

Accepted Manuscript

Natural fiber textile reinforced bio-based composites: Mechanical properties, creep, and environmental impacts

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PII: S0959-6526(18)32005-5

DOI: [10.1016/j.jclepro.2018.07.038](https://doi.org/10.1016/j.jclepro.2018.07.038)

Reference: JCLP 13492

To appear in: *Journal of Cleaner Production*

Received Date: 27 May 2018

Revised Date: 4 July 2018

Accepted Date: 4 July 2018

Please cite this article as: Miller SA, Natural fiber textile reinforced bio-based composites: Mechanical properties, creep, and environmental impacts, *Journal of Cleaner Production* (2018), doi: 10.1016/j.jclepro.2018.07.038.

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1 **Natural fiber textile reinforced bio-based composites: mechanical properties, creep, and**
2 **environmental impacts**

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9 **Word count:** 8,166

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11 **Abstract:**

12 With rising demand for construction materials, so too grow the environmental impacts associated with
13 their production. This trend has raised interest in the development of bio-based composites as
14 environmentally favorable alternatives to conventional materials. Yet, a greater understanding is needed
15 of both the mechanical properties of bio-based composites and their long-term properties, particularly
16 their creep deformation. This work examines the use of a bio-derived polymer matrix reinforced with
17 three types of natural fiber textiles. The mechanical properties and the creep deformation properties of
18 these composites are characterized showing a property dependence on textile type and orientation for
19 mechanical properties and creep deformation. Application of time-stress superposition to capture creep
20 behavior through accelerated testing is examined and is shown to be a promising means of capturing
21 long-term creep deformation. The results of this work show that the textile reinforced bio-based
22 composites studied have similar mechanical properties to several conventional construction materials.
23 Further, because time-stress superposition is shown to capture creep behavior of most of the composites
24 studied, this method might prove to be a means for expediting the collection and analysis of creep data
25 for bio-based composites. Finally, combined comparisons of mechanical properties and environmental
26 impacts of these bio-based composites suggest these materials could offer environmentally favorable
27 alternatives to conventional materials.
28

29 **Keywords:** Bio-based composite; Creep behavior; Bio-based polymer; Natural fiber textiles
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32 **Declarations of interest:** none.
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