

# Reinventing the Catheter: Inhibiting UTIs by Creating a Novel Material Integrated with *Castanea sativa* to Inhibit Quorum Sensing among Nosocomial Infection Causing Bacteria

Thapa, Devina

150 million UTIs occur annually, amounting to over \$6 billion in expenditures. Of these, over 80% are associated with the use of urinary catheters. *Staphylococcus epidermidis* bacteria are one of the most common causes of nosocomial infections and UTIs. *S. epidermidis* communicate through quorum sensing, the production and release of autoinducers that trigger different behaviors contributing to the incidence of UTIs. The purpose of this project is to create a cost-effective antimicrobial catheter that inhibits UTIs without facilitating bacterial resistance using *Castanea sativa* leaves, which are known to inhibit quorum sensing amongst *Staphylococcus* bacteria. Multiple groups of catheter material were created using Polydimethylsiloxane(PDMS): PDMS, PDMS+25% *C. sativa*, PDMS+50% *C. sativa*, PDMS+75% *C. sativa*, PDMS+100% *C. sativa*, and PDMS+silver. "Catheters" were then incubated at 37°C in 5:1 urine:bacteria solution, modeling UTI incidence. Surface areas of viable/non-viable biofilms were calculated/analyzed using fluorescence staining, ImageJ. Kruskal-Wallis testing was also performed. Upon analysis, it was determined that material integrated with 75% and 100% *Castanea sativa* leaf extract have the greatest potential to be used as a cost-effective infection inhibiting component in medical devices. 75% and 100% extract significantly decreased the average percent biofilm formation from the plain control by 90.20% and 97.72% respectively. Both had the same effect as the silver nano-powder material did. This suggests *C. sativa* has great potential to be utilized in medical devices susceptible to *Staphylococcus*. *C. sativa* is over 800x cheaper than silver nano-powder, a common component in current medical devices, and bacteria have no detectable resistance to it.

## Awards Won:

Second Award of \$2,000