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"Solidarity in a competing world — fair use of resources"

Greenhouse Gas Assessment of Soybean Biodiesel in Brazil

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Abstract

Biodiesel has been playing an increasingly important role in Brazilian energy matrix and promoting the national bio-based economy. The biodiesel production in Brazil has grown from 736 m^3 in 2005 to approximately 4.4 million m^3 in 2014. Among all the inputs, soybean predominate the biodiesel production in Brazil with a share of 77.2 % in 2014 and made Brazil the 2nd largest biodiesel producer worldwide. Current models used in energy balance reports have shown positive net energy ratio, indicating the renewability of soybean biodiesel. However, the environmental impacts and the fair use of this agricultural resource have debatably come to public attention. Consumers value more and more the environmental sustainability of agricultural products, with a particular interest in the greenhouse gas (GHG) emissions as a sustainability indicator. For policy and decision making processes, this sustainability indicator is also being progressively demanded. To assess the GHG emission of the soybean biodiesel production in Brazil, we used the data mainly from the Center West region and partly from the neighbour regions, which represent more than 70 % of the whole soybean production in Brazil. A life cycle assessment (LCA) model from cradle to distribution was also integrated into our calculation and was divided into four stages: the field stage; the extraction stage; the production stage; the distribution and delivery stage. Carbon footprint through all stages are calculated and evaluated. Results show an average GHG emission of 316 g CO_{eq} kg^{-1} of soybean in agricultural stage. The largest source of GHG emission from the agricultural production in Brazil is the decomposition of crop residues (36 %). Production stage contributes the highest amount of GHG emssion (52%) in a non-integrated system, which suggests the emerging integrated system (combined units from extraction and production) might have high potential in GHG emission reduction. The whole study with the integration of the four life cycle stages of soybean biodiesel will contribute to identify the main GHG emission source in the production chain of Brazilian soybean biodiesel and suggest the mitigation priority for policy and decision making.

Keywords: Carbon footprint, emission factors, life cycle stages

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