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Anti-Biofilm Agents: Synergistic Impact of Polysaccharide Degrading & Oxidative Enzymes on Biofilms

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ABSTRACT: The association of biofilms within human body to cause wounds, oral plaques, infections associated with implants has prompted a search for antimicrobial interventions that are effective against biofilms. The polysaccharide degrading enzymes (such as alginate lyase, and amylase) help in removal of EPS (extra polymeric substance) matrix, that prevents adhesion of bacteria to the surface. Oxidative enzymes help in restricting the growth of the bacterial colonies. The combination of these enzymes will enhance the killing of cells and will cause complete eradication of biofilms. EPS matrix plays an important role in cell-surface adhesion, cell-cell adhesion, cell-cell communication (quorum sensing). Polysaccharides are a major component of EPS matrix, targeting a biofilm with polysaccharide degrading enzyme leads to destruction of EPS matrix and thus all the associated functions of EPS matrix are ceased. There are two kinds of oxidative enzymes. First includes the "H2O2 -producing enzymes" (e.g. glucose peroxidase) and the other one is "H2O2– responsive enzymes" (e.g. lactoperoxidase). These oxidative enzymes could be used for therapeutics, where Glucose peroxidase system will generate H2O2 and this H2O2 will be further utilized by peroxidases to generate potent antimicrobial agents, which will impart a bacteriostatic as well as bacteriocidal impact on biofilms. The study emphasizes on a multistep strategy to combat bacterial biofilms. It includes hydrolases and oxidoreductases with the ability to destabilize the biofilm matrix by hydrolyzing its polysaccharides, as well as accumulation of reactive oxygen species, that would not only reduce bacterial viability, but will also show reduction in biomass. The development of effective complex enzyme formulations is urgently needed to deal with the problems associated with biofilm formation in healthcare settings.

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