Sustainable Trims for the Apparel Industry: Innovations and Future Perspectives

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Abstract

Sustainability discussions in the apparel industry have traditionally focused on fabrics, fibres, and dyeing processes, while trims such as buttons, zippers, labels, and fasteners have received comparatively little attention. However, these components play a critical role in determining the environmental impact and recyclability of garments. This paper examines the growing importance of sustainable trims, explores alternative materials currently available in the market, and reviews bio-based and recycled options adopted by leading apparel brands. By incorporating renewable, recyclable, and biodegradable materials, sustainable trims can significantly improve garment recyclability and reduce overall environmental harm. The study emphasizes the need for lifecycle-oriented design approaches that integrate trims into circular fashion systems, thereby supporting long-term sustainability goals within the apparel industry.

Introduction

In recent years, sustainability has become a central concern in the apparel industry. While considerable progress has been made in areas such as fibre selection, fabric development, and eco-friendly dyeing techniques, trims often remain overlooked during garment design and production. Components such as buttons, zippers, labels, tags, and fasteners may appear minor in scale, yet they contribute substantially to a garment's environmental footprint, particularly at the end-of-life stage.

Trims are frequently manufactured using mixed materials, including plastics and metals, which complicates recycling and disposal processes. As the fashion industry moves toward circularity, the role of trims becomes increasingly important. Sustainable trims are designed to minimize waste, reduce reliance on virgin resources, and enable easier disassembly and recycling. Innovations such as biodegradable buttons, recycled polyester zipper tapes, and mono-material fasteners highlight how trims can actively support circular fashion systems when designed with the entire garment lifecycle in mind.

Need for Sustainable Trims

Conventional trims contribute to environmental challenges due to their material complexity and resource-intensive production methods. Many trims combine plastics, metals, and synthetic coatings, making them difficult to separate and recycle. As a result, garments that might otherwise be recyclable are often discarded into landfills because of non-recyclable trims.

With growing consumer awareness and stricter environmental regulations, apparel brands are under increasing pressure to adopt transparent and responsible practices. Sustainable trims help address these concerns by reducing the use of virgin materials, lowering chemical inputs, and supporting closed-loop production systems. In addition, well-designed sustainable trims can improve garment durability and simplify end-of-life processing by enabling easier removal or recycling of components.

Alternatives in Sustainable Trims

Several practical alternatives are now available in the market to replace conventional trims:

1. Buttons

- Corozo (Tagua nut) buttons are derived from a natural seed often called "vegetable ivory." They are compostable, durable, and can be carved and finished similar to premium plastic buttons. As a result, many apparel brands use them as an effective plastic substitute.
- Coconut shell and wooden buttons are biodegradable and can be locally sourced, making them lower in environmental footprint compared to petroleum-based plastics.

- Recycled plastic buttons (rPET) are produced from post-consumer PET waste, helping keep plastic within the recycling loop instead of relying on virgin raw materials.
- PLA or bio-plastic buttons, made from polylactic acid, offer a plant-based alternative with reduced dependence on fossil fuels.
- Metal and shell buttons (mother-of-pearl) are long-lasting and can be fully recycled at the end of their life cycle.
- Recycled metal buttons, rivets, and eyelets, made from materials such as recycled brass, zinc, or aluminium, further reduce the need for virgin metal extraction.

2. Zippers and Fasteners

- Mono-material zippers, where both the teeth and tape are made from a single polymer, are designed to simplify recycling by avoiding mixed materials. Examples include innovations such as the NYGUARD zipper developed under the Ny2Life project.
- Recycled polyester tape and recycled nylon zippers use GRS-certified or similar recycled yarns in both the tape and coils. Suppliers such as Riri and LenZip offer these recycled and bio-based alternatives.
- Metal zippers made from recycled metals are highly durable and can be efficiently recycled, especially when paired with compatible tapes.
- Bio-based or plant-based zippers incorporate materials derived from corn starch, molasses, or castor beans, as seen in products like YKK NATULON® and GREENRISE™.

3. Threads and Sewing Yarns

- Recycled polyester sewing threads, produced from rPET, reduce the use of virgin polyester while maintaining strength and performance.
- Organic cotton or Tencel™ sewing threads are suitable for garments designed with fully natural or renewable material concepts.
- Low-emission, OEKO-TEX® certified threads ensure the absence of harmful chemical residues, improving both environmental and consumer safety.

4. Tapes, Webbing, Bindings, and Elastics

- Recycled PET webbing and binding tapes are widely available and commonly used in applications such as sportswear, bags, and functional trims.
- Natural fibre tapes made from bamboo, hemp, or linen are renewable and require fewer agricultural inputs, making them suitable for organic or premium product lines.
- Recycled elastic and lower-impact elastane blends help reduce the environmental impact while retaining stretch and comfort.

5. Labels, Hangtags, and Badges

- Recycled paper and recycled cardboard hangtags are a widely adopted low-impact solution in the apparel industry.
- Seed paper hangtags, embedded with seeds, can be planted after use, combining branding with a circular end-of-life option.
- Cork labels and badges are made from renewable and biodegradable materials and provide a premium eco-friendly aesthetic.
- Washable paper labels, based on cellulose, are durable during use and compostable at the end of their life.
- Fabric labels made from organic cotton, Tencel, or recycled polyester improve recyclability when the label material matches the main garment fabric.
- GOTS-certified organic cotton labels are commonly used for both internal and external branding.

6. Hardware: Buckles, Sliders, Rivets, and Eyelets

- Recycled metal hardware, including zinc, brass, and steel components, offers durability and recyclability, provided that environmentally safe plating processes are used.
- PVD-coated or REACH and OEKO-TEX compliant metal finishes reduce the presence of harmful chemicals, making them safer for both users and the environment.
- Bio-based plastic hardware serves as an alternative in applications where metal components are not suitable.

7. Labels and Branding (Printed or Embellished Trims)

- Water-based or low-VOC inks are commonly used for printing labels and logos to reduce chemical emissions.
- Laser-etched or heat-pressed branding eliminates the need for additional plastic badges or tags.
- Recycled or biodegradable embellishments, such as biodegradable glitters and sequins from suppliers like Bioglitter, help reduce microplastic pollution.

8. Embellishments, Beads, and Sequins

- Biodegradable sequins and glitters, made from PLA or cellulose-based materials, offer eco-friendly alternatives to conventional plastic options.
- Recycled metal or glass beads are preferred over virgin plastic sequins due to their durability and recyclability.
- Natural shell, wood, or corozo embellishments are commonly used in premium garments to enhance aesthetics while maintaining sustainability.

Trim Type	Sustainable Alternative	Sustainability Feature
Buttons	Coconut shell, wooden, or corozo nut	100% biodegradable and renewable
Zippers	Recycled PET or metal zippers	Made from waste bottles or reused metals
Labels	Organic cotton, bamboo fiber	Printed using water-based inks
Threads	Recycled polyester, organic cotton	Energy-efficient and chemical-free
Elastic	Natural rubber and organic cotton	Compostable and toxin-free
Tags	Recycled paper or seed paper	Can be reused or planted after use
Beads/Decor	Clay, shell, or glass beads	Natural, non-toxic, and long-lasting

Bio-Alternatives Used by Brands
Several brands are known for using bio-based buttons, labels, and zippers as part of their sustainable fashion initiatives:

i. Buttons

Brands such as Chetna International supply bio-based and recycled buttons made from natural materials including coconut shells and wood, along with recycled plastics and metals. These options reduce dependence on virgin plastic and promote material reuse.

Japanese trim suppliers are recognized for producing eco-buttons that utilize plant waste to lower overall plastic content.

Patagonia, widely regarded as a sustainability leader, uses recycled materials across its products and places strong emphasis on durability, repair, and long product life. The brand incorporates recycled metal zippers, recycled polyester components, and sewing threads in many of its garments.

ii. Labels

Pangea Organics uses innovative packaging labels embedded with organic seeds that can be planted after use, demonstrating a practical application of bio-based and plant-embedded labeling.

Several high-end fashion brands have explored mycelium-based tags, derived from mushroom materials. Brands such as Stella McCartney and Hermès have experimented with Mylo mushroom leather and related tag applications, reflecting a growing interest in bio-fabricated materials.

iii. Zippers

Many fashion brands have started adopting sustainable zipper alternatives made from recycled or bio-based materials. Notable examples include Patagonia, Outerknown, Pact, EILEEN FISHER, and Reformation, all of which integrate such zippers into their apparel collections.

iv. Recycled Metal Trims (India-based Brand)

The Terra Tribe, an Indian sustainable fashion brand, has been recognized for its use of recycled metal trims in clothing, supporting waste reduction and responsible material sourcing within the local fashion industry.

Emerging & Innovative Trims

Innovative trims play an important role in supporting the circular economy by focusing on materials that are bio-based, biodegradable, or derived from upcycled waste streams.

- **Agricultural waste–based materials**:
  Trims such as badges and patches are increasingly produced using composite materials made from coffee grounds, eggshells, or wheat straw crumbs combined with suitable binders. These materials help utilise agricultural waste that would otherwise be discarded.
  Alternative leathers developed from agricultural by-products are also used for patches and zipper pulls. Examples include grape leather made from grape-pressing waste, apple leather derived from apple pomace, and Piñatex, which is produced from pineapple leaf fibres.
- **3D-printed trims:**
  Buckles, sliders, and accessories are being manufactured using 3D printing technology with recycled plastic waste or bio-plastics sourced from materials such as sugarcane starch.
  This method supports lean manufacturing, as trims are produced only in required quantities, reducing material waste and excess inventory.
- **Zero-waste and upcycled trims:**
  Patches, appliqués, and piping made from upcycled fabric scraps or production leftovers help minimise textile waste.
  By repurposing existing materials, these trims directly contribute to waste reduction while adding unique aesthetic value to garments.

The Circularity Challenge: Mono-Material Trims

One of the major challenges in implementing sustainable trims is achieving true circularity. Garments can be recycled more efficiently when they are made from a single type of material, commonly referred to as a mono-material design. When trims and fabrics are incompatible, recycling becomes difficult and often impractical. Therefore, a more sustainable approach to trim selection includes the following practices:

1. **Use natural trims with natural fibres:**

   Natural fibre garments should be paired with trims made from similar materials. For example, using organic cotton sewing threads on an organic cotton shirt improves material compatibility and simplifies recycling.

2. **Use recycled synthetic trims with synthetic fibres**:

   Synthetic garments made from recycled fibres should incorporate matching trims, such as using an rPET zipper on a recycled polyester jacket. This alignment supports efficient recycling within the same material stream.

3. **Design for disassembly:**

   Trims such as buttons, snaps, or fasteners should be designed so they can be easily removed from the garment before recycling. This approach allows different components to be separated and processed appropriately at the end of the garment's life..

Certifications and Compliance for Sustainable Trims

The credibility of sustainable trims in the fashion industry depends strongly on third-party certifications and regulatory frameworks that verify environmental performance, material safety, and responsible sourcing. These certifications help distinguish genuine sustainability efforts from unverified claims and play a key role in building trust among brands and consumers.

One of the most widely recognised standards is the Global Recycled Standard (GRS), which confirms the authenticity of recycled content used in trims such as sewing threads, webbing, and zippers made from recycled polyester (rPET). Beyond tracing recycled materials throughout the supply chain, GRS also sets requirements related to environmental management, chemical use, and social responsibility. As a result, it ensures greater transparency and reliability in sustainability claims made by manufacturers and brands.

Another important certification is **OEKO-TEX® STANDARD 100,** which guarantees that trims including buttons, labels, tapes, and threads are free from harmful substances and safe for human contact. This certification is especially significant for trims used in garments that come into direct contact with the skin or are intended for children's wear. Suppliers such as the AMANN Group provide OEKO-TEX certified products, ensuring that every component, from threads to coatings and accessories, is tested for toxic substances, thereby supporting consumer safety and environmental protection.

In addition, **REACH (Registration, Evaluation, Authorisation and Restrictions of Chemicals)**compliance, governed by the European Union, regulates the use of hazardous chemicals in textile trims, particularly in metal components such as rivets, buckles, and zippers. Substances like nickel, chromium, and lead, which are commonly used in metal plating, are closely monitored under REACH. Trims that meet REACH requirements help reduce health risks and promote safer manufacturing, use, and disposal practices.

For trims promoted as biodegradable or compostable, certifications such as TÜV Austria's OK Biodegradable and OK Compost provide reliable verification. These certifications confirm that materials like cellulose-based glitters, biodegradable sequins, and bio-resins meet strict decomposition standards under specific conditions, such as soil, water, or industrial composting environments. This level of validation helps prevent greenwashing and ensures that claims related to end-of-life sustainability are scientifically supported.

Overall, these certifications not only validate the environmental claims associated with sustainable trims but also strengthen consumer confidence, encourage accountability among suppliers, and align fashion brands with global sustainability frameworks. By adopting certified trims, fashion houses and manufacturers can ensure that sustainability efforts extend beyond design concepts and are supported by measurable and verifiable practices

Future Scope

The future of sustainable trims depends on continuous innovation, closer collaboration between designers and responsible trim suppliers, and stronger integration within circular fashion systems. As research and development progress, emerging technologies such as biodegradable polymers, enzyme-based treatments for fabrics and trims, and laser finishing techniques that reduce or eliminate the use of harmful chemicals are expected to further lower the environmental impact of apparel production.

In addition, the scalability of bio-based and recycled trim alternatives will play a key role in their wider adoption across the industry. Improved traceability supported by recognised certifications will enable both fast fashion and luxury brands to confidently incorporate sustainable trims into their supply chains. In the long term, sustainable trims are likely to become a standard component of garments designed for easy disassembly, reuse, and complete recyclability, supporting the broader goal of a zero-waste apparel industry.

Conclusion

Sustainable trims are an important but often overlooked part of apparel sustainability. Using recycled, biodegradable, and bio-based trims can significantly reduce the environmental impact of garments. With growing technological advancements and increasing consumer and regulatory pressure, adopting sustainable trims through a full lifecycle approach is essential for achieving a truly circular fashion industry

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