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ABSTRACT
BOOK

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ID262 | Uncovering Microbial Drivers of Cellulosic Textile Degradation in Composting Environments

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Background: The exponential growth of global textile production, coupled with inadequate waste management infrastructure, has intensified the environmental burden of textile waste. Of particular concern is the cellulose-rich fraction, comprising natural and regenerated fibres, which remains largely excluded from effective recycling pathways. Its high abundance and untapped potential for microbial degradation underscore the need for targeted strategies. Leveraging the metabolic capabilities of specialised microbial communities within composting environments offers a promising route to address this gap, enabling sustainable bioconversion of cellulosic textiles into value-added products. This study investigates the potential of composting as a biologically driven strategy for the sustainable treatment of cellulosic textile waste. **Methods:** Cotton and lyocell fabrics, in both whole and shredded forms, were subjected to industrial (55 days) and community (90 days) composting processes conducted at a urban waste treatment and recovery Association (LIPOR, Portugal). Upon completion of the composting process, compost and textile samples were collected for downstream analyses, including culture-based and metagenomic approaches. **Results:** Degradation efficiency, determined through dry mass weight loss, was significantly higher in shredded samples (p 93% mass loss for both fabrics). Shotgun metagenomic analysis revealed microbial communities predominantly composed of Actinomycetota, Bacillota and Ascomycota. Functional annotation highlighted a rich repertoire of carbohydrate-active enzymes (CAZymes), notably glycoside hydrolases (GH), with the highest abundance detected in lyocell samples from community composting. Notably, cellulosome-associated domains were exclusively identified in lyocell samples. Complementary culture-based screening yielded 48 cellulolytic isolates across genera such as *Bacillus*, *Aspergillus*, and *Neurospora*. **Conclusions:** These findings position composting as a promising strategy for valorising cellulosic textile waste and as a potential foundation for advancing biotechnological innovations in textile waste management.

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