Textile Fibres and Structures for Valorisation of Natural Resin

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Abstract

The textile industry strives to lead innovation in sustainability by integrating natural gum rosin resin into bio-based thermoplastic fibres. Thus far, this approach demonstrates significant improvements in antioxidant activity, UV resistance and dye absorption, with minimal impact on mechanical properties. Therefore, gum rosin-based composites represent a breakthrough in sustainable textile solutions, improving both textile performance and environmental impact.

This study showcases novel composite materials in the form of textile fibres and structures, which provide significant advantages over traditional synthetic options. In bio-based polyamide (PA) and bio-based high-density polyethylene (HDPE) fibres, incorporation percentages up to 20 wt.% have been accomplished. This incorporation into polymeric matrices during the melt spinning process significantly enhances the material's performance, enabling lower processing temperatures and improving the polymer's rheological behavior. This emphasizes the resin's role as a flow enhancer and a key contributor to process optimization. These innovative fibres were transformed into jersey knitted structures, and characterized regarding its bursting strength, distension, antioxidant properties, UV resistance, and dyeing performance, to understand the resin impact on both processing and functional properties. For PA jersey knitted structures, the addition of rosin resin resulted in a slight decrease in rupture strength, measured according to standard EN ISO 13938-1:2019, while no significant impact was verified on elongation at rupture. In terms of antioxidant potential (DPPH method), the incorporation of the resin exponentially increases the radical inhibition: 500%

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improvement for 10% gum rosin content and over 1000% for 20% gum rosin content. Among other properties, the UV resistance was assessed using an adaptation of standard 4399:19961, and the results showed that adding rosin resin substantially improves the UV protection factor (UPF): approximately 130% with a 10% gum rosin content and more than 150% in jersey structures containing 20% gum rosin.
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