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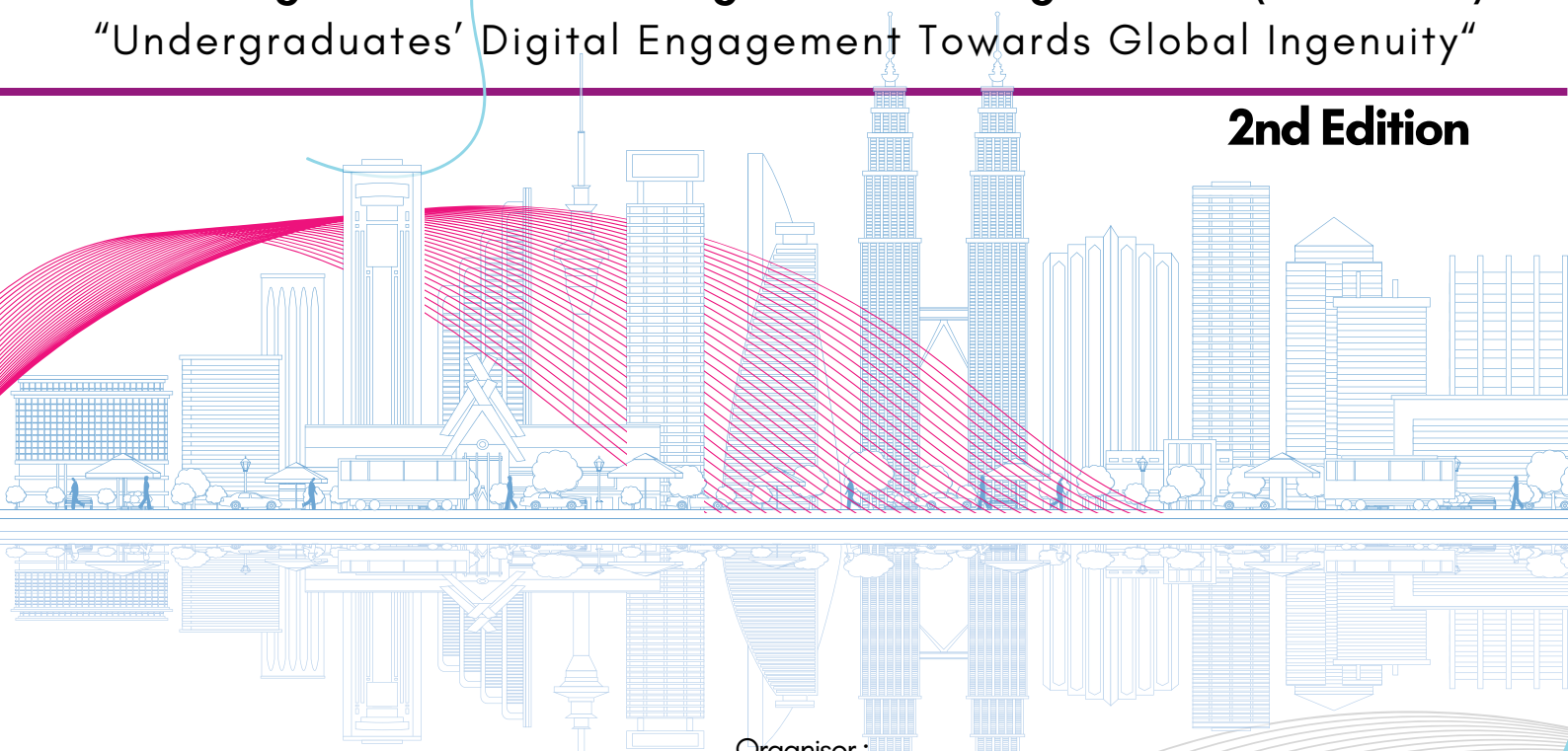
Proceeding for International Undergraduates Get Together 2024 (IUGeT 2024)

"Undergraduates' Digital Engagement Towards Global Ingenuity"

2nd Edition



Organiser :

Department of Built Environment Studies and Technology, College of Built Environment, UiTM Perak Branch

Co-organiser :

INSPIRED 2024. Office of Research, Industrial Linkages, Community & Alumni (PJIMA), UiTM Perak Branch

Bauchemic (Malaysia) Sdn Bhd

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Publication date :

November 2024

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Perpustakaan Negara Malaysia Cataloguing in Publication Data

No e- ISBN: 978-967-2776-42-0

Cover Design: Muhammad Anas Othman
Typesetting : Arial

e-ISBN: 978-967-2776-42-0

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REPLASTISEAT: FOLDING PICNIC STOOL FROM RECYCLED HDPE

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Abstract
Replastiseat is a stool from recycled HDPE that represents an innovative approach to sustainable design, merging functionality with environmental responsibility. This stool is expertly crafted from recycled high-density polyethylene (HDPE), showcasing the potential for creating high-quality, durable products from post-consumer plastic waste. The stool's design emphasises both durability and lightweight portability, making it an ideal companion for various activities, whether indoors or outdoors. By utilising recycled HDPE, Replastiseat not only significantly reduces the environmental footprint associated with virgin plastic production but also actively contributes to waste reduction and promotes circular economy practices. Furthermore, the stool's production process highlights the importance of resource efficiency and environmental stewardship. This project powerfully demonstrates the feasibility and numerous benefits of incorporating recycled materials into everyday products, encouraging sustainability through innovative and responsible design. Replastiseat stands as a testament to how thoughtful design can lead to positive environmental impact while meeting consumer needs.

Keywords: *Recycled HDPE, sustainable design, environmental responsibility*

1. INTRODUCTION

In this era, innovative methods of product design and manufacturing are essential to address the pressing issue of plastic waste, especially as environmental sustainability becomes increasingly crucial. Replastiseat, a folding picnic stool made from recycled high-density polyethylene (HDPE), exemplifies this commitment to sustainability. Replastiseat and similar products demonstrate how post-consumer plastic waste can be transformed into high-quality, functional items, highlighting the growing awareness of the environmental impact of single-use plastics and the importance of recycling. This stool is not only a testament to the potential of recycled materials but also a practical solution for outdoor enthusiasts who value both convenience and eco-conscious choices. Designed for durability, Replastiseat is lightweight and versatile, making it perfect for use in a café or living room, where it also adds an aesthetic touch. By incorporating recycled HDPE into its design, Replastiseat supports a circular economy that repurposes materials to reduce waste and decrease reliance on virgin plastics. This introduction explores Replastiseat's significance within the framework of sustainable design, highlighting the innovative use of recycled materials and its role in mitigating environmental impact.

Its innovative design ensures durability against the challenges of outdoor use while minimising environmental impact. Replastiseat fosters a circular economy by continuously repurposing resources to cut down on waste and reduce dependency on virgin plastics. The impact of different plastics on surface performance, as well as the potential negative environmental and economic consequences of this process, is discussed by Wu and Montalvo (2021). This approach addresses the growing issue of plastic pollution while also conserving natural resources.

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Replastiseat demonstrates how environmentally friendly products can meet consumer demands for sustainability without compromising on design or functionality. By providing a tangible example of how recycled materials can be effectively used in everyday products, it encourages ethical consumer behaviour. Innovations like Replastiseat are crucial for reshaping our consumption habits and fostering a more mindful society as we strive for a better future. This introduction highlights Replastiseat's relevance in sustainable design, emphasising the company's creative use of recycled materials and its role in reducing environmental impact. It sets the stage for a deeper exploration of how Replastiseat not only meets functional needs but also serves as a model for sustainable innovation in product design.

2. MATERIALS AND METHODS

2.1 Materials

These are the details about the materials that will be used:

i. Materials: Recycled HDPE (high-density polyethylene).
ii. Source: Post-consumer HDPE items such as bottles, containers, and packaging.
iii. Non-toxic Pigments: HDPE may be coloured with environmentally acceptable pigments that offer both UV protection and visual variation.

2.2 Methods

These are the methods involved in production:

i. Collect HDPE:

HDPE that has been used once, sourced from recycling programs and waste disposal sites. To ensure the consistency and quality of the recycled material, sort the collected HDPE by category and colour. Effective domestic waste management is crucial for a sustainable environment. This paper introduces a novel waste classification and localisation system for sorting and placing materials into the correct recycling bins (Ellis, 2020).

ii. Cleaning and Shredding:

Ensure that the sorted HDPE is thoroughly cleaned to remove any impurities such as labels, adhesives, and residues. This paper focuses on designing a shredding machine for recycling plastic waste. Prepare the cleaned HDPE by shredding it into small flakes for the recycling process.

iii. Pelletising:

Plastic pelletising is the process of converting waste plastic into clean, usable raw material. These pelletised plastics can then be reused by plastic manufacturing companies in various applications, supporting a closed-loop recycling system. To create pellets, melt the shredded HDPE flakes and extrude them. During this process, the plastic is heated to its melting point, forming small, homogeneous pellets that are manageable and suitable for production. The use of 3D printing is increasingly popular due to its ability to produce complex parts with minimal waste. One of the most common and cost-effective 3D printing techniques is fused filament fabrication (FFF), where parts are built using filament (Kumar, 2022).

iv. Injection Moulding:

Create moulds based on CAD blueprints for each stool component. Use injection moulding equipment with pelletised recycled HDPE to manufacture the stool parts. In the injection moulding process, the pellets are heated to a molten state and then injected into moulds, where they take on specific shapes as they cool and solidify. During injection moulding, the mould and the plasticising area are kept separate. The plasticised material is injected into the clamped mould to form the final components.

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v. **Quality Control:**
Examine each stool for finish, functionality, and durability. Perform load testing to ensure that the stool can support the required weight. Inspect the production process for any defects or errors and adjust the production protocol as needed. The methods described earlier for controlling two related variables can be extended to cases involving more than two related variables (Jackson, 1959).

vi. **Finishing:**
Apply non-toxic paint to the stool's surface components to achieve the desired colour and provide additional UV protection. Ensure that the pigments used are safe for both users and the environment. Achieving a long-lasting aroma finish on textiles has been a long-time goal for textile chemists. Since fragrances are volatile, only microencapsulated aromas can remain on textiles for extended periods, as the capsules significantly reduce aroma evaporation. Textiles with aroma finishes must also be washable (Li et al., 2008).

vii. **Packaging and Distribution:**
Pack the completed Replastiseat in recyclable and recycled materials. Distribute stools to stores and customers, emphasising their sustainability and eco-friendliness in marketing materials. By using these techniques, Replastiseat will showcase the potential of recycled materials in everyday products and offer an eco-friendly and stylish outdoor seating option. This methodology examines the entire distribution chain, from manufacturer to end consumer, and the life cycle from raw material extraction to the waste phase (Svanes et al., 2010).

3. RESULTS AND DISCUSSION

The stool, constructed from recycled high-density polyethylene (HDPE), is designed for durability and is capable of supporting substantial weight. Thanks to HDPE's natural resistance to weather conditions, the stool can be used in various environments, which ensures its longevity and reliability. Moreover, its ergonomic design, featuring a rounded seat and a solid base, enhances comfort and allows users to sit comfortably for extended periods, making it ideal for long-term use. In addition to its durability and comfort, the stool's use of recycled HDPE reduces the reliance on virgin plastic, thereby conserving resources and minimising environmental pollution. Reusing discarded materials supports environmental initiatives and promotes a sustainable manufacturing approach. Initial market feedback highlights high customer satisfaction, emphasising the stool's functionality and sustainable design. Consumers value its environmental benefits without sacrificing convenience or quality. Furthermore, Replastiseat's eco-friendly materials and innovative design offer a unique selling proposition compared to traditional camping stools, which is likely to attract outdoor enthusiasts and environmentally conscious consumers, giving it a competitive edge in the market.

Replastiseat's utilisation of recycled HDPE is one of its greatest advantages, as it supports a circular economy while assisting in plastic waste management. This not only helps reduce environmental impact but also educates consumers on making sustainable choices. Furthermore, the durability of HDPE means that stools made from this material last longer and require fewer replacements over time. The foldable and lightweight design of the Replastiseat enhances its appeal, making it a desirable option for consumers seeking convenience and practicality.

However, some customers may perceive recycled products as lower in quality, so it is crucial to address this misconception through persuasive marketing and demonstrations of the stool's durability and functionality. Moreover, the processes involved in collecting, sorting, and processing recycled materials can sometimes result in higher production costs.

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Therefore, balancing competitive pricing with maintaining quality is essential. The quality of the product and its environmental impact can be further enhanced by investigating new developments in recycled materials. Further exploration into combining recycled HDPE with other eco-friendly materials may yield even more durable and versatile products. Collaborating with environmental organisations and participating in eco-friendly initiatives can also boost brand exposure and credibility, reinforcing Replastiseat's position as a sustainable and appealing choice for a wide range of consumers.

4. CONCLUSION

The Replastiseat stool exemplifies how recycled materials can be effectively used to create functional, durable, and environmentally friendly products. Although there are challenges in shifting consumer perceptions and managing production costs, the stool's strengths and market opportunities indicate a promising future. Emphasising its sustainability and practicality will be crucial for its continued success and growth in the market.

5. ACKNOWLEDGEMENT

We would like to express our heartfelt gratitude to Sir Muhammad Naim Bin Mahyuddin for all your help and guidance. Your dedication and commitment to your students have left a lasting impression on us. We deeply appreciate your valuable insights, kind critiques, and constant encouragement to strive for excellence. Your confidence in our abilities has been a tremendous source of inspiration. We sincerely value the time and effort you have invested in ensuring our success and are grateful for your support as a wonderful supervisor.
Additionally, thanks to all teammates for your efforts in completing this assignment ahead of the deadlines despite your busy schedules. Your dedication this semester to meeting every assignment requirement has been greatly appreciated.

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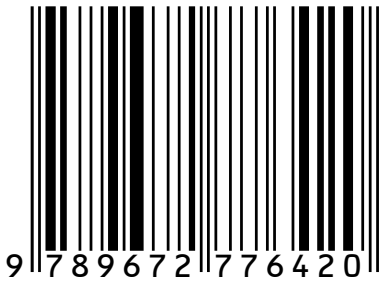

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