Testing the Extent of Synergistic Anti-biofilm Activity of Galla chinensis and Potentially Adjuvant Chemicals on Escherichia coli Biofilm Formation and Reformed Biofilm

Ning, Angelina (School: American Heritage School of Boca Delray)

This experiment investigated the effectiveness of using cinnamaldehyde (CAD) and zinc in conjunction with G. chinensis to inhibit E. coli biofilm formation and to disperse preformed E. coli biofilm. It was hypothesized that if biofilms were cultivated in the presence of treatment or exposed to treatment after cultivation, then in both cases, the combination of G. chinensis and CAD would exhibit stronger antimicrobial properties. To test this hypothesis, E. coli biofilms were cultivated in the presence of treatments constituted of 0.16 mg/mL G. chinensis water extract (GWE) and varying concentrations of either CAD or $ZnCl_2$, or were exposed to these treatments after cultivation. Both the combined treatments of GWE and CAD, and GWE and $ZnCl_2$ were more effective at inhibiting biofilm formation than GWE alone, showing that using both chemicals in conjunction with GWE produced synergistic antimicrobial effects. As the CAD treatment was more effective than the $ZnCl_2$ treatment, the hypothesis that the CAD treatment would inhibit biofilm formation more was supported. Both combined treatments were also effective at dispersing preformed biofilm, and as the $ZnCl_2$ treatment was more effective than the CAD treatment, the hypothesis that the CAD treatment would be more effective at dispersing preformed biofilm was rejected. This experiment demonstrated that using chemicals in conjunction with Chinese herbal medicines, such as G. chinensis, can produce synergistic effects on inhibiting and dispersing bacterial biofilm, thus supporting the potential of CHMs to replace antibiotics as treatment for bacterial infections.

Awards Won: