An Environmental Life Cycle Assessment Analysis of Lignocellulosic Bioethanol as an Alternative Transportation Fuel

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Short Description (maximum 2500 characters)

Considering the threat of oil depletion and climate change due to increasing level of GHG emissions, a shift from fossil resources to renewable biofuels is ongoing to secure long-term low carbon energy supplies. In the view of GHG emission reduction targets together with the continuous increase in energy consumption have motivated increasing support for renewable energy. Bioethanol from lignocellulosic feedstocks could be a viable alternative for renewable transportation fuels produced from food crops and gasoline due to the limited competition with food production and 45-65% GHG emission reduction compare to conventional gasoline (CG). Within this scope, the objective of this paper is to conduct a Life Cycle Assessment study (LCA) according to the ISO 14040 series by using the GaBi4 LCA software, Ecoinvent database and the EDIP 2003 methodology for lignocellulosic bioethanol blends (E10 and E85 - 10% and 85% in volume of bioethanol with gasoline, respectively) and CG to compare these fuels in terms of environmental aspects.

The potential environmental impacts of fuel production and combustion patterns along with life cycle interpretation are global warming, acidification, aquatic and terrestrial eutrophication, photochemical oxidant formation and ozone layer depletion potentials. 1 km traveling distance with a flex-fuel vehicle (FFV) is taken into account as functional unit for the life cycle analysis of each fuel blends from production to combustion. According the LCA results, one kilometer driven by E10 and E85 fueled vehicle could reduce the GHG emissions by 4.3% and 47% and ozone layer depletion emission by 3% and 66% with respect to CG, respectively. However, shifting from gasoline to lignocellulosic bioethanol increases the emissions which contribute to eutrophication and photochemical ozone depletion. In terms of acidification potential, E85 shows better result than E10 and CG.