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# Digestate from Spanish wholesale food markets: valorization as biofertilizer and analysis of environmental impacts compared to synthetic fertilizers

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**Abstract-**

**This study presents a comprehensive environmental impact assessment of biofertilizers from digestate in Spain’s 23 most extensive food markets using life cycle analysis. Eleven impact categories were evaluated. Results revealed significant variations in impacts across food markets, primarily due to differences in infrastructure sizing and energy self-sufficiency. Markets with appropriately sized anaerobic digestion facilities and energy self-sufficiency demonstrated significant environmental benefits, resulting in emission savings in 9 of the 11 impact categories assessed, except acidification and eutrophication. As a representative case of the markets with properly sized anaerobic digestion infrastructure and energy self-sufficiency, Market G as a representative market achieved up to 86% reduction in abiotic depletion and over 75% in toxicity categories. However, four food markets with either oversized or undersized infrastructure exhibited lower benefits, with Market A showing no advantages over synthetic fertilizers. In addition, the acidification and eutrophication categories posed challenges for all markets due to ammonia emissions during composting; in these impact categories, the values of biofertilizers are 5 to 8 times higher, depending on the market. When comparing unit and aggregate values (single scores), 19 out of 23 markets offer environmentally sustainable biofertilizers, resulting in an average emission savings of 55%. In conclusion, biofertilizers present a more sustainable alternative to synthetic fertilizers in most markets, contingent on adequate infrastructure and energy self-sufficiency. Future studies should focus on optimizing facility sizing and evaluating the influence of waste composition, as both factors significantly affect the environmental performance of digestate-based biofertilizers. This research highlights the potential of biofertilizers to contribute to more sustainable agricultural practices when the production process is well-optimized.**
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**Index Terms- Anaerobic digestion, Digestate, Biofertilizer, Impact assessment, Waste valorization, Nutrient management.**

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