Interpreting and communicating LCA results in models with high variability and uncertainty – the wider impact of the AQUAVALENS project

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1. Introduction

✓ LCA practitioners must face the peculiarities of the analyzed system:

  • data availability
  • uncertainty of the input data
  • resolution of the model
  • necessary assumptions
  • unsettled parameters

✓ In the presented study we analyze the consequences of adopting decisions on the features in the design of the LCA models

2. System features

✓ Novel platforms developed under the AQUAVALENS project for the detection of pathogens in drinking water.

✓ Difficulty for setting a high number of parameters related to platforms manufacturing and protocols and procedures to use them.

✓ The complexities due to the diversity of:

  • Platforms
  • Manufacturers (confidentiality issues)
  • Potential users

3. System characterization

Platform developers

qPCR kits

Online monitoring

4. Carbon footprint calculation

✓ Cradle-to-gate boundaries

✓ Background data Ecoinvent 3.1

✓ IPCC global warming potential

✓ Functional unit:1 analysis (e.g., q-PCR)

AQUAVALENS platforms

Online monitoring

Distribution of the total Carbon Footprint of the online monitoring device. Total Carbon Footprint 87.8 g CO₂-eq/analysis.

qPCR kits

Distribution of the total Carbon Footprint of the qPCR kits: type of input and by stage of the procedure. Total Carbon Footprint 1.18 kg of CO₂-eq/analysis.

AQUAVALENS vs CONVENTIONAL

• The Functional Unit is now the analysis of a set of six species from the three kingdoms in a sample.

• The total scores of CFP are 12.1 and 34.7 kg CO₂-eq/analysis for AQUAVALENS and conventional procedures, respectively, in base case scenario.

• Parametric uncertainty derived from the variation and stochastic errors of the input data is analysed, excluding those that arise from methodological decisions and the use of background data.

• The CFP of conventional methods is significantly higher than AQUAVALENS procedures.

5. Conclusions

✓ Focused on environmental impact minimization

✓ Based on a standardized Life Cycle Assessment (ISO 14040 series)

✓ Input data from real case studies (laboratory materials producers and users) and not purchases

✓ Including all cycle: material production, energy consumption and waste disposal, not only improvements opportunities in specific stages

6. Acknowledgements

✓ European Union’s Seventh Framework Programme, grant agreement no. 311846.

✓ Spanish Ministry of Education and Science, ECO2016-75204-P.