Synergistic Effects of D-Amino Acids and Ciprofloxacin on Staphylococcus epidermidis Biofilms and Viability

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Staphylococcus epidermidis biofilms resist antibiotics like ciprofloxacin. This project evaluates D-amino acids as adjuvants to increase ciprofloxacin efficacy. Combining ciprofloxacin with D-methionine reduced biofilm metabolic activity by >90% and biomass by >85% versus controls (ANOVA, $p < 0.001$), outperforming ciprofloxacin alone (70% biomass reduction). Other D-amino acids (D-valine, D-tryptophan) alone showed no statistically significant effect but improved ciprofloxacin efficacy moderately. Assay reliability was confirmed with negative controls. D-methionine likely disrupts biofilm structure, enabling ciprofloxacin penetration. This combined action could offer a strategy to lower antibiotic doses, minimizing resistance risks. Future work will explore mechanisms, in vivo validation, and applications to pathogens like S. aureus and P. aeruginosa.

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