



CALIFORNIA SCIENCE & ENGINEERING FAIR 2019 PROJECT SUMMARY

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| Name(s) Phoebe Durant | Project Number S1505 |
| Project Title Sensitivity of Gram (+) and Gram (-) Bacteria to Essential Oils Based on the Sensitivity Disc Diffusion Method | |
| <p style="text-align: center;">Abstract</p> <p>Objectives Based on the Kirby-Bauer method of sensitivity disc diffusion, 7 100% pure essential oils were tested on Gram (+) and Gram (-) bacteria cultured from the Arcata Marsh to determine bacterial sensitivity.</p> <p>Methods A sterile pipette and inoculating loop were used to place 1 mL of Arcata marsh water on Tryptic Soy Agar (TSA) and nutrient agar plates. The culture plates were stored for 24 hours at 37 degrees Celsius to allow bacterial growth. The cultures were then streaked on CNA/MacConkey bi-plates to identify Gram (+) and Gram (-) bacteria which was then streaked on TSA and nutrient agar plates depending on their original growth media. Sterile sensitivity discs were soaked in 100% pure essential oil for 24 hours. The infused discs were placed on each bacteria-streaked agar plate according to the Kirby-Bauer method configuration. The cultures were stored at 37 degrees Celsius for 24 hours, and the sensitivity results were read using a ruler with mm markings to measure clear spaces around the discs where no bacterial growth occurred.</p> <p>Results Gram (-) and Gram (+) bacteria were most resistant to oregano, tea tree, and clove oils. Gram (-) and Gram (+) had less sensitivity to lavender, rosemary, eucalyptus, and a 4-oil blend on both growth media types. On nutrient agar, oregano prevented growth to 19mm with Gram (-) and to 55mm with Gram (+). On TSA, oregano prevented growth to 32mm with Gram (-) and to 66mm with Gram (+) bacteria. In all tests, Gram (+) bacteria was measurably more sensitive to essential oils than the Gram (-) bacteria.</p> <p>Conclusions While lavender, rosemary, eucalyptus and an antimicrobial oil blend may be effective at high concentrations against bacteria, the results of this project support the efficacy of low concentrations of oregano, tea tree, and clove oils to prevent or treat bacterial infections. Current societal trends encourage using antibacterial products, such as hand sanitizer, antibacterial face washes, laundry detergents, and fabrics infused with antibacterial agents, which has led to medically resistant bacterial strains. MRSA is Gram (+) bacteria and this project supports that a possible alternative to treatment with antibiotics for resistant bacteria may be essential oils. The use of essential oils may prove to be a non-toxic, effective alternative to treat or prevent bacterial infections that antibiotics may no longer treat.</p> | |
| Summary Statement The sensitivity disc diffusion method to test Gram (-) and Gram (+) sensitivities to essential oils supports that essential oil may be a valid alternative to antibiotics for treating/preventing bacterial infections. | |
| Help Received Greta Turney provided supervision and instruction to follow appropriate sterility procedures throughout the project, aided in purchasing the materials and acquiring the Arcata Marsh water sample. | |