

Bio-Waste to Organic Fertilizers: Valorization for Sustainability

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Sulfuric and phosphoric acid hydrolysis is pivotal in waste valorization, sanitizing products and improving nutrient bioavailability in fertilizers. This method transforms anaerobic digestate and dairy waste into organic-mineral fertilizers, retaining vital nitrogen. Hydrolysis with these acids breaks down bio-waste into plant-accessible short peptides and amino acids, essential for plant nutrition. This enhances nutrient use and supports initiatives for waste reduction and resource reuse.

This research highlights the sustainable conversion of bio-waste to organic-mineral fertilizers, focusing on sulfuric and phosphoric acid hydrolysis. This process makes nutrients in anaerobic digestate and dairy waste more accessible to plants by simplifying complex organic compounds. Ensuring product sanitation and safety for agricultural application is a key outcome of this method (Chojnacka, 2024; Izydorczyk et al., 2024).

Utilizing sulfuric and phosphoric acids not only breaks down bio-waste but also aids in creating balanced NPK fertilizers to meet diverse agricultural needs. This practice aligns with environmental sustainability by encouraging bio-waste reuse in agriculture, contributing to the circular economy (Izydorczyk et al., 2024).

Post-hydrolysis neutralization, using KOH or biomass ash, is essential for fertilizer granulation, adhering to Regulation (EU) 2019/1009 on EU fertilizing products. This ensures fertilizers meet EU standards, with a specified NPK ratio and microelement content. Biosorption, as an alternative, enriches biomass with microelement ions, further enhancing fertilizer quality and offering a holistic bio-waste valorization strategy (Mikula et al., 2024; Skrzypczak et al., 2024).

Compliance with EU Regulation (EU) 2019/1009 is crucial after hydrolysis neutralization, ensuring fertilizers' quality, safety, and efficacy. This regulatory adherence is vital for integrating the fertilizers into EU agricultural practices.

Biosorption is an innovative method to enhance biomass value by adding microelement ions, making biomass a vector for bioavailable nutrients. This complements the acid hydrolysis approach, providing a complete solution for converting bio-waste into high-quality organo-mineral fertilizers. By enriching the biomass with essential microelements, biosorption improves the fertilizers' nutritional profile, supporting sustainable agriculture and efficient waste management.

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