

# “Biofilm Disruption activity of Alpha-tocopherol (Vitamin E) - Mechanism of action and its potential applications”

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Biofilms are bacterial communities attached to a surface and are embedded in a matrix of self-produced extracellular polymeric substances. Biofilms can grow on living tissues and indwelling medical devices, leading to biofilm-associated infections. *Staphylococcus aureus* is inherently resistant to antimicrobial treatments, which further challenges treatment of *S. aureus* biofilm infections. In a study by our research group, it was discovered that treatment with  $\alpha$ -tocopherol (vitamin E) had exhibited effective biofilm disruption activity against *S. aureus* biofilms. Therefore, the objectives of this research project were to investigate the possible mechanism of action involved in the disruption of *S. aureus* biofilms by  $\alpha$ -tocopherol and to explore the application of  $\alpha$ -tocopherol in combination with antibiotics for antimicrobial and anti-biofilm therapies. Scanning electron microscopy results demonstrated disruption and dispersion of the biofilm layers after treatment with  $\alpha$ -tocopherol. Furthermore,  $\alpha$ -tocopherol disrupts biofilm without causing DNA degradation but instead interferes with the reactive oxygen species (ROS) levels in the biofilm layers ( $35.5 \pm 3.4$  % reduction in ROS levels when compared to negative control).  $\alpha$ -Tocopherol may have scavenged the ROS within the biofilm, thus affecting the bacterial regulatory signals that maintains biofilm integrity, subsequently causing the disruption of the biofilm layers. Moreover,  $\alpha$ -tocopherol - antibiotics combination studies had demonstrated that  $\alpha$ -tocopherol combination with daptomycin was much more effective in reducing biofilm cell viability (in terms of CFU) as compared to combinations with either vancomycin and linezolid. The combination of  $\alpha$ -tocopherol with higher concentrations of daptomycin (at 2x and 4x MIC) had showed promising results, which could be further explored to improve the application of  $\alpha$ -tocopherol for anti-biofilm therapies.

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