



# CALIFORNIA SCIENCE & ENGINEERING FAIR 2018 PROJECT SUMMARY

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<b>Project Title</b> Light Bite: An Optical Measurement Method and Device to Determine the Ripeness of Fruits	
<b>Abstract</b> <b>Objectives/Goals</b> The purpose of this project was to answer following questions: <ol style="list-style-type: none"><li>1. How does a fruit become ripe?</li><li>2. What biochemical and physiological changes happen when a fruit ripens?</li><li>3. Can optical properties of fruits be used to measure the ripeness?</li><li>4. How can I use optical properties to create a method to measure ripeness?</li></ol> <b>Methods/Materials</b> My test method is based on measuring the ratio of transmittance and reflectance for red and white LEDs and try to correlate these optical measurements with taste and color of the banana. Fixture: my fixture comprised of two light sources (Red & white) and two photodiodes (PD) to measure transmittance and reflectance. Method: The test started with 8 bunches of bananas. For 6 days, I recorded the optical measurements, color and average taste for one banana from each group. I calculated the ratio of red to white light measured at top PD; this is the transmittance ratio. I also calculated the ratio of red light to white light measured at bottom PD; this is reflectance ratio. Then I studied the correlation between these two measurements, taste and color. <b>Results</b> <ol style="list-style-type: none"><li>1. Very good correlation between the R/W transmittance ratio and the taste. (<math>R = 0.803</math>)</li><li>2. Good correlation between the red to white reflectance ratio and the taste. (<math>R = 0.787</math>)</li><li>3. Optical measurements changed over 6 days for all groups. This means that light interaction with banana changes as the fruit becomes ripper. The transmittance ratio of banana increases when it becomes ripper, which means ripe banana transmits more light.</li><li>4. Samples visually ripe but with poor taste were properly detected as not ripe by the optical method.</li></ol> <b>Conclusions/Discussion</b> In this project, it was hypothesized that a simplified optical method with the use of off-the-shelf visible light LED(s) and silicon photodiodes has the potential for optical, non-destructive evaluation of banana ripeness. After analyzing all the collected data, the results from using my very simple setup shows that it is possible to monitor the process of fruit ripening, in this case banana, using a non-destructive optical method. There was a clear correlation between the taste (sweetness) and optical measurements, which confirmed my hypothesis. This correlation was better than how color correlated with the taste.	
<b>Summary Statement</b> In this project I used fundamentals of optics and studied the interaction of visible light with fruits, to evaluate the ripeness of fruits.	
<b>Help Received</b> I conducted the experiment by myself. I got help in understanding the statistical analysis.	