



CALIFORNIA SCIENCE & ENGINEERING FAIR 2018 PROJECT SUMMARY

Name(s) Eric T. Vuong	Project Number S1620
Project Title Assessing the Efficacy of Phytochemical Therapy for Biofilm Inhibition in vitro	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals Biofilms infecting orthopedic implants, catheters, and pacemakers pose a significant healthcare risk due to their resistance to antibiotics and phagocytosis. Every year, 1.7 million Americans acquire biofilm-related infections, and 100,000 die as a result. Currently, promising preventative measures include quorum sensing disruption and metal-coated implants. However, these measures may be hazardous to patients. Impregnating medical implants with non-toxic phytochemicals may be a viable solution for inhibiting or preventing biofilm formation following insertion. The objective of this project is to determine the efficacy of salicylic acid, methyl salicylate, thymol, and silver nitrate for inhibition of <i>Staphylococcus epidermidis</i> and <i>Escherichia coli</i> biofilms, which develop postoperatively at surgical sites.</p> <p>Methods/Materials Biofilms were grown in a 24-well microtiter plate. A crystal violet assay was used to determine the % biofilm inhibition of each chemical when 10, 25, 50, and 100 microliters were added. Silver nitrate was tested to compare the effectiveness of silver-coated implants with the phytochemicals. 3 trials were conducted for both species.</p> <p>Results In both species, thymol was the most effective phytochemical for inhibiting biofilm formation at higher concentrations, while methyl salicylate was more effective at lower concentrations. At all concentrations, silver nitrate inhibited the most growth. When 100 microliters of each respective chemical were added to the <i>S. epidermidis</i> wells, silver nitrate inhibited 84.9% biofilm growth, methyl salicylate inhibited 70.2%, thymol inhibited 75.7%, and salicylic acid inhibited 45%.</p> <p>Conclusions/Discussion The results indicate that methyl salicylate and thymol are effective in preventing biofilm growth when compared to silver nitrate. Although silver nitrate inhibited the most growth, its use is impractical due to the potential toxicity of elemental silver. Thus, phytochemical-impregnated implants are a viable alternative to silver-coated implants, which may be toxic to patients.</p>	
Summary Statement The effects of salicylic acid, methyl salicylate, and thymol on biofilm formation were evaluated in comparison with silver nitrate to identify a solution for preventing postoperative biofilm growth.	
Help Received Clinical lab scientist Kimmie Long allowed me to conduct the experiment at the Antelope Valley Hospital laboratory. However, I designed and conducted the experiment independently. Only the incubator was used at the lab. My chemistry teacher lent me the LabQuest, temperature probe, and colorimeter.	