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Treating Input Data Uncertainty in LCA: Monte Carlo and Fuzzy Approaches

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Abstract

This work aims at discussing the differences between Monte Carlo method and Fuzzy data sets approaches when dealing with input data uncertainty in LCA models. Input data variation is treated in most LCA studies considering uncertainties because practitioners do not have the necessary specific data for the case study or even because the available data has a characteristic variation. In this work the probabilistic and the possibilistic approaches are detailed discussed and the probability density function and the membership function curves of the respective results are compared, through the application of both methods in a simple case study. It consists of two materials mainly composed of recycled cotton fibers used as acoustic barriers in automotive vehicles: DL (Dual Layer) and ABA (Absorption, Barrier, Absorption). The Monte Carlo Method was applied through SimaPro[®]. The lognormal probability density function adapted to the result data showed that DL material is more impacting than the ABA one in the Acidification category, however in the Photochemical Oxidation category, there is an intersection between the curves and in this interval there is a chance of both materials to be the most harmful for the environment. The same results were observed through the membership functions of these impact categories when applying the Fuzzy data sets approach; therefore, probabilistic and possibilistic approaches were validated for the treatment of input data uncertainty in LCA models and they can be useful tools for LCA practitioners.

Keywords: Life Cycle Assessment, Input data uncertainty, Monte Carlo Method, Fuzzy data sets