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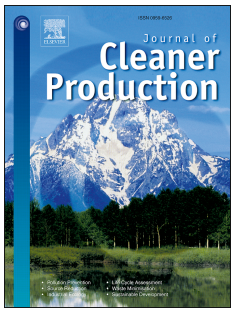

Bio-based plastics - A review of environmental, social and economic impact assessments

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

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Abstract

Bio-based plastics show an evolving market and application range and therefore have become increasingly popular in research and economy. The limitation of fossil resources as well as linked environmental issues have led to the development of an innovative bioeconomy and also triggered the shift from fossil-based plastics to bio-based plastics. The original motivation for this study was to propose a comprehensive approach to calculate the sustainability performance of bio-based plastics on a global scale. To provide a calculative basis, a review on available data from life cycle assessment (LCA), social life cycle assessment (S-LCA) and life cycle costing (LCC) studies on bio-based plastics was carried out and showed limited availability of quantifiable results with regard to the social and economic performance of bio-based plastics. In environmental LCA, with the ISO-family and related documents, a group of harmonized standards and approaches does exist. However, missing practical and consented guidelines hamper the comparability of studies and the exploitability of data - not only within the bio-based plastic sector but also in comparison to the fossil-based counterparts. Therefore, a calculation for the global sustainability performance of bio-based plastics was merely conducted for the environmental impact category global warming potential. Taking the technical substitution potential of fossil-based with bio-based plastics as well as limitations in data availability into account the estimation was performed for a substitution of approximately two-thirds of the global plastic demand. The results show, that bio-based plastics could potentially save 241 to 316 Mio. t of CO_2-eq. annually. Thereby this study gives a first outlook how bio-based plastics could contribute to a sustainable development, making benefits and drawbacks more tangible.