Disfiguring E. coli Biofilm Structure Through Hydrolysis of Extracellular Polymeric Substance via Application of Bacterial Protease and Amylase

Balasubramanian, Muhilan (School: Ballard High School)

Biofilms are extracellular matrixes that secure microorganisms embedded within them through the EPS or extracellular polymeric substance which provides rigidity and tolerance to a wide degree of antibiotics and conventional antimicrobial drugs. This is alarming as biofilms increasingly contribute to oral infections and medical device contaminations. Therefore, protease and amylase applied to hydrolyze polypeptide chains and polysaccharides of the EPS could be viable options for a more efficient and innocuous treatment method. Colonies cultivated from a pre-streaked plate of MM294 E coli strain inoculated in peptone broth medium with rapid cell growth were applied to vinyl tubes for biofilm formation. Grown biofilms were applied in vitro with differing catalyst concentrations; subsequently, benedicts and biuret colorimetric reagents were administered to identify the reduction of complex polysaccharides and peptides. In a subsequent experiment, varying biofilm to protease concentrations was applied in vitro to find the most efficient ratio for future implementations. Protease applications exhibited darker hues signifying protease's efficient cleavage of peptide chains while amylase applications revealed lighter hues indicating amylase's inadequate reduction of glycans. Similarly, combined enzyme applications exhibited darker concentrations homogenous to protease applications. Differing biofilm-to-protease ratios also exhibited darker hues. This shows that protease can be utilized for the degradation of EPS and successful disruption of biofilm structure. Future experiments would include explicit testing methods and seek to develop efficacious regimens utilizing enzymes.