Mapping Global Research on Sustainable Textile Materials: A Comparative Bibliometric Study of China and International Literature

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Abstract

At present, the world is facing a critical stage of sustainable development transformation. In particular, the introduction of the EU Sustainable Products Regulation (ESPR) marks a fundamental shift in the regulatory paradigm from end-of-pipe governance to ecological design. However, sustainable materials still face challenges in terms of cost, performance, strength, comfort, and large-scale production. At present, there is a lack of cross-country comparative bibliometric analysis on the emerging sustainability trends in textile materials research.Based on this, this study uses CiteSpace (v6.4.RI) to conduct a visual analysis of this field based on Chinese and English literature from 2010 to 2025 in CNKI and Web of Science databases using bibliometric methods. The key analysis indicators include annual publication volume, national and institutional cooperation networks, high-frequency keywords, keyword clustering, evolution path and emerging terms to compare the research status at home and abroad. This study aims to systematically map and compare the domestic and international research trends of sustainable textile materials to determine the evolving themes and future directions. The results show that the number of related papers has continued to grow in the past 14 years, and China is in a leading position in terms of the number of published papers. International cooperation is characterized by multi-center and decentralization. The current research mainly focuses on three directions: material innovation, performance optimization and environmental governance mechanism. It is expected that future research will focus more on bio-based textile technology (especially bionic materials) and intelligent response materials that can be applied on a large scale, such as thermochromic fibers and self-healing composites.

Keywords: Sustainable textile materials, CiteSpace, Knowledge Graph, Visual Analysis, Research Hotspot

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1 Introduction

According to the United Nations Environment Programme (UNEP) report, the fashion industry produces more than 92 million tons of waste per year, accounting for about 4% of global waste. The carbon emissions of the fashion industry account for 10% of the global total, exceeding the total emissions of international flights and shipping. As the world's second largest polluting industry, the fashion industry's impact on the environment cannot be ignored. With the increasingly serious global climate change and environmental problems, in recent years, governments, international organizations and industry institutions around the world have introduced policies and regulations to promote the transformation of the fashion industry to a sustainable direction. In 2021, China's '14th Five-Year Plan for Circular Economy Development' clearly defined the goal of circular economy in the textile industry, and the amount of waste textile recycling will be controlled at 2 million tons in 2025. In 2022, the EU issued the 'Circular Economy Action Plan' requiring that all textiles must be durable and 100% recyclable by 2030, promoting the certification of biological fabrics, limiting the excessive production of fast fashion, and prohibiting the destruction of unsalable textiles. In addition, the United Nations has also introduced a 'fashion industry climate action charter,' which aims to reduce emissions by 30% by 2030 and achieve net zero emissions by 2050. In fact, sustainable fashion is not only a trend, but also defined as a responsibility for environmental and social commitment. As early as around 2000, sustainability and responsible behavior have become important issues in the world's fashion industry [1].

Currently, the global fashion industry is increasingly focused on 'fashion sustainability'. As the core direction of the sustainable textile field, sustainable fabrics have developed rapidly in recent years, driven by technological breakthroughs, market demand and policies, and have become a key factor for the sustainable development of fashion. Generally, sustainable fabrics refer to textile materials that have minimal impact on the environment and society throughout their entire life cycle, from raw material acquisition to production, processing, use, and waste treatment, while meeting the principles of resource conservation, low carbon emissions, and environmental protection. These materials are also recyclable or degradable. At the present stage, the academic research and technological innovation achievements on sustainable textile materials have emerged in an endless stream. After consulting the literature in this field, a certain number has been reached. In particular, the development of new bio-based raw materials [2], green preparation processes [3], degradation technologies under the circular economy [4], and other aspects have been widely studied by scholars and experts. Some scholars have mentioned in the overall trend research of fashion sustainability that the research on sustainable supply chains is a hot spot and trend [5], but they failed to point out its current development status and future trends. A few scholars have pointed out the research trend in this field from a subjective perspective [6], but have failed to objectively use the data to explain and analyse the current situation and trends in the field. It can be seen that at present, there are few achievements in the research on the trend of sustainable textile materials, especially in the field of using data from an objective perspective. CiteSpace is a software tool for scientific literature analysis and visualisation, developed by the university (Drexel University) professor Chen. Software development is mainly used to analyse research trends in academic literature, knowledge structure, discipline frontiers, and cooperation networks, helping researchers quickly identify the core topic of a field, key literature, and research hotspots. Some scholars have used CiteSpace software to explore trends in the field of clothing and textiles, such as Chen QH [7], Li WJ [8], and Wang M [9]. In addition, with the upgrade and optimisation of software technology, software has matured to process tens of thousands of