepared in the ratio 50:50, 60:40 and 70:30 and vice versa for waste fabric fillers to starch matrix. The samples were molded and the physical properties such as compressibility, bulk density and moisture absorption were determined accordingly. A sample B2 was also used to produce a prototype lampshade and was assessed by panelist because of its water absorption properties and compressive stress results. Results from the studies showed that Sample Ac (control) has the highest compressive stress at 66.93 MPa, Samples A1, A2, and A3 have slightly lower compressive stress values ranging from 62.85 to 62.90 MPa, Samples B1, B2, and B3 have significantly lower compressive stress values compared to the control and samples A1-A3, ranging from 31.03 to 85.19 MPa. The findings also showed Sample Ac has a mass of 270g, Samples A1 and A2 had a mass of 200g each, Samples A3, B1, and B2 have masses ranging from 250g to 255g and Sample B3 has the highest mass at 300g.the results also showed sample Ac has a bulk density of 0.038 g/cm³. Samples A1 and A2 have a bulk density of 0.028 g/cm³ each, Sample A3 has a bulk density of 0.035 g/cm³, Samples B1 and B2 have a bulk density of 0.035 g/cm³ each and Sample B3 has the highest bulk density at 0.042 g/cm³. The acceptability tests showed Functional attributes 3.50 Agreed, Aesthetic attributes 2.91 Agreed, Environmental Impact 4.40 Agreed, Income generation 3.20 Agreed, Ease of raw materials 4.10 Agreed, Satisfaction and willingness to use 2.50. The study concludes that this research has shed light on the multifaceted aspects of utilizing waste materials in eco-friendly product design and highlights the economic and environmental significance of utilizing waste fabrics and discarded garments in sustainable product development. By leveraging these materials. The study recommends that through collaborative efforts and innovative approaches, a better sustainable future can be formed*

***Keywords:** Innovation solutions, Ecological bricks, Environmental sustainability, Recycled fabrics.*

1.0 INTRODUCTION

Ecological bricks or sustainable bricks are bricks made from waste materials usually pre-consumer, post-consumer and industrial textile wastes such as fabrics and discarded clothing. The bricks are formed by mixing waste fabrics materials with a binding agent and then subjecting the mixture to a process of compression or heat treatment (Ispara *et al*., 2023). The concept is for non-degradable materials to be repurposed into functional products. Textile fabric wastes and discarded garments are used as a filler material in making these bricks with suitable ecofriendly binding agents. These bricks may be used in civil engineering-based products for building designs and structures, thermal insulation but functional and aesthetics to interior and exterior spaces. Textile fabrics are woven not only by interlacing natural fibres but also with synthetic fibres and terminology is a blended fabric, means natural fibers and manmade fibers are used together because of which clothes cannot be 100 % biodegradable and can cause hazardous effects to environment thus making economic and environmental sustainability an issue. The textile and clothing industry is a significant driver of the global economy and job creation. However, it is also a major contributor to environmental pollution. The transition from handloom to power loom, along with the availability of low-cost materials and large-scale production, has led to the proliferation of Fast Fashion (Richa & Ashok, 2023). This model focuses on reducing lead times and purchasing cycles by introducing new designs and patterns each season to keep up with trends and meet consumer demands.

Clothing nowadays has shorter lifespan. According to Richa and Ashok (2023), clothing purchases will reach 100 million tonnes by 2030, exceeding the current level of around 60 million tonnes. The proportion of natural fibers is declining, while synthetic fibers are on the rise, constituting over 70% of the total. Textile production is projected to consume 300 million tonnes of fossil fuels and contribute 26% of carbon emissions by 2050, marking a significant increase of 206% and 1200% respectively from 2015 levels (Leal et al., 2019). According to Richa and Ashok (2023), polyester fiber holds more than 54% of the global fiber production market share but despite a slight decrease in output due to COVID-19 in 2020, global polyester fiber production rebounded from 57 million tonnes to 61 million tonnes in 2021. Fabric wastes and discarded garments to a large extent contribute to landfills. These fabrics can be recycled allowing for the recovery of fibers and energy for new production of household and engineering structures and articles at the same time reduce environmental risks and hazards caused by disposing them into the environment. According to Richa and Ashok (2023), if circular economy techniques are properly implemented, they have the potential to reduce global greenhouse gas (GHG) emissions by more than a third and lower resource consumption by over a quarter.

According to Li et al., (2021), the current recycling rates for disposed textiles are relatively low in most developing countries of the world. Developed countries typically recycle around 16% of their disposed textiles, while in developing countries, only 10% or less are properly recycled. The studies of Ellen MacArthur Foundation showed that nearly 97% of clothing materials come from virgin resources, with only 1% of the 3% of recovered materials being recycled textiles (Li et al., 2021). An alternative to total recycling is repurposing the Waste fabrics and discarded garments into product designs that are eco-friendly to man. This will improve the environmental safety at the same time provide economic growth to the society since the materials will be readily available and less energy and resources will be spent in such process. These fabric wastes and discarded garments materials can also find a major application in brick production for thermal insulation in engineering and interior design projects. The compressive strength of bricks is highly dependent on the cement-sand mix ratio, physical characteristics (specific gravity, moisture content, etc.) of the sand used, size and shape of the block, curing method, mode of production (hand ormachine vibrated mould), and the water quality (Yusuf and Hamza, 2011; Akpokodje and Uguru, 2019). Water-cement ratio and water quality are important factors to be considered, since they strongly influence the final strength properties of the bricks (Adewumi et al., 2016; Akpokodje and Uguru, 2019). Despite their comparative lower strength properties, when compared to steel and synthetic fibres, sandcrete blocks are gaining popularity inbuilding and construction companies due to their higher resistance to rusting and crumbling, cheapness, and non-hazardous nature (Odeyemi et al., 2015; Esegbuyota etal., 2019).

Waste apparel materials polyester, polyester cotton (PC), and polyester viscose (PV). According to Ispira et al., (2023), subjecting a clay mixture to various treatments, with modifications based on the material type, manufacturing technique, and desired characteristics of the final product, weight measurements of waste apparel added to bricks and assessed on the physical characteristics of the resulting bricks, with a particular emphasis on compressive strength and water absorption. The experimental results revealed that the addition of 25 g of PC, PV, or polyester to a brick resulted in a remarkable 45 percent increase in compressive strength while simultaneously reducing water absorption. However, the investigation also demonstrated that exceeding a certain amount of textile waste in the brick composition can lead to a decline in compressive strength compared to the original results. Thus, a careful balance must be struck when incorporating waste apparel to achieve optimal improvements in brick performance.

This research focus on harnessing the waste fabrics bricks produced from tailor wastes and discarded garments and the prospects for economic and environmental sustainability using a prototype lampshade as a product. The emphasis is on fostering production of eco-friendly materials which can be used in interiors or exterior spaces at the same time providing source of income and entrepreneurial benefits to the society. The specific objectives of the study were to;

i. Develop ecological brick prototypes from fabric wastes and discarded garments
ii. Determine compressive stress of waste fabric bricks, developed from fabric wastes and discarded garment
iii. Ascertain the bulk density
iv. Determine the moisture absorption capacity of ecological bricks prototype from fabric wastes and discarded garments
v. Evaluate the acceptability of the attributes of a prototype lampshade designed with ecological bricks from fabric wastes and discarded garments

The study has several potential significances, including environmental, economic, social, and practical contributions. Here are some key areas of significance: By reusing tailor waste fabrics and discarded garments to produce ecological bricks, the study addresses textile waste, which is a significant contributor to global landfill and pollution issues. It offers an eco-friendly solution that reduces waste and promotes sustainable waste management practices. Using waste materials for construction purposes could lead to a decrease in the demand for conventional building materials, thus conserving natural resources and minimizing environmental degradation.

The research explores a novel approach to creating ecological bricks, contributing to the growing field of sustainable construction materials. If the bricks demonstrate favorable physical properties (such as durability, insulation, and load-bearing capacity), they could become a viable alternative to traditional bricks in eco-conscious construction projects. The development of these ecological bricks may inspire further research into alternative, recycled materials for building, contributing to advancements in sustainable construction. Using inexpensive waste materials could make ecological bricks a cost-effective alternative for construction, especially in regions with limited access to conventional materials. This could reduce the overall cost of construction projects, making affordable housing and infrastructure projects more feasible. If the process of manufacturing these bricks from textile waste can be scaled, it may create new job opportunities in recycling and eco-friendly manufacturing sectors.

By converting textile waste into useful construction materials, the study promotes circular economy principles, where materials are reused and repurposed rather than discarded. This resource-efficient approach helps reduce the strain on landfills and incineration plants while extending the lifecycle of textile products. Such initiatives also raise awareness of the value of recycling and encourage industries to rethink waste as a resource, potentially inspiring broader sustainability initiatives across sectors. The prototype lampshade made from the same materials represents an additional application of recycled textile waste, indicating potential for aesthetically pleasing and functional products. This highlights the versatility of textile waste as a material that can be adapted to various design purposes. By creating functional and attractive interior decor items from waste, the study demonstrates how sustainable materials can be both eco-friendly and marketable, appealing to environmentally-conscious consumers.

This study's findings could have positive social implications, particularly in communities where textile waste and construction material shortages are prevalent. Local production of ecological bricks from textile waste can empower communities by providing them with a self-sustaining resource for building materials. Involving communities in the collection and transformation of textile waste into useful products could promote environmental responsibility and raise awareness about sustainable practices at the grassroots level. In summary, this study has the potential to contribute to sustainability in construction, reduce waste, and promote circular economy principles while also offering economic and social benefits through innovative, cost-effective, and eco-friendly applications of textile waste.

2.0 MATERIALS AND METHOD

2.1 Research Design

The research adopted an experimental research design.

2.2 Procurement of Materials

Waste fabrics and tailor wastes were gathered from households and commercial tailors in Makurdi local government area. While commercial starch was purchased from Wadata market in Makurdi. The research was carried out in the textile recycling laboratory in the Department of Family and Consumer Science, Joseph Sarwuan Tarka University, Makurdi.

2.3 Materials Used

i. Starch resin
ii. Acetic acid
iii. Waste Fabrics
iv. Mould
v. Wire
vi. Lampholders
vii. Switch
viii. Wire guaze

2.4 Production of ecological bricks

The fabrics were mechanically shred and weighed accurately. Commercial starch was modified with 0.1% acetic acid to inhibit the growth of bacteria and improve the starch binding efficiency. The starch served as the binder while the shredded fabrics were the filler. Two standard moulds were designed (one for physical tests and the other for final product development). The best formulation from the physical tests were used for the final product development. The formulation used to mix the starch and fabric is shown in table 1 below while figure 1 shows the flow chart for the production of the ecological bricks.

Table 1: Ratio combination for waste fabric bricks prototype samples

Sample	Fabrics filler	Starch resin
Ac	50	50
A1	60 ↓	40
A2	70	30
A3	80 ↓	20
B1	40	60
B2	30	70
B3	20	80

Key: Ac, A1, A2, A3, B1, B2, B3 are sample formulations where Ac is the control sample

Figure 1: Flow chart for development of ecological bricks and lampshade from fabric wastes and discarded garments

2.5 Functional properties of waste fabric brics

The compressive strength of waste fabric brick prototypes were measured in accordance with America Standard Testing Materials (ASTM) International procedures.

The compressive strength: compression testing machine *model: STYE 2000*)

a. Compressive stress = $\frac{crushing\ farce}{net\ crossectional\ area\ of\ brick}$..................1

b. Bulk Density = $\frac{Mass\ of\ waste\ fabric\ brick}{Volume\ of\ waste\ fabric\ brick}$ 2

c. Moisture Absorption Capacity = $\frac{Ma-M}{Mb}$ x100 3

Where *Ma = weight of waste fabric brick before soaking in water*
Mb = weight of waste fabric brick after soaking in water

2.6 Instrument for Data Collection

A questionnaire and an assessment form were used for data collection

i. Assessment form titled “Waste fabric bricks functional properties form” (WFBFF) which was used to record the values of the physical tests conducted on the bricks

ii. Assessment form titled “Waste fabric bricks solution” (WFBSF) which was used by panellist for the acceptability test conducted on the prototype lamp shade designed with ecological bricks from fabric wastes and discarded garments

Acceptability test: An expert panelist consisting of six (6) academic staff and (3) technologist in the Department of Family and Consumer Sciences for functional and aesthetic properties, environmental impact, income generation, ease of raw materials and satisfaction. The assessment was carried out on a four-point scale. Items were generated on a four-point scale of Strongly Agree (SA) to strongly disagree (SD). A mean of 2.50 was used for attributes agreed while items less than 2.50 were disagreed.

2.7 Data Analysis Technique

The data obtained from the acceptability tests were analyzed using descriptive statistics of means. The values for compressive stress, bulk density and water absorption were generated in triplicates and analyzed using descriptive means.

3.0 RESULTS AND DISCUSSION

Plate 1: Ecological brick prototypes from fabric wastes and discarded garments

Plates 1: Prototype samples of ecological bricks and prototype lampshade

Table 2. Compressive stress of waste fabric bricks

Sample	Volume (cm^3)	Mass (g)	Area (cm^2)	Compressive stress (mpa)
Ac	7150	270g	0.0493	66.93
A1	7150	200g	0.0493	62.88
A2	7150	200g	0.0493	62.85
A3	7150	250g	0.0493	62.90
B1	7150	250g	0.0493	31.03
B2	7150	255g	0.0493	85.19
B3	7150	300g	0.0493	85.13.

Values are volume, area, compressive stress and average compressive stress triplicate mean values of bricks. Ac, A1, A2, A3, B1, B2, B3 are sample formulations where Ac is the control sample**.**

Table 3: Bulk density of ecological bricks

Sample	Initial mass (g)	Final Mass (g)	Density (*P*) g/cm^3	Moisture absorption (%)
Ac	270	293	0.038	23
A1	200	253	0.028	53
A2	200	250	0.028	50
A3	250	279	0.35	29
B1	250	277	0.35	27
B2	250	280	0.36	30
B3	300	350	0.42	50

Values are volume, area, compressive stress and average compressive stress triplicate mean values of bricks. Ac, A1, A2, A3, B1, B2, B3 are sample formulations where Ac is the control sample

Table 4: Moisture absorption capacity of ecological bricks

Sample	Initial mass (g)	Final Mass (g)	Density (*P*) g/cm^3	Moisture absorption (%)
Ac	270	293	0.038	23
A1	200	253	0.028	53
A2	200	250	0.028	50
A3	250	279	0.35	29
B1	250	277	0.35	27
B2	250	280	0.36	30
B3	300	350	0.42	50

Values are volume, area, compressive stress and average compressive stress triplicate mean values of bricks. Ac, A1, A2, A3, B1, B2, B3 are sample formulations where Ac is the control sample

Table 5: Acceptability of the attributes of a prototype lampshade

S/No.	Lamp shade Attribute	Mean	Remarks
1	Functional attributes	3.50	Agreed
2	Aesthetic attributes	2.91	Agreed
3	Environmental Impact	4.40	Agreed
4	Income generation	3.20	Agreed
5	Ease of raw materials	4.10	Agreed
6	Satisfaction and willingness to use	2.50	Agreed

Values are volume, area, compressive stress and average compressive stress triplicate mean values of bricks. Ac, A1, A2, A3, B1, B2, B3 are sample formulations where Ac is the control sample

4.1 Discussion of Results

The volume of each sample is consistent at 7150 cm^3, indicating that the amount of material used for each sample is the same. Similarly, the area of each sample is consistent at 0.0493 cm^2.The compressive stress values vary across the different samples. Sample Ac (control) has the highest compressive stress at 66.93 MPa, Samples A1, A2, and A3 have slightly lower compressive stress values ranging from 62.85 to 62.90 MPa. Samples B1, B2, and B3 have significantly lower compressive stress values compared to the control and samples A1-A3, ranging from 31.03 to 85.19 MPa. The compressive stress values suggest that varying the proportions of fabric filler and starch resin in the samples has an impact on their compressive strength. Samples with higher fabric filler content (A1-A3) tend to have slightly lower compressive stress compared to the control, while samples with higher starch resin content (B1-B3) exhibit a wider range of compressive stress values, with some samples (B2 and B3) having significantly higher compressive stress compared to the control. The compressive stress results are crucial for evaluating the suitability of these waste fabric bricks for structural applications, such as in the production of lampshades.

The compressive stress values indicate the load-bearing capacity of the waste fabric bricks. Higher compressive stress values show greater structural integrity, which is essential for ensuring that the bricks can support the weight of a lampshade or any other load they may encounter. The compressive stress of the prototype bricks, you can gauge how well they perform under pressure. This information is vital for determining whether the waste fabric bricks meet the required standards for use in sustainable construction practices, aligning with the ecological focus of your research. The results in table 1 shows the suitability of the bricks for supporting structures and products just like the lampshade and ensures its stability and durability. Incorporating waste fabrics and discarded garments into the production of ecological bricks not only offers potential economic benefits by reducing material costs but also addresses environmental concerns by diverting textile waste from landfills. The compressive stress results contribute to evaluating the economic viability and environmental sustainability of this approach in sustainable development initiatives

The masses, bulk density and water absorption capacity of the prototype bricks. Sample Ac has a mass of 270g, samples A1 and A2 have a mass of 200g each, and samples A3, B1, and B2 have masses ranging from 250g to 255g while Sample B3 has the highest mass at 300g. The variation in mass across samples can be attributed to differences in the composition of waste fabrics and discarded garments used in the formulations. This variation may impact the mechanical properties and performance of the bricks, including compressive strength and durability.

Sample Ac has a bulk density of 0.038 g/cm^3, samples A1 and A2 have a bulk density of 0.028 g/cm^3 each, sample A3 has a bulk density of 0.035 g/cm^3, samples B1 and B2 have a bulk density of 0.035 g/cm^3 each, and sample B3 has the highest bulk density at 0.042 g/cm^3

The Bulk density reflects how densely the waste fabric materials are packed within the bricks. Higher bulk density indicates a higher mass of material within a given volume, suggesting a denser and potentially stronger brick. However, excessively high bulk density indicate poor porosity, which could affect factors such as thermal insulation and moisture resistance. Lower mass and bulk density values indicate more efficient use of waste materials, potentially reducing production costs and environmental impact. Higher mass and bulk density generally correlate with higher compressive strength, which is essential for ensuring the structural integrity of applications such as lampshades or construction materials.

The moisture absorption values showed sample Ac 23, sample A1:53.sample A2: 50, sample A3: 29, sample B1:27, sample B2: 30 and sample B3:50. The moisture absorption values indicate the ability of the waste fabric bricks to absorb moisture from the surrounding environment. Higher moisture absorption values suggest greater moisture sensitivity, which can have implications for the durability and long-term performance of the bricks, particularly in humid or wet conditions. Excessive moisture absorption can lead to dimensional changes, weakening of the material, and potential degradation over time. Understanding the moisture absorption behavior of the waste fabric bricks is essential for assessing their stability and suitability for various applications, including lampshades or construction materials. Moisture absorption can influence various properties of the bricks, including mechanical strength, thermal conductivity, and insulation properties. High moisture absorption may compromise these properties, affecting the overall performance and effectiveness of the bricks in their intended applications. Materials with lower moisture absorption may require less maintenance and replacement, leading to reduced waste generation and environmental impact over their lifecycle. This is similar to findings of Agbi et al., (2020), Results from the compressive strength tests showed that all the sandcrete blocks were substandard, as they fall below the minimum permissible compressive strength value recommended by Nigeria Industrial Standard (NIS-87). From the results, the mean compressive strength ranged from 0.653 Nmm^{-2} to 1.203 $Nmm^{-2.}$ Production of eco-bricks from fabric wastes extended the research of Ispira *et al*., (2023). The findings open up possibilities for utilizing discarded clothing as a reinforcement in conventional brick production, highlighting its potential as a viable and environmentally friendly solution. By diverting waste apparel from landfills and utilizing it in construction materials, this approach offers a sustainable method for enhancing the properties of bricks while reducing environmental impacts. In conclusion, this study provides valuable insights into the incorporation of waste apparel into conventional brick manufacturing, presenting a novel avenue for enhancing brick performance and promoting a more eco-conscious approach to construction practices.

The acceptability test results from the panelists provided valuable insights into various attributes of the prototype lampshade designed with ecological bricks from fabric wastes and discarded garments. The Functional Attributes (Mean: 3.50) generally agreed on the functional attributes of the lampshade. This suggests that the lampshade effectively serves its intended purpose and meets functional requirements such as providing illumination, shade, or ambiance. The Aesthetic Attributes (Mean: 2.91) showed that there is slightly lower agreement on the aesthetic attributes of the lampshade. This may indicate that there are aspects of the design or appearance that could be improved to enhance its visual appeal and attractiveness. Environmental Impact (Mean: 4.40), indicated strong agreement among the panelists regarding the lampshade's positive environmental contribution. This aligns well with the focus of your research on sustainable development, highlighting the significance of utilizing waste fabrics and discarded garments to create eco-friendly products. Income Generation (Mean: 3.20), showed the potential for income generation associated with the lampshade. This suggests that they recognize the economic viability and potential market demand for products made from ecological bricks, which could contribute to sustainable livelihoods and economic development. Ease of Raw Materials (Mean: 4.10), The high mean score indicates that the panelists perceive the lampshade as easy to manufacture using raw materials sourced from waste fabrics and discarded garments. This reflects positively on the feasibility and practicality of the production process, supporting the scalability and widespread adoption of sustainable manufacturing practices. Satisfaction and Willingness to Use (Mean: 2.50), the relatively lower mean score suggests that there may be some reservations or concerns among the panelists regarding their satisfaction and willingness to use the lampshade. This could be due to factors such as design preferences, functionality, or other personal considerations that may vary among individuals. This was supported by the findings of Awomeso *et al*., (2010), that there should be private participation in managing wastes in the developing nation. Since the largest percentage of wastes in developing countries is mainly organic, composting of wastes should be encouraged.

4.0 CONCLUSION

Based on the major findings of this study, the exploration of ecological bricks derived from waste fabrics and discarded garments represents a promising avenue for sustainable development initiatives. Through the production and evaluation of a prototype lampshade, this research has shed light on the multifaceted aspects of utilizing waste materials in eco-friendly product design. The physical properties analysis revealed valuable insights into the structural integrity and material efficiency of the waste fabric bricks. Variations in compressive stress, density, and moisture absorption underscore the importance of careful formulation and manufacturing processes in achieving desirable material properties. These findings emphasize the potential for waste fabric bricks to serve as viable alternatives in sustainable construction practices, aligning with the objectives of eco-friendly building materials. The acceptability test results from the panelists provided crucial feedback on the attributes of the prototype lampshade. While the lampshade demonstrated strong agreement in functional aspects and environmental impact, areas such as aesthetic appeal and user satisfaction warrant further attention. Addressing these aspects through iterative design improvements and user-centered approaches can enhance the market acceptance and desirability of products made from ecological bricks.

5.0 RECOMMENDATIONS

i. Further research and experimentation should be conducted to optimize the formulation of waste fabric bricks, taking into account the desired physical properties such as compressive strength, density, and moisture absorption. Fine-tuning the proportions of fabric filler apart from starch resin to achieve a proper balance between structural integrity and material efficiency.

ii. From the agreement on aesthetic attributes in the acceptability test, efforts should be directed by researchers and manufacturers towards enhancing the visual appeal of products made from waste fabric bricks by researchers and engineers. This will involve exploring innovative design concepts, surface finishes, or decorative elements to make the products more attractive to consumers.
iii. Outreach initiatives, workshops, and educational programs will raise more awareness among stakeholders, including designers, architects, builders, and consumers, thereby fostering greater acceptance and demand for eco-friendly materials such as waste fabric bricks
iv. Collaboration across sectors, including academia, industry, government, and non-governmental organizations, is essential for advancing research, innovation, and market adoption of waste fabric bricks. Establishing collaborative partnerships can facilitate knowledge exchange, resource sharing, and collective action towards sustainable development goals.
v. Governments and regulatory bodies play a crucial role in incentivizing the use of eco-friendly materials and practices through policy frameworks, incentives, and regulations. Policymakers should consider implementing measures such as tax incentives, green building certifications, and procurement policies that promote the use of waste fabric bricks in construction and manufacturing.
vi. Continuous monitoring, evaluation, and refinement of production processes and product performance by researchers are essential for ensuring the ongoing quality and sustainability of waste fabric bricks. Adopting a lifecycle approach, including assessment of environmental impacts, resource efficiency, and end-of-life considerations, can guide continuous improvement efforts and support the transition towards a circular economy.

REFERENCES

Agbi, G. G., Akpokodje, O. I. & Uguru, H. (2020). Compressive strength of commercially produced sandcrete blocks within Isoko Metropolis of Delta State, Nigeria. *Turkish Journal of Agricultural Engineering Research* (TURKAGER), 1(1): 91- 103.

Agbi, G. G., & Uguru, H. (2021). Assessing the impact of cassava starch on the structural properties of sandcete blocks produced from recycled paper. *Saudi J Eng Technol*, *6*(5), 99-103.

Akpokodje, O.I. & Uguru, H. (2019). Effect of fermented cassava waste water as admixture on some physic-mechanical properties of solid sandcrete blocks. *International Journal of Engineering Trends and Technology* (IJETT), 67(10): 216 – 222.

Atikpo, E. & Ukala, D.C. (2018), Performance evaluation of building blocks produced from recycled waste paper. Journal of the Nigerian Association of Mathematical Physics, 46:395-398

Awomeso J. A., Taiwo A. M.., Gbedebo A. M. & Arimoro A. A. (2010). Waste disposal and pollution management in Urban areas: A workable remedy for the environment in developing countries. *Am. J. Environ. Sci*., (6): 26-32.

Harmsen P, Scheffer M, Bos H. (2021). Textiles for circular fashion: the logic behind recycling options. Sustainability. 13: 9714.

Ispara Xavier, S., Divahar, R., Aravind Raj, P. S., Adarsh, P. J., Manoj, A., & Jalal, B. (2023, August). Manufacturing of Eco-Friendly Brick Using Wasted Textile Apparel. In *International Conference on Smart Sustainable Materials and Technologies* (pp. 153-164). Cham: Springer Nature Switzerland.

Leal Filho W, Ellams D, Han S, Tyler D, Boiten VJ, Paço A et al., (2019). A review of the socio-economic advantages of textile recycling. *J Cleaz Prod*. 218: 10-20.

Li W, Wei Z, Liu Z, Du Y, Zheng J, Wang H et al., (2021).Qualitative identification of waste textiles based on near-infrared spectroscopy and the back propagation artificial neural network. *Text Res J.* 91: 21-25.

Khulbe R, Athalye A. (2023). Developments in Recycling of Polyester Textile Waste. *Adv Res Text Eng.* 2023; 8(2): 1084

Sorout, J., Raj, S., Kaur, D. P., & Lamba, P. (2023). Waste-Based Bricks: Evaluation of Strength Behaviour of Bricks Containing Different Waste Materials as an Additive. *Water, Air, & Soil Pollution*, *234*(7), 424.

Sumo, P. D. (2024). Textile waste management and recycling opportunities and challenges for africa: a mini-review. *The holistic approach to environment*, *14*(2), 57-70.

Sushma R. and Zeba J. (2018). Recycling of Textile waste for environmental protection. *International Journal of Home Science*. 4 (1):164-168)

Rani, S., & Jamal, Z. (2018). Recycling of textiles waste for environmental protection. *Int. J. Home Sci*, *4*(1), 164-168.

Richa K. and Ashok A. (2023). Developments in Recycling of Polyester Textile Waste. *Journal Of Advanced Research in Textile Engineering*. 8(2):1084

Van Beukering, P. J., & Van den Bergh, J. C. (2006). Modelling and analysis of international recycling between developed and developing countries. *Resources, Conservation and Recycling*, *46*(1), 1-26.

Wit M, Hoogzaad J, Ramkumar S, Friedl H, Douma A. (2018). The circularity gap report 2018, circle economy. Shifting Paradigms;