



Biorenewable Insights: Non-Conventional Bio-Based Textile Fibers

Non-Conventional Bio-Based Textile Fibers is one in a series of reports published as part of NexantECA's 2019 Biorenewable Insights program.

Overview

The textile industry as traditionally constituted is one of the most polluting and otherwise unsustainable sectors of the global economy. Besides that it involves many steps of processing, and other than food, its products are the most highly demanded on the planet. Few people today go naked, and while there is a fairly narrow range of per capita consumption that is feasible for food, many people in affluent societies have far more clothing than they need, and “fashion” drives much more disposability than is practically necessary. Challenges to sustainability include many issues all down the value chain from providing fibers to spinning, weaving, finishing textiles, sewing garments and home furnishings, and global transportation of materials in between. Conventional natural fibers have unsustainability issues as well as synthetic and man-made fibers. New non-conventional bio-based textile fibers and related developments have some promise of improving the sustainability of this sector.

Over the past half century, man-made fibers have begun to displace natural fibers in clothing, household furnishings, industries and agriculture. Man-made fibers mainly consist of synthetic fibers such as acrylic, nylon, polyester and polypropylene; modified cellulosic fibers such as rayon, viscose etc. The success of synthetic fibers is due to their lower cost of production, compared to many natural fibers such as chitosan, glass fibers. Commonly used synthetic fibers are mass produced from petrochemicals to uniform strengths, lengths and colors which are easily customized to specific applications.

Technologies

Emerging technologies for the production of natural fibers such as banana, pineapple leaf, lotus, corn etc. are discussed in the report. Most of these provide some unique properties, are very labor-intensive, but have relatively low carbon intensities and pollutant profiles. The section also discusses the developing technologies for the production of synthetic polymer fibers from bio-based feedstocks for PLA, PHA, PTT, and nylon. These tend to provide some performance advantages, but will be challenged to come to economic scale to compete with incumbent fibers. After all, on the issue of carbon footprint and biodegradability, conventional bio-based fibers stand

in competition. New developments in the production of silk and leather fibers via fermentation or other chemical modification are also covered in this section. These provide, in the case of spider silk, remarkable new property advantages, and in the case of leather from fungi, humanitarian advantages.

Process Economics

Cost of production estimates have been made for production in the U.S. Gulf Coast (USGC), Brazil, China, and Western Europe

- Fibers:
 - PLA
 - PTT
 - PHA
 - Nylon 6,6
- Monomers:
 - Rennovia Adipic Acid process
 - NatureWorks PLA via Sugar Fermentation process
 - Mango Materials PHA via Syngas Fermentation process
 - Dupont PTT production from 1,3 PDO and PTA

Markets

NexantECA has provided market data on natural fiber markets, as available, for major markets.

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