

Comparing Slurry Aeration and Manure Acidification by Life Cycle Assessment

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Abstract

Livestock manure poses an immense environmental challenge, contributing to GreenHouse Gas (GHG) emissions, alongside nutrient losses that can lead to environment impact. Processing this manure into valuable products is needed for achieving sustainable agriculture. This study focuses on Comparative Life Cycle Assessment (LCA), utilizing openLCA software and Ecoinvent database with Europe as the location of the study, to quantify the environmental performance of the untreated manure and compare it with two common treatment technologies which are acidification and aeration. The comparison is standardized across a Functional Unit of 1 tonne of livestock manure as an input of the cradle process. The objective is to compare the system's cradle to grave impacts, focusing on key environmental impacts, including Global Warming Potential, Acidification Potential, and Eutrophication Potential. The system boundary includes the entire cycle from manure collection through the treatment process to spreading to the field with avoided fertilizer value included. The intended output of this research is to generate quantitative environmental impact results for both acidification and aeration per tonne of manure treated, to identify the main emissions and characterize trade-offs among environmental impacts within each system. The study will also provide sensitivity analysis results that show how key modelling assumptions and parameters influence their comparative performance, and, on this basis, aims to deliver decision support information for policymakers and farm managers to aid in selecting manure management strategies that can reduce overall environmental impacts while remaining practical and applicable under real farming conditions.

Keywords: Agriculture; Emissions; Europe; Fertilizer; Sustainable