Sustainable Outdoor Gear Using Knit and Woven Fabrics: A Case of Shell Jacket

Rui Zhao, Sibei Xia, Chuanlan Liu, Louisiana State University

Keywords: Sustainability; Knitting Fabric; Woven Fabrics; Functional Design

Introduction. Sustainability and minimalism are increasingly emphasized in the fast-changing fashion industry, with consumers now favoring timeless and simple designs (Rahman et al., 2023). Currently, the market mostly adopts woven fabrics that are windproof and waterproof, but these need improvement in terms of comfort and adaptability (Adamu & Gao, 2022). Knitted fabrics are known for their superior comfort and adaptability and are widely used in daily apparel due to their excellent comfort and stretch. However, there is still much room for their application in outdoor apparel (Mishra et al., 2021). This project explores the design of an outdoor shell jacket that combines knit and woven technologies, utilizing eco-friendly and other functional materials to meet consumer and market demands for sustainable fashion while demonstrating the advantages of versatility and adaptability to fashion trends.

Material. Knitted Hemp Fabric. The selection of knitted fabric aimed to enhance this design's sustainability and market appeal. Hemp was chosen as one of the main materials due to its durability and eco-friendliness. Its production process minimizes environmental impact by reducing water consumption and chemical use, thus significantly lowering the overall ecological footprint (Kaur & Kander, 2023). Hemp material exhibits excellent breathability and moisture absorption properties (Gedik & Avinc, 2020). The use of plated knit technology in the knit enables the functional knitting process to be divided into a separating layer and an absorbent layer. The outer layer, composed of hemp fabric, fulfills the function of breathability (Jhanji et al., 2015) (Figure 1). Silk fabric, known for its softness, skin-friendliness, moisture absorption, and sterilizability (Kaplan et al., 1994), can be an absorbent layer (Figure 2). This technology meets the modern consumer's demand for environmentally friendly fashion while fulfilling the demand for functionality. Woven Fabrics. For the woven part, high-tech fabrics with wind, water, and oil-repellent features were selected. These features ensure that the jacket provides necessary protection in all climatic conditions, protecting the wearer from the harsh elements (Kovačević et al., 2010).

Functional Design. This design strategically uses knitted fabrics in areas prone to sweating, such as the underarms and back, addressing the thermal management needs of the human body during outdoor activities. The design breathability and stretch of knitted fabrics significantly enhance comfort in these areas (Wang et al., 2018). In contrast, woven fabrics, which are more robust and structurally complete, are utilized in the large body and sleeves of garments to enhance the overall abrasion resistance (Kovačević et al., 2010). The fusion of these fabrics extends the aesthetic and functional latitude of the garment, creating an additional competitive advantage in the consumer market (Rotimi et al., 2021). Another core aspect of this design is sustainability; adding appendages to the knitted sections can enhance their adaptability and usability in various environments. This approach extends the garment's lifespan by making it suitable for multiple uses, aligning with sustainable fashion practices by reducing the need for multiple garments. According to WGSN analysis, the future trend in the fashion industry will be an increase in adaptable and customizable garments as lifestyles change and consumers seek garments that adapt to various environments or conditions (WGSN, 2023). Mixing knitted and woven fabrics promises future fashion trends by providing new design concepts with a market appeal (Zhu et al., 2013). It meets the growing consumer demand for versatile, sustainable, and aesthetically pleasing garments.

Color and Process. Sage green was chosen as the main color for its natural and muted nature, its ability to blend in with the outdoor environment, and its appeal to contemporary consumer's color preference for nature and a sense of peace. Sage green, a neutral color, is attractive to consumers of different genders, making it a practical and popular choice (Rachel, 2021). This color enhances the harmony between the wearer and the natural environment and is easy to match with other colors. In terms of garment craftsmanship, the use of press-gluing improves the waterproofing and sealing properties of the garment. Adding an extra layer of waterproofing to the seams reduces water and moisture penetration, providing greater protection and durability (Figure 3, 4). The application of this technology not only enhances the performance of the garment in adverse weather conditions but also maintains wearing comfort and dryness (Jana, 2011). In addition, the color chosen for the press-gluing is a less pure light grey. This neutral color complements sage green and enhances the design's color layers, adding style. Both light gray and sage green are highly resistant to dirt and stains, increasing the garment's practicality and keeping it stylish and presentable in various settings.

Conclusion. This design demonstrates how combining different types of fabrics and advanced technologies can enhance the functionality and aesthetics of a garment, offering significant advantages in environmental protection and sustainability. By merging the benefits of two different types of fabrics, this garment meets outdoor sports' high comfort and flexibility requirements while ensuring aesthetics and durability, catering to the market's diverse needs.

Figure 1 Hemp

Figure 2 Silk

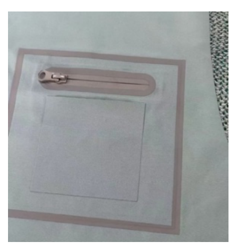

Figure 3 Press-gluing (Front)

Figure 4 Press-gluing (Back)

Reference

Adamu, B. F., & Gao, J. (2022). Comfort related woven fabric transmission properties made of cotton and nylon. *Fashion and Textiles*, *9*(1), 8.

Gedik, G., & Avinc, O. (2020). Hemp fiber as a sustainable raw material source for textile industry: can we use its potential for more eco-friendly production? *Sustainability in the Textile and Apparel Industries: Sourcing Natural Raw Materials*, 87-109.

Jana, P. (2011). Assembling technologies for functional garments—An overview.

Jhanji, Y., Gupta, D., & Kothari, V. (2015). Comfort properties of plated knitted fabrics with varying fibre type. *Indian Journal of Fibre & Textile Research (IJFTR)*, *40*(1), 11-18.

Kaplan, D., Adams, W. W., Farmer, B., & Viney, C. (1994). Silk: biology, structure, properties, and genetics. In. ACS Publications.

Kaur, G., & Kander, R. (2023). The Sustainability of Industrial Hemp: A Literature Review of Its Economic, Environmental, and Social Sustainability. *Sustainability*, *15*(8), 6457.

Kovačević, S., Ujević, D., & Brnada, S. (2010). Coated textile materials. *Woven fabric engineering*, *241*.

Mishra, R., Jamshaid, H., Yosfani, S. H. S., Hussain, U., Nadeem, M., Petru, M., Tichy, M., & Muller, M. (2021). Thermo physiological comfort of single jersey knitted fabric derivatives. *Fashion and Textiles*, *8*, 1-22.

Rachel, B. (2021). *Go Green With Fashion's Favorite Color*. Retrieved 05.22 from https://www.vogue.com/slideshow/green-color-trend

Rahman, O., Hu, D., & Fung, B. C. (2023). A systematic literature review of fashion, sustainability, and consumption using a mixed methods approach. *Sustainability*, *15*(16), 12213.

Rotimi, E. O. O., Topple, C., & Hopkins, J. (2021). Towards a conceptual framework of sustainable practices of post-consumer textile waste at garment end of lifecycle: A systematic literature review approach. *Sustainability*, *13*(5), 2965.

Wang, L., Yu, K., Zhang, D., & Qian, K. (2018). Cut resistant property of weft knitting structure: a review. *The journal of the Textile Institute*, *109*(8), 1054-1066.

WGSN. (2023). *WGSN reveals the Top Trends for 2023 and Beyond*. Retrieved 05.22 from https://www.wgsn.com/en/wgsn/press/press-releases/wgsn-reveals-top-trends-2023-and-beyond