International Journal of Advanced Research and Multidisciplinary Trends (IJARMT)
An International Open Access, Peer-Reviewed Refereed Journal
Impact Factor: 6.4 Website: https://ijarmt.com ISSN No.: 3048-9458

INNOVATIVE TRENDS IN PACKAGING DESIGN

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Abstract

This project investigates the evolving role of paperboard packaging in modern design, emphasizing its significance in sustainability, structural integrity, and branding. Through a comprehensive exploration, the project aims to highlight how paperboard serves as a versatile and eco-friendly material that not only protects products but also enhances consumer experience and brand identity. Paperboard packaging is increasingly recognized for its environmental benefits and cost-efficiency. Made from renewable resources, it is lightweight, recyclable, and biodegradable, making it a preferred choice for brands aiming to reduce their ecological footprint. Moreover, its affordability and ease of production contribute to lower shipping costs and reduced carbon emissions, aligning with sustainable distribution practices.
The structural design of paperboard packaging serves as the "skeleton and strength" of a package. It involves engineering custom packaging solutions that not only protect the product but also communicate its intended use. Effective structural design ensures that products remain secure during transportation and handling, while also providing opportunities for creative branding. Innovative structural designs, such as moulded pulp, offer enhanced protection and are made from recycled materials, further supporting sustainability goals. Beyond functionality, paperboard packaging plays a crucial role in shaping consumer perception and experience. The tactile feel, visual appeal, and ease of use of packaging can influence purchasing decisions. Incorporating features like embossing, foil stamping, and spot UV coatings can elevate the unboxing experience, making it more memorable and engaging for consumers. Furthermore, integrating interactive elements like QR codes can provide consumers with additional product information, fostering a deeper connection with the brand.

Key words: Structural design, paper board packaging, corrugated board packaging, creasing matrix, cost efficiency, renewable resources, environmental benefits, grain direction, Reverse tuck-in, Lock bottom carton.

Introduction

Packaging is a multifaceted discipline encompassing both structural and graphic design elements, ensuring product safety during transit and serving as a vital component of branding. Effective packaging guarantees the protection of the product throughout distribution, storage, sale, and until it reaches the end consumer. It performs several essential functions:

Functions of Packaging

1. **Protection**: The primary role of packaging is to safeguard the product from damage during transportation, handling, and varying environmental conditions. A well-designed package acts as a barrier, preventing physical harm and contamination, ensuring the product arrives in optimal condition.
2. **Preservation**: Packaging helps maintain the product's shelf life and quality by controlling factors such as temperature, moisture, and exposure to air. This is particularly crucial for perishable goods, where packaging materials are selected to extend freshness and prevent spoilage.
3. **Information**: Packaging serves as a medium to communicate essential information about the product, including ingredients, usage instructions, nutritional facts, and brand authenticity. This transparency helps consumers make informed choices and fosters trust in the brand.
4. **Sales**: Packaging plays a significant role in marketing by attracting consumers and differentiating the product from competitors.

Packaging is not merely a protective covering but a strategic element that contributes to the product's safety, longevity, communication, and marketability. Its design and functionality are integral to the overall success of the product in the marketplace. Structural design serves as the "skeleton and strength" of a package**.** It's the engineering process behind creating custom packaging that not only protects and unifies the product but also communicates its intended use. Effective packaging design acts as a silent salesperson, influencing consumer decisions through its appearance and tactile experience, often more than the product inside. By opting for structural design, companies gain the flexibility to craft unique packaging solutions that subtly promote their products, avoiding the constraints of standard sizes found in off-the-shelf options.

RESEARCH OBJECTIVE

The primary objective of this study is to evaluate the method of Paper board designing for product packaging. This study is focused on the factors that need to take care while structural designing or making sure the principle of converting design into the carton. Structural designing is foundation of any product packaging which ensure the safety of the products and does products branding. Structural design serves as the cornerstone of product packaging, safeguarding the integrity of the product and enhancing brand identity. This research aims to assess the methodologies employed in paperboard design for product packaging. It focuses on identifying the critical factors to consider during structural design to ensure the effective transformation of design concepts into functional cartons.

RESEARCH METHODOLOGY

The overall objective and method was to ensure high level of accuracy while creating packaging for a product. This research employs a comprehensive literature review methodology to explore the following aspects of paperboard design in product packaging:

a). Parameters of product packaging designing:

Investigating the critical factors to consider during the creation of product packaging designs, encompassing aspects such as material selection, structural integrity, and environmental considerations. Selecting appropriate raw material for the product packaging.

b). Method of structural designing: taking care of all the formulas and standard of carton building, product packaging structure trials are performed by choosing proper raw material as per the product requirement. Dimensions are assumed to understand the key areas.

c). Studying converting process of design to carton and factors need to be taken care of. Explore the proper method of getting folding crease of cartons.

DATA COLLECTION & ANALYSIS

This study adopts a structured approach to assess the structural integrity and design parameters of paperboard and corrugated cartons. The evaluation framework encompasses the following components:

Design Parameters for Paperboard Cartons

- Dimensions: The carton is modelled with internal dimensions of 50 mm (Length) × 50 mm (Width) × 100 mm (Height).

- Material: A 300 GSM paperboard is utilized, with two walls corresponding to the length and two to the width.
- Width Wall Variation: The second width wall is reduced by 0.5 mm compared to the first, compensating for the increased GSM of the paperboard.
- Pasting Flap: A pasting flap of 13 mm is incorporated to facilitate secure closure.
- Tuck Panels: Each width panel includes two tuck panels, with the tuck-in panel height reduced by 1.5 mm to ensure proper closure.

Design Parameters for 3-Ply Corrugated Cartons

- Dimensions: The carton is modelled with internal dimensions of 50 mm (Length) × 50 mm (Width) × 100 mm (Height).
- Material: A 3-ply corrugated board is employed, with the second width wall shorter than the first by 1 to 1.5 mm, depending on the GSM and flute type.
- Width Wall Variation: The second width wall is reduced by 1 to 1.5 mm compared to the first, compensating for the increased GSM and flute size.
- Pasting Flap: A pasting flap of 13 mm is incorporated to facilitate secure closure.
- Tuck Panels: Each width panel includes two tuck panels, with the tuck-in panel height reduced by 2.5 mm to ensure proper closure.

Design Parameters for lock bottom Cartons

- Bottom Lock Panel: The bottom lock panel is designed with a height of 33 mm, constituting 66% of the width, to provide structural stability and efficient material usage.

Methodology for Selecting Creasing Matrix in Carton Conversion

This study systematically evaluates the process of converting printed sheets into cartons, emphasizing the importance of selecting the correct creasing matrix to ensure precise folding and structural integrity.

1. Creasing Matrix Selection for Paperboard:

- Grain Direction: For creasing along the grain direction of the paperboard:

$$\text{Creasing Matrix Width} = (1.3 \times \text{Board Thickness}) + 2 \times 0.35$$

- Opposite Grain Direction: For creasing against the grain direction:

Creasing Matrix Width=(1.5×Board Thickness)+2×0.35

Where:

Board Thickness is the thickness of the paperboard.

0.35mm is the thickness of the point (1 PT = 0.35 mm).

2. Creasing Matrix Selection for Corrugated Board

- Grain Direction: For creasing along the grain direction of the corrugated board:

Creasing Matrix Width=(1.8×Board Thickness)+3×0.35

- Opposite Grain Direction: For creasing against the grain direction:

Creasing Matrix Width=(2.0×Board Thickness)+3×0.35.

RESULT & DISCUSSION

By considering all the methods and following the needed tolerance as per taken material, the sample is made and confirmed that it is as per requirement. If fitment of product is slightly loose or tight it can be managed accordingly by modification. Below are the values that are achieved as result:

(1). The size of the RTI carton, parallel to grain direction is:

13mm (Pasting flap) + 50mm(L1) + 50mm(W1) + 50mm(L2) + 49.5mm(W2) = 212.5mm

The size of the RTI carton, perpendicular to grain direction is:

100mm(H) + 48.5 x 2mm (Tuck in panel) + 16 x 2mm (Tuck in flap) + 0.5 x 2mm (board thickness) = 230mm

Flat size of the carton is 230mm X 212.5mm.

(2). The size of the CLB carton, parallel to grain direction is:

14mm (Pasting flap) + 50mm(L1) + 50mm(W1) + 50mm(L2) + 49.5mm(W2) = 213.5mm

The size of the CLB carton, perpendicular to grain direction is:

100mm(H) + 48.5mm (Tuck in panel) + 33mm (bottom lock, 66% of width) + 16mm (Tuck in flap) + 0.5mm (board thickness)= 198mm

Flat size of the carton is 198mm X 213.5mm.

By adhering to these systematic calculations and considerations, the conversion of printed sheets into cartons can be optimized, ensuring both structural integrity and efficient material usage.

CONCLUSION

This project underscores the multifaceted role of paperboard packaging in contemporary design. By focusing on sustainability, structural integrity, and consumer experience, it demonstrates how paperboard packaging can be both environmentally responsible and a powerful tool for branding and consumer engagement. Through innovative design and thoughtful implementation, paperboard packaging continues to evolve, meeting the demands of both businesses and environmentally conscious consumers. The structural design of paperboard packaging is pivotal in ensuring product protection, optimizing material usage, and enhancing brand presentation. A comprehensive understanding of material properties, design principles, and manufacturing processes is essential for creating effective packaging solutions. In conclusion, the structural design of paperboard packaging is a multifaceted process that requires a balance between material properties, design precision, and manufacturing capabilities. By integrating scientific principles, computational modeling, and practical experience, designers can create packaging solutions that not only protect the product but also contribute to sustainability and brand identity.

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