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Identification And Characterization With Antibiotics Resistant Profile Of Tannin Degrading Bacteria

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Structured Abstract

Background: Tannins are natural compounds used in substantial applications, but their presence can have negative sequences. Hence, there is a need for the production of tannase to break down tannins. Tannase is primarily exploited in microorganisms as these enzymes are commonly more stable, but its optimal activity can also be influenced by environmental factors. Furthermore, there is limited research on the antimicrobial resistance profile of tannin-degrading bacteria (TDB) and tannase.

Methods: Therefore, this study aims to identify four tannin degrading bacteria isolated from the ruminal fluid and faeces of the goat sample. The study also aims to characterize the properties of the crude tannase using modified spectrophotometric method under varying conditions such as pH, substrate concentration, temperature, and incubation time. Additionally, the study also explored the antibiotic resistance profile and synergistic effects of crude tannase from TDB through disc diffusion assay.

Results: All four isolates were identified as *Lysinibacillus macroides* and *Acinetobacter nosocomialis*, marking the first report for these microorganisms. The crude tannase activity of these bacteria was observed in a minimum salt medium (MSM) supplemented with 0.6% tannic acid (pH 5) over 5 days, ranging from 13.64 to 43.84 U/mL. Optimization revealed that crude tannase activity for both bacteria was maximum at pH range 6 to 7, substrate concentration at 2%, and temperature range at 30ºC to 40°C. The highest crude tannase activity was exhibited at 45 minutes incubation time for *Acinetobacter nosocomialis* while at 105 minutes for *Lysinibacillus macroides.* Both bacteria were susceptible to meropenem, tigecycline, gentamicin, streptomycin, and chloramphenicol while resistant to penicillin G, cephalothin, cefoxitin and vancomycin. Notably, *Acinetobacter nosocomialis* demonstrated sensitivity to sulfamethoxazole, while in contrast, *Lysinibacillus macroides* exhibited resistance to this antibiotic. Moreover, the antibacterial activity of crude tannase was enhanced with antibiotics against Gram-positive and Gram-negative bacteria tested.

Conclusion: In this study, the *Lysinibacillus macroides* emerged as the most efficient producer of tannase, exhibiting the highest tannase activity (70.85 U/mL) upon exposure to optimal pH condition with possible potential tolerance in high tannin levels and source as thermostable tannase. The crude tannase extracted from the bacteria in combination with antibiotics provide benefit in inhibiting other multidrug-resistant bacteria.

Keywords: Tannin degrading bacteria, crude tannase, antibacterial, antibiotics, goat.

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