



CALIFORNIA STATE SCIENCE FAIR 2013 PROJECT SUMMARY

Name(s) William F. Abersek	Project Number J2101
Project Title A Global Tune-Up: Developing a Performance Index for Green Lubricants	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals My project was designed to determine whether commercially available bio-based lubricants offer viable alternatives to petroleum-based lubricants when all relevant factors (technical performance, costs, and environmental impacts) are taken into account.</p> <p>Methods/Materials The technical, economic, and environmental qualities of six 5W-30 motor oils were evaluated. Technical performance was identified with lubricity, and coefficients of friction were measured in an experiment in which an incline plane was gradually raised to determine the slip point angle. 10 trials were taken for each oil, and a t-test was performed to determine whether sample means in bio-based and petroleum-based oils were statistically different. Cost for each oil was assessed, and "green" characteristics (renewable sources, low energy refining, and biodegradability) were determined from Material Data Safety Sheets. Technical performance, cost, and environmental factors were united in a performance index created by the researcher and the overall performance of the oils was evaluated. Viscosities were assessed to establish confidence in lubricity findings.</p> <p>Results Coefficients of friction for the 6 sampled oils and an unlubricated control were calculated using the method described above, yielding values ranging from .162 (most slippery) to .694 (control). A difference of means test (t-test) was performed and no statistical difference between the lubricity of bio-based and petro-based oils was found. Viscosities of the samples were assessed and no statistical difference between bio-based and petroleum based lubricants was found. An environmental factor was determined for each sample, giving 1 point for each of the green characteristics identified above. Lubricity, cost, and environmental factors were united in an index with weights .4, .3, and .3. The best performing oils in the index performed well in both price and environmental aspects.</p> <p>Conclusions/Discussion My hypothesis posited that green lubricants would compete well with petroleum lubricants and my findings bear this out. Technical characteristics were statistically indistinguishable among the oils, and thus price and environmental characteristics became key performance factors. The index highlights the many ways in which a lubricant can be green and points to trade-offs between user costs and social benefits from environmentally desirable products.</p>	
Summary Statement My project establishes a performance index that unites technical, price, and environmental characteristics of lubricants to enable a comparison of lubricants..	
Help Received Mother loaned textbook with instructions on t-testing; friend's dad was sounding board in early brainstorming on shape of index	