



CALIFORNIA SCIENCE & ENGINEERING FAIR 2018 PROJECT SUMMARY

Name(s) Owen M. Smith	Project Number 38252
Project Title How Does Melting Temperature of an Oil Affect Its Soap's Hardness?	
Abstract Objectives/Goals I studied if the melting temperature of an oil could predict its soap's hardness. I hypothesized that the higher the melting temperature of the oil the harder the soap it would make. Methods/Materials I made eight soaps using six different oils and two mixtures. I tested the soap hardness when the soap was wet by dropping a lead ball on the soap from the same height (n=3 for each soap). I also dried the soaps and measured their hardness using a static method where I attached a round metal teaspoon to the bottom of an 11.3 kg weight which I set on the soap for 20 seconds (n=3 for each soap). This second method was needed because the drop ball method cracked the dried soap. For both tests I measured the diameter of the dent to represent hardness. The harder the soap the smaller the dent and the smaller the diameter. Results I first plotted the hardness of the wet soaps versus the literature melting points for the oils and fats and got no correlation. I decided to measure the freezing points of the oils myself and to plot the graphs using my values instead. This resulted in graphs with a trend showing that oils with melting temperatures of 6°C or higher made harder soaps with increasing melting temperature and oils with melting temperatures lower than 6°C, the opposite was true, with hardness increasing with decreasing melting temperature. Conclusions/Discussion The results showed that my hypothesis was half right. While the hardest soaps were made with fats with the highest melting temperature fats, the softest soaps were not the ones made with oils with the lowest melting temperature oil. Also, adding a higher melting temperature fat to a lower temperature oil did not always make a harder soap and in fact the mixed soap was softer than either of the pure oil soaps. Some other observations were learned in this study. One was avocado oil had a different freezing point than stated in the literature. It should freeze at 6-9°C but it froze a -15°C, which leads me to believe the avocado is not pure or maybe is not even avocado oil. Also, lard should be very hard but the lard I used was soft. I think this was because it had some non-triglycerides in it because I got it from the non-pure source of frying bacon. This study proved that a soap's hardness cannot be predicted based solely on the melting temperature of the starting oil.	
Summary Statement This study proved that a soap's hardness cannot be predicted based solely on the melting temperature of the starting oil.	
Help Received I weighed out all the materials. My dad and mom mixed the soaps with the immersion blender because I was splattering sodium hydroxide in the kitchen. I decided when we reached traced. My mom plotted the data on the computer. I told her what I wanted in the plots.	