



**CALIFORNIA STATE SCIENCE FAIR  
2013 PROJECT SUMMARY**

<b>Name(s)</b> <b>Amith T. Galivanche</b>	<b>Project Number</b> <b>J1604</b>
<b>Project Title</b> <b>Antimicrobial Activity of Clove Oil and Cinnamon Oil against Escherichia coli</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives/Goals</b> In this project, the antimicrobial effectiveness of cinnamon oil and the antimicrobial effectiveness of clove oil were tested against the Gram-negative Escherichia coli.</p> <p>The hypothesis of this study was "If the antibacterial properties of clove oil and cinnamon oil are tested against the Gram-negative bacteria, E. coli, then they will show effective results in terms of Zone of Inhibition, Minimum Inhibitory Concentration (MIC), and Minimum Bactericidal Concentration (MBC)."</p> <p><b>Methods/Materials</b> Procedures included the Kirby-Bauer Disk Diffusion Method for testing the Zone of Inhibition, the Broth Dilution Method for MIC and nutrient agar plate method of testing MBC. In the disk diffusion method, a filter paper disk is impregnated with a certain antimicrobial agent and is placed on an agar plate that has already been swabbed with bacteria, and incubated at 37° C for 24 hours. The Zone of Inhibition is the area around the impregnated filter paper disk with no bacterial growth after overnight incubation. In the Broth Dilution Method, a serial dilution is performed with essential oils fighting E. coli and LB Broth. After overnight incubation at 37°C, the MIC end point is determined as the lowest concentration of essential oil, at which there is no visible growth of bacteria. To determine the MBC, the liquid in each test tube is swabbed onto an agar plate. After overnight incubation at 37°C, the last plated test tube with no bacterial growth on the agar plate will be determined as MBC.</p> <p><b>Results</b> The results showed that cinnamon oil performed significantly better than clove oil. Zone of Inhibition of Amoxicillin was 26.33 mm, and that of cinnamon oil was 22.0 mm. The clove oil had a lower Zone of Inhibition at 14.0 mm. The MIC of clove oil is 0.0078 mL and MBC is 0.0156 mL. The MIC/MBC value of clove oil is 0.5. The MIC of cinnamon oil is 0.0039 mL and MBC was 0.0156 mL. The MIC/MBC of cinnamon oil is 0.25.</p> <p><b>Conclusions/Discussion</b> The results of the study consistently proved that cinnamon oil is a more effective antibacterial agent against E. coli compared to clove oil. However, clove oil showed good antibacterial properties against E. coli. The results of the study suggest that the essential oils of clove and cinnamon have a good potential to be used as natural, low cost and easily available antibiotic agents against E. coli, a Gram-negative bacteria.</p>	
<b>Summary Statement</b> The purpose of this science fair project was to determine and compare the results of the antibacterial activity of clove oil and cinnamon oil against Escherichia coli.	
<b>Help Received</b> Mrs. Schmahl mentored my project and Dr. Khalaf and Mr. Carroll guided me through laboratory procedures.	