Review of Emission Factor and Land Use Change Analysis used for the Renewable Fuel Standard by US-EPA

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ABSTRACT

The United States Environmental Protection Agency (EPA) conducted live cycle analysis (LCA) on the biofuel standard of palm oil used as the feedstock for biodiesel. The early 2012 version of the analysis concluded that palm oil, used as the feedstock of biodiesel and renewable diesel, does not meet the minimum requirement of 20% emission reduction relative to the emission frompetroleum based diesel. According to the analysis, emission from peat decomposition and land use change contributed to over 46% of the total emissions. We reviewed and commented on (i) the emission factor, (ii) land use change analysis and assumed Indonesianpeatland area used by the EPA. The emission factor of 95 Mg CO_2 ha^{-1} yr^{-1} used by the EPA was based on a peat subsidence study, rather than on carbon stock change measurement. This value was more than twice as high as the average annual emission rate of 38 Mg CO_2 ha^{-1} yr^{-1} based on direct CO_2 flux measurements from closed chambers. In the land use change analysis, EPA lumped the activity data of low C-stock shrubland into forest, and this bulges the figure of forest contribution on emission and overlooked thecontribution of shrub conversion to oil palm plantation on sequestration. In addition, EPA used the old, mostly remote sensing-basedversion of Indonesian peatland map, that over-estimated the total peatland area of Sumatra and Kalimantan as large as 13 million ha. We propose the use of the more reliable 2011 version, which was verified with soil survey data, showing that the total peatland area of the two islands as large as 11.2 million ha. We recalcuted the land use change (and peat emission) portion of the LCA by introducing three additive scenarios, (S1) peat emission factor of 38 Mg CO_2 ha^{-1} yr^{-1} which was based on direct CO_2 flux measurement; (S2) future oil palm expansion will use 28% forest and 15% shrubland, rather than using 43% forest, (S3) data of peatland area in Sumatra and Kalimantan is reduced as high as 13% based on the revised peatland map. Our recalculation shows mean emission reductions of 31% (ranging from 26% to 35%), 33% (28%-38%) and 35% (31%-38%) from palm oil (PO) biodiesel and 25% (20%-29%), 27% (22%-32%) and 29% (25%-33%) from PO renewable diesel under the additive scenarios S1, S2 and S3, respectively, meaning that palm oil meet the minimum requirement of 20% emission reduction. This calculation shows the risk of losing opportunity to utilize palm oil based biodiesel when the analysis uses a rough estimate subsidence-based emission factor, a rough land cover classification and the old version peat land map.

Keywords: live cycle analysis, land use change, emission factor, subsidence measurement, CO_2 flux measurements