

BACTERIAL CELLULOSE: FROM BIOFABRICATION TO APPLICATIONS IN SUSTAINABLE FASHION AND VEGAN LEATHER

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The rising demand for sustainable materials has led to a significant focus on developing resources from renewable systems, particularly through the integration of biological processes. Bacterial cellulose (BC) has emerged as a highly promising biomaterial, gaining attention across multiple industries, such as food, pharmaceuticals, materials science, and textiles, due to its renewable, biodegradable, and eco-friendly characteristics. Within the fashion industry, bacterial cellulose (BC) biofabrication presents a groundbreaking method for producing sustainable textiles and vegan leather. This systematic review emphasizes BC's pivotal role in advancing sustainable materials, addressing challenges like low yields, strain instability, and high production costs, and exploring innovative biofabrication techniques to overcome these barriers. Current advancements aim to enhance the thickness, uniformity, and mechanical properties of BC layers by optimizing the environmental and nutritional conditions during *Komagataeibacter* cultivation and leveraging co-culturing methods. Furthermore, recent innovations in synthetic biology and genetic engineering have opened new avenues for improving BC biosynthesis, making it a viable solution for the sustainable fashion industry. This review explores three core topics: (1) bacterial cellulose and its applications, (2) the biofabrication of BC for vegan leather, and (3) emerging innovations and patents utilizing bacterial cellulose as a sustainable industrial biomaterial.