Investigating the Cycling of Nutrients from Seafood Processors' Waste in Organic Fertilizer

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The seafood industry in Louisiana generates an economic impact of $2.4 billion annually. The chemical profile of waste from urban processors presents a unique input of naturally derived phosphorus and protein that become readily available nutrients for microbial communities. With processing operations being focused on commodities such as shrimp and crab, the generation of processing waste often exceeds 40-70% by weight of the raw materials used in the industry. Current trends of disposal of this waste in landfills are not only causing environmental pollution owing to the contamination of sensitive coastal ecosystems but also costing a significant amount of money to processors. The objective of this study is to test the potential of the Black soldier fly larva (BSFL)-based bioconversion system, which allows the valorization of seafood processing waste into protein-rich animal feed ingredients and fertilizer to be used in agricultural operations. The adoption of this system may enable the processors to run a sustainable processing operation that emphasizes on circular economy. Nutrient analysis of Louisiana seafood shells confirmed their suitability for BSFL rearing. Findings from larval growth trials indicated commercial BSFL diet could be replaced with up to 40% seafood waste without affecting larval development, while bioconversion efficiency improved at inclusion rates up to 60%. The nutritional content of harvested BSFL and fertilizer, referred to as frass, remained comparable to controls across all treatments, indicating seafood waste can effectively substitute commercial formulations in industrial-scale BSFL production. Comprehensive economic analysis and further research on the efficacy and safety of the resulting byproducts are recommended before commercial implementation of this strategy.