



**CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY**

Name(s) Jeeyeon Sohn	Project Number S0626
Project Title The Effect of D-limonene Contained in Various Citrus Oils on Disintegration of Polystyrene Foams	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The purpose was to determine the effect of d-limonene in oils extracted from various citrus fruit rinds on disintegration of two different types of polystyrene foams-expanded (EPS) and extruded (XPS). It was hypothesized that the d-limonene extracted from orange rind will disintegrate polystyrene foams most, and expanded polystyrene foam will be more disintegratable.</p> <p>Methods/Materials The oils were extracted from four different citrus fruits-grapefruit, orange, tangerine, and lemon. The rinds were peeled and dried. The dried peels were grinded and put into separate 400.-mL beakers. Approximately 150.0mL of ethanol was added to each of the grinded dry peels. The mixture was filtered into a 125-mL Erlenmeyer flask. The liquid in each flask was the various citrus oils containing d-limonene. Two different types of foams, expanded (EPS) and extruded (XPS; Styrofoam), were each cut into 12 similar sized blocks. Each type of foams had a model block which was used to convert mass into volume and volume into mass. 2.00mL of citrus oil was put on each block of polystyrene foams using a 4.00mL pipette. The volume of each EPS and XPS blocks were measured using the water displacement method.</p> <p>Results Grapefruit was found to be most effective on the degradation of EPS and orange and lemon oils were found to be most effective on the degradation of XPS. The mean disintegration of EPS by mass by grapefruit, orange, tangerine, and lemon oils were found to be 18%, 15%, 12%, and 11%, respectively. The mean disintegration of XPS by mass by grapefruit, orange, tangerine, and lemon oils were found to be 3.2%, 7.4%, 3.6%, and 7.4%, respectively. The percent deviation of grapefruit, orange, tangerine, and lemon oils of EPS trials were 5%, 4%, 8%, and 9%, respectively. The percent deviation of grapefruit, orange, tangerine, and lemon oils of XPS trials were 6%, 4%, 5%, and 4% respectively. The data was found to be precise, for the percent deviation was less than 9%.</p> <p>Conclusions/Discussion The hypothesis was partially supported as EPS was more disintegratable than XPS, but it was grapefruit that was found to be most effective for EPS and orange and lemon for XPS. The information gathered can be used to improve the recycling of polystyrene foams in the landfill.</p>	
Summary Statement How d-limonene in various citrus oils effected disintegration of expanded and extruded polystyrene foams.	
Help Received Parents helped with materials; Mr.Antrim helped with planning	