CHARACTERIZATION OF INDIGENOUS CELLULOLYTIC AND AMYLOLYTIC BACTERIA FOR SUSTAINABLE ORGANIC WASTE BIODEGRADATION

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Abstract

Organic waste generation is increasing globally and causing environmental problems. Microbial biodegradation of organic waste acts as an eco-friendly alternative to transform such waste into valuable compost. The study aimed to isolate and characterize the cellulolytic and amylolytic bacterial strains from Batticaloa district, Sri Lanka and evaluate their potential for organic waste biodegradation. Soil samples were collected from eleven locations, including paddy fields, coconut estates, and other agricultural lands, to capture diverse agricultural environments and indigenous bacterial isolates. Thirty-two bacterial isolates were obtained using serial dilution and culture methods. Cellulolytic and amylolytic activities were qualitatively evaluated on carboxymethyl cellulose agar with Congo red staining and starch agar with iodine staining, respectively, and quantitatively determined using the dinitrosalicylic acid method with three replicates (n = 3). Isolate I-31 produced the highest starch hydrolysis index (3.09 ± 0.03) and amylase activity (3.45 ± 0.09 U mL^{-1}), whereas I-25 showed a starch hydrolysis index of 2.75 ± 0.03 and amylase activity of 2.98 ± 0.08 U mL^{-1}. I-25 showed the highest cellulolytic performance, with a cellulolytic index of 2.59 ± 0.01 and cellulase activity of 1.86 ± 0.04 U mL^{-1}, while I-31 recorded 2.22 ± 0.07 and 1.42 ± 0.08 U mL^{-1}, respectively. No antagonistic effect was observed between the isolates. BLASTn analysis against the NCBI GenBank database showed >99% sequence similarity of I-31 and I-25 to *Priestia aryabhattai* and *Priestia megaterium*, respectively. The 16S rRNA sequences were deposited under accession numbers PZ780565 (*P. aryabhattai*) and PZ780540 (*P. megaterium*). Biodegradation was evaluated using grass, plant waste, and straw for 60 days, with weight loss used to estimate efficiency. The complementary activities of these strains highlight their potential for organic waste biodegradation and sustainable waste management.

Keywords: Biodegradation; Composting; Cellulase; Amylase; Cellulolytic bacteria