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Design And Development Of Recycled Polyester Fibre In Technical Products (Making of cold insulation Jacket)

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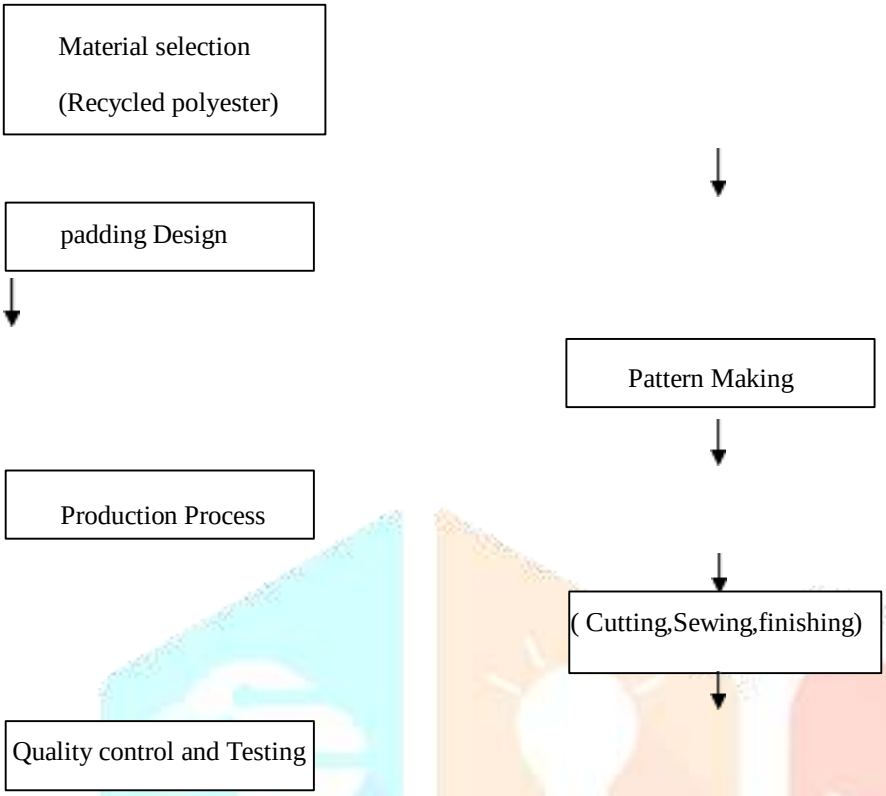
Abstract: Recycled polyester jackets offer a sustainable alternative to traditional outerwear, providing an eco-friendly solution for environmentally conscious consumers. Made from post-consumer plastic waste, these jackets reduce landfill contributions and conserve resources, decreasing the need for virgin polyester production. Retaining polyester's water-resistant and breathable properties, recycled polyester jackets are durable, lightweight, and suitable for various outdoor activities. Several prominent brands, including Patagonia and The North Face, have incorporated recycled polyester into their designs. By choosing recycled polyester, consumers actively support environmentally responsible fashion practices, promoting a more sustainable textile industry. This innovative material helps bridge the gap between style, functionality, and environmental stewardship.

Keywords – Sustainable, Eco-friendly, Recycled, Polyester, Environmentally-responsible.

I. INTRODUCTION:-

The production of cold insulation jackets in today's world is a crucial response to the increasing demand for functional and comfortable outerwear, especially in regions with harsh winters. The padding layer plays a pivotal role in determining the jacket's ability to retain heat and provide warmth. Traditional padding materials such as down feathers and synthetic fibers have been widely used in the past. However, with growing concerns about animal welfare and sustainability, there is a shift towards synthetic and recycled alternatives that offer comparable insulation properties without compromising ethical considerations.This study aims to investigate the development and characterization of cold insulation padding using unique quilting patterns to obtain good thermal insulation properties with sustainable manner in response to this need. Because of their intrinsic qualities, recycled polyester materials hold promising options for cold insulation and provide good warmth property. The purpose of this research is to thoroughly evaluate the cold insulation potential of recycled padding , environmental impact and practical feasibility of incorporating unique quilting padding patterns using recycled polyester for production of Jacket.

II METHODOLOGY AND IMPLEMENTATION:-



1.MATERIAL AND METHODS :

Here we utilized 100% post-consumer recycled polyester fabric, quilting padding material made from recycled polyester fiber fill, breathable mesh fabric for insulation lining, recycled polyester for both inner and outer shell, and 100% polyester thread. Zippers and fasteners also utilized and the interlining was fusible recycled polyester. Fabric preparation involved cutting, sorting, and treating with eco-friendly finishes for water repellency, followed by inspection for defects. Quilting padding was achieved through cutting, layering, and quilting using industrial sewing machines, ensuring even distribution and thickness. Jacket construction involved pattern making, cutting, sewing, and assembly of components, integrating quilting padding and insulation lining. Zippers, fasteners, and hardware were attached, and the jacket underwent thermal insulation testing (ASTM D-1518), durability testing (ASTM D-3514), user trials, and environmental impact assessment through life cycle analysis. Industrial sewing machines, quilting machines, and specialized testing equipment were employed, supported by computer-aided design and life cycle analysis software.

2.PADDING MATERIALS AND APPLICATIONS:

Quilted Padding materials made from recycled polyester are used to control penetration of cold air into the jacket, provides good warmth property and it is done by help of designing tightly packed compartment structure. By this construction, they enhance the thermal insulation property of jacket and reduce utilization of synthetic polyester. In the field of technical textile and sustainable clothing, utilizing recycled polyester materials minimize environmental impact on increasing landfills , reduces cost of manufacturing and provides almost equal durability, thermal insulation property and strength compared to synthetic polyester. Historically, synthetic materials polyester have dominated these applications. However, the drive for eco-friendly solutions has led to the investigation of incorporating unique quilted padding pattern using recycled polyester.

Role of quilting stitch in padding:

Quilting stitching is a technique used to join three layers of fabric: a top layer, a batting (insulation or padding) and a backing layer. These stitches not only hold the layers together but also create intricate patterns and designs.

How it's used for creating padding:

1.Layering: The batting or middle layer , made of recycled polyester of mesh or foam form, is placed between the top and bottom fabric layers. This batting provides insulation and warmth, as well as thickness and structure.

2.Stitching: The stitches are then sewn through all three layers. This process secures the batting in place, preventing it from shifting or bunching. The stitches also create a grid-like pattern that adds strength and stability to the quilt.

3.Design and Texture: Quilting stitches can be used to create various designs, from simple straight lines to intricate patterns like square compartments, feathers or flowers. The choice of stitches and the spacing between them can significantly affect the quilt's appearance and texture.

Outer shell of jacket- Construction:

The outer shell is the outermost layer of a jacket, providing protection from the elements such as wind, rain, and snow. It's crucial for keeping the wearer warm, dry, and comfortable.

(NON-WOVEN FOAM)

(PADDING WITH TRIPLE LAYERED STRUCTURE)

3. PATTERN MAKING:

Pattern Making for a Recycled Polyester Jacket

1. **Design Planning**:
   - Choose a versatile design like a bomber, puffer, or parka.
   - Incorporate functional details such as hoods, adjustable cuffs, and pockets.
2. **Body Block Development**:
   - Draft basic jacket blocks for the front, back, and sleeves, considering the fabric thickness and ease for layering.
   - Include extra seam allowances for thicker recycled materials.
3. **Quilting and Padding Sections**:
   - Create patterns for quilted panels (e.g., horizontal, diamond) to evenly distribute padding.
   - Ensure alignment of seams in the quilting pattern for aesthetic and structural consistency.
4. **Sustainable Fabric Utilization**:
   - Optimize pattern placement to reduce fabric waste during cutting.
   - Combine panels from smaller scraps for less visible areas, like linings.
5. **Functional Features**:
   - Add pattern pieces for details like zippers, snap closures, or ventilation slits.
   - Design pocket patterns with practicality in mind, ensuring reinforcement in high-stress areas.

(JACKET FRONT VIEW DESIGN)

(JACKET BACK VIEW DESIGN)

4.PRODUCTION PROCESS LAYOUT:

 Material Sourcing: Procure certified recycled polyester fabrics, padding, and eco-friendly accessories like zippers and threads. Ensure materials meet durability and sustainability standards.

 Pattern Cutting: Lay out patterns efficiently to minimize fabric waste and cut precisely for consistent sizing. Use automated or manual cutting techniques as needed.

 Sewing and Assembly: Stitch fabric panels together, add padding, and assemble features like pockets, hoods, and closures. Ensure proper seam reinforcements for durability.

 Quality Control: Inspect for defects in stitching, padding distribution, and overall finishing. Ensure the jacket meets design and performance standards before final approval.

Incorporation of padding and jacket's outer shell:

i)Layering:

1.The jacket's inner lining is laid flat.

2.The padding material is placed evenly on top of the lining.

3.The outer shell fabric is placed on top of the padding.

ii)Stitching:

The layer between outer shell and padding are stitched together using two techniques:

Baffles: These are channels sewn into the jacket to contain the padding and provide structure.

Quilting: This involves stitching through all three layers in a pattern to secure the padding and create a quilted appearance.

Result:

(RECYCLED POLYESTER JACKET FRONT VIEW)

(RECYCLED POLYESTER JACKET BACK VIEW)

5.CUTTING, SEWING ,FINISHING:

1. Cutting
Lay out the recycled polyester fabric on cutting tables or automated cutters.
Align patterns efficiently to reduce waste and ensure accurate cuts for all jacket components.

2. Sewing
Assemble cut pieces by stitching panels together, starting with the body, sleeves, and lining.
Integrate padding and features like zippers, pockets, and hoods while reinforcing stress points.

3. Finishing
Inspect and trim loose threads, press seams, and attach final details like labels and tags.
Perform a quality check for aesthetics and functionality before packing for distribution.

Perform a quality check for aesthetics and functionality before packing for distribution.

6.GARMENT CONSTRUCTION PROCESS:

1. **Seams:** Seams are the primary method of joining fabric pieces together in jacket. They can be either **flat-locked** or **double-needle stitched**. Flat-locked seams are more durable and stretchy, while double-needle stitching is more traditional and can be reinforced with bar tacks.
2. **Zippers:** Zippers are used to close the jacket and provide easy access. They can be coil zippers (common in jackets) or teeth zippers (used in heavier-duty garments).
3. **Hoods:** Role of jacket's hoods is to provide additional protection from the elements. Hoods can be adjustable with drawstrings and may have a brim for added coverage.
4. **Cuffs and Hem:** Cuffs and hems are finished edges that prevent fraying and provide a clean appearance. They can be elasticated or adjustable for a better fit.
5. **Front and back panel:** These front and back panel should be designed according to size of a person, which attaches hood,cuffs,hem together with high quality seam and stitching technique.Then zippers used for providing closure for the jacket. All these parts are made only in recycled polyester.
6. **i)Layering:**

   The jacket's inner lining is laid flat.

   The padding material is placed evenly on top of the lining.

   The outer shell fabric is placed on top of the padding.
7. **ii)Stitching:**

   The layer between outer shell and padding are stitched together using two techniques:
8. **Baffles:** These are channels sewn into the jacket to contain the padding and provide structure.
9. **Quilting:** This involves stitching through all three layers in a pattern to secure the padding and create a quilted appearance.
10. **iii)Finishing:**

    1.The jacket's seams are finished to prevent fraying and enhance durability.

    2.Zippers, buttons and other closures are added as needed.

    3.Pockets, cuffs and hems are attached.

7. QUALITY CONTROL AND TESTING:

1. **Fabric Inspection**:
   - Check the recycled polyester fabric for color consistency, texture, and any defects like tears or stains.
   - Ensure the fabric meets the necessary performance standards such as breathability, durability, and sustainability.
2. **Stitching Quality**:
   - Inspect all seams for proper alignment and even stitching.
   - Ensure reinforcement at stress points, such as armholes, zippers, and pocket areas, to enhance durability.
3. **Padding and Insulation Testing**:
   - Verify the even distribution of padding or insulation material to prevent cold spots.
   - Ensure the quilted pattern is uniform, and there are no lumps or uneven filling.
4. **Functional Features Testing**:
   - Test all zippers, buttons, and Velcro closures to ensure they operate smoothly without sticking or breaking.
   - Inspect functional features like adjustable cuffs, hoods, and pockets for ease of use and proper attachment.
5. **Fit and Comfort**:
   - Conduct wear tests to assess the fit, comfort, and mobility of the jacket.

III.CONCLUSION:-

The adoption of recycled polyester jackets represents a significant stride towards sustainability in the fashion industry. By transforming post-consumer plastic waste into durable, functional, and stylish garments, manufacturers reduce landfill contributions, conserve resources, and mitigate environmental harm. As consumers increasingly prioritize eco-friendly practices, recycled polyester jackets have emerged as a viable alternative to traditional outerwear. With pioneering brands leading the charge, this innovative material is redefining the textile industry's environmental footprint. As technology continues to evolve, the potential for recycled polyester to revolutionize fashion production and consumption grows. Ultimately, embracing recycled polyester jackets embodies a commitment to sustainability, encouraging a more responsible and environmentally-conscious approach to fashion.

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