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Biopolymers as sustainable raw material for textile industry: An opportunity or a challenge

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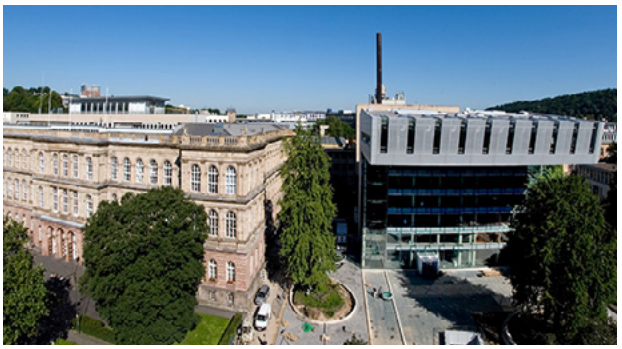
Abstract

Use of polymer in household as well as in industrial applications is increasing day by day due to their unique properties. Majority of polymers is de-rived from petroleum oil, which also poses enormous environmental problems in terms of global warming and pollution. Depleting reserves of petroleum oil and strong fluctuations in the crude oil prices make the search of alternatives necessary. So-called biopolymers are polymeric materials, which are produced from renewable materials or are biodegradable or both. The use of biopolymers in polymer and textile industry not only reduces carbon footprint but also provides independency from petroleum oil. A transition from petroleum based resources to bio-based resources has seen as an opportunity. Despite increasing interest in the sustainable raw materials, a shift from petroleum based resources to bio-based resources is seen as a long awaiting milestone in the polymer industry. The challenges are associated not only with higher price than conventional polymers but also with the limited process ability and the inadequate properties. The development of biopolymers has been a long history in different generations of development. The biopolymers of first generation i.e. starch, cellulose etc. were directly extracted from the natural resources and implemented in different polymer processing routes. However, natural polymer in their raw form had enormous difficulties in the processing due to undesired polymer structure, morphology, lack of homogeneity and presence of impurities. An efficient solution was seen as depolymerizing bio-based raw materials and using the clean monomers for polymer synthesis. This led to the second generation of biopolymer, so called synthesized biopolymers having desired molecular structure and tailored polypeptides i.e. polylactic acid. The modification in the structure of synthesized biopolymers is still a major topic of research and gaining a lot of attention. Despite, enormous potential of synthetic biopolymers, they are showing competition with food and feed. It seems challenging to fulfil the world polymer demand by synthesized bio-based polymers without endangering food and feed capabilities. Development of biopolymers from industrial, agricultural and household waste is seen as effective solution to fulfil world's demand without endangering food demand. Development of polyhydroxyalka-noates from waste and thermoplastic polyurethane (partially) from carbon dioxide is seen as potential solution. Research group "Biopolymer" at Institut fur Textiltechnik of RWTH Aachen University is devoted to find out the potential of biopolymers in textile application, developing textile process chain for interdisciplinary application and aiming at turning challenge with biopolymers into an opportunity for textile industry.



Biography

Pavan Kumar Manvi is head of the research group "Biopolymer" at Institut fur textiltechnik of RWTH Aachen University, where he has been since 2011. From 2011 till 2016 he served as researcher in the field of melt spinning of biopolymers. In 2016, he founded biopolymer research group and serving as head of the research group till date. During 2016-2018 he was a visiting scientist at Maastricht University. He received his Ph.D. on the topic of melt spinning of carbon dioxide based thermoplastic polyurethane. His research interests lies in the field of sustainable materials in the textile applications. Much of his work has been on improving the understanding and designing melt spinning process for biopolymers and improving performance during filament processing. For his achievements and excellent work, he got best poster prize in Applied Biopolymer Conference 2017 in Maastricht and first poster prize in International Conference on Biobased Textiles and Plastics 2018 in Gent. Working as a researcher after PhD, he is concentrating now not only sustainable fiber and process development but also on tailoring functionality of biopolymer fibers using additives and filament surface area. Major concentration is given on development of tailor-made biodegradability in the filaments..

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