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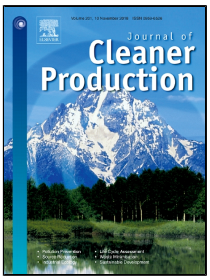

Uncertainty analysis in the life cycle assessment of cassava ethanol in China

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Uncertainty analysis in the life cycle assessment of cassava ethanol in China

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Abstract: In the context of China's severe energy and environmental problems, as an alternative vehicle fuel bioethanol is a promising choice because its theoretically renewable and carbon neutral. To guarantee grain security, China is developing non-grain fuel ethanol. Based on a life cycle assessment (LCA), this paper assesses the uncertainty of energy efficiency and environmental performance in the development of cassava ethanol of 1.5-generation bioethanol whose raw materials are non-staple crops. The results show that cassava ethanol is a good alternative vehicle fuel from the view of energy efficiency. From an environment perspective, global warming potential and photochemical ozone formation potential of cassava ethanol are better than gasoline, but acidification potential and respiratory inorganics inferior. The Monte Carlo simulation reveals cassava ethanol is feasible compared with gasoline in the case of uncertain variables. Among these uncertain variables, cassava yield, nitrogen fertilizer use, and steam use are the most important variables for energy efficiency and environmental performance of cassava ethanol. Furthermore, this study calculates the potentials for energy savings and emissions reduction with improving key aspects, and gives the suggestions of enhancing the performance of key indicators to promote the development of bioethanol vehicle fuel.

Key words: Uncertainty analysis; Life cycle assessment; Cassava ethanol; Energy consumption; Environment impact

1. Introduction

China is experiencing severe energy and environmental challenges. As the world's largest energy consumer and importer, China's share of global energy demand is projected to increase from 23% in 2015 to 26% in 2035, accounting for 35% of global net growth, and the dependence rate on oil imports is projected to increase from 61% in 2015 to 79% in 2035 (BP, 2017). As the largest emitter of greenhouse gas (GHG), China has committed to achieving a carbon dioxide emissions peak by 2030 (Su et al., 2015). Carbon dioxide emission of per unit GDP decrease by 60%–65% in 2030, compared with the 2005 level, and non-fossil energy approximately accounts for 20% of