ISOLATION AND CHARACTERIZATION OF *BACILLUS MEGATERIUM* ANTIMICROBIAL PEPTIDE AGAINST *LISTERIA* AND *SALMONELLA* BIOFILMS IN HYDROPONIC SYSTEMS

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ABSTRACT

The rapid growth of hydroponic systems has led to biofilm formation, with *Listeria monocytogenes* resisting standard cleaning methods and posing risks. This study examines the predominant microflora in hydroponic biofilms and explores antimicrobial strategies for effective microbial control. 3M swabs were used to collect biofilm samples from (a) hydroponic tubing, (b) water pump, (c) drainage area, and (d) air pump areas of NFT hydroponic system. swabs were plated on tryptic soy agar and incubated at 37°C for 24 hours, after which the isolates were identified using MALDI-TOF analysis. To study microbial interactions, 120 co-exclusion combinations of two isolates each were prepared. Isolates were mixed in a 1:1 ratio in tryptic soy broth, incubated at 37°C for 24 hours, and plated on tryptic soy agar. The isolates were differentiated based on colony morphology, gram staining, and MALDI-TOF identification. Analysis of variance determined microbial predominance, revealing both gram-positive and gram-negative bacteria. Identified species included *Bacillus cereus, Micrococcus luteus, Bacillus infantis, Aeromonas hydrophila*, and *Enterobacter bugandensis*. In co-culture, one species consistently dominated, averaging 7.8±0.08 log CFU/mL. This research also explored the antimicrobial potential of *Bacillus megaterium* cell-free supernatant (CFS) against *Salmonella enterica*, *E. coli O157:H7*, and *Listeria monocytogenes*. Using an agar well assay, *B. megaterium* CFS showed strong inhibition, with *S. enterica* exhibiting greater inhibition (16±0.04 mm) than *S. Tennessee* (12±0.10 mm) and *E. coli O157:H7* (11.5±0.08 mm). *L. monocytogenes Scott A* showed the highest inhibition (17±0.09 mm). Biofilm studies on PVC and vinyl surfaces revealed significant reductions in *L. monocytogenes* (2.15±0.08 log CFU/cm²) and *S. enterica* (2.75±0.11 log CFU/cm²). These findings suggest *B. megaterium* CFS as a promising disinfection strategy for mitigating biofilm formation and microbial risks in hydroponic systems.

Keywords: Bacillus megaterium, Listeria, Salmonella, biofilms, hydroponic system

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