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SUSTAINABILITY ASSESSMENT OF TWO DIGESTATE TREATMENTS: A COMPARATIVE LIFE CYCLE ASSESSMENT

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Abstract

Digestate derived from the anaerobic digestion of biowaste is a nutrient-rich substance whose direct use on land is not permitted by the Italian Legislation. The possibility of recovering its nutrients can be given by the processes of stabilisation and sanitation required by the Italian Legislation. Among these processes, composting and calcium hydrolysis with neutralization (CHN) permit to obtain useful soil improvers like compost and defecation gypsum (DG). In this paper a gate-to-gate Life Cycle Assessment (LCA) of these two processes is performed to evaluate their relative environmental sustainability, by using the ReCiPe H midpoint and endpoint impact assessment methods. The functional units (FUs) used in this analysis are one tonne of digestate treated by each process, and the amount of compost and DG necessary to amend one hectare of maize cultivation. Data used in the assessment were collected from plants located in Northern Italy and were referred to one year of operation. The processes of transport and spreading on land of the final products were not considered. The results of both the analyses show that CHN is the process with the largest environmental impacts, mainly due to the use of chemicals (i.e., sulfuric acid and calcium oxide). For both processes and FUs, the most impacted midpoint categories are Natural land transformation, Marine ecotoxicity and Freshwater ecotoxicity. Among the endpoint categories Resources is the most impacted one (followed by Human Health and Ecosystems), for both FUs, although showing larger differences for the agronomic use.

Key words: anaerobic digestion, circular economy, digestate treatment, LCA, sustainability assessment

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