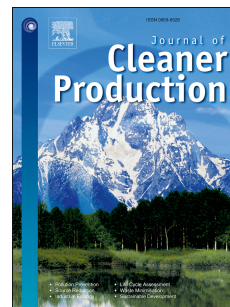


Accepted Manuscript

Bio-based plastics - A review of environmental, social and economic impact assessments

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PII: S0959-6526(18)30663-2

DOI: [10.1016/j.jclepro.2018.03.014](https://doi.org/10.1016/j.jclepro.2018.03.014)

Reference: JCLP 12272

To appear in: *Journal of Cleaner Production*

Received Date: 28 September 2016

Revised Date: 15 February 2018

Accepted Date: 1 March 2018

Please cite this article as: Spierling S, Knüpffer E, Behnsen H, Mudersbach M, Krieg H, Springer S, Albrecht S, Herrmann C, Endres H-J, Bio-based plastics - A review of environmental, social and economic impact assessments, *Journal of Cleaner Production* (2018), doi: 10.1016/j.jclepro.2018.03.014.

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

1 **[wordcount: 14,357 words]**

2 **Bio-based plastics - a review of environmental, social and economic**
3 **impact assessments**

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15 Keywords: bio-based plastic, bioeconomy, sustainability, life cycle costing, social life cycle
16 assessment, life cycle assessment

17 **Abstract**

18 Bio-based plastics show an evolving market and application range and therefore have
19 become increasingly popular in research and economy. The limitation of fossil resources as
20 well as linked environmental issues have led to the development of an innovative
21 bioeconomy and also triggered the shift from fossil-based plastics to bio-based plastics. The
22 original motivation for this study was to propose a comprehensive approach to calculate the
23 sustainability performance of bio-based plastics on a global scale. To provide a calculative
24 basis, a review on available data from life cycle assessment (LCA), social life cycle
25 assessment (S-LCA) and life cycle costing (LCC) studies on bio-based plastics was carried
26 out and showed limited availability of quantifiable results with regard to the social and
27 economic performance of bio-based plastics. In environmental LCA, with the ISO-family and
28 related documents, a group of harmonized standards and approaches does exist. However,
29 missing practical and consented guidelines hamper the comparability of studies and the
30 exploitability of data - not only within the bio-based plastic sector but also in comparison to
31 the fossil-based counterparts. Therefore, a calculation for the global sustainability
32 performance of bio-based plastics was merely conducted for the environmental impact
33 category global warming potential. Taking the technical substitution potential of fossil-based
34 with bio-based plastics as well as limitations in data availability into account the estimation
35 was performed for a substitution of approximately two-thirds of the global plastic demand.
36 The results show, that bio-based plastics could potentially save 241 to 316 Mio. t of CO₂-eq.
37 annually. Thereby this study gives a first outlook how bio-based plastics could contribute to a
38 sustainable development, making benefits and drawbacks more tangible.

39

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