CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)
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Project Number
J1705

Project Title
Measuring the Spectral Reflectance of Food as It Cooks

Abstract

Objectives/Goals
We can all see that some foods change color when they cook. I wanted to understand what aspect of reflectivity changes in food as it cooks. The human eye has difficulty quantifying color because it sees in only blue, green, and red. A spectrometer is an instrument that quantifies light emission as a function of wavelength. My hypothesis is that a spectrometer can be used to detect changes in the spectrum of light reflected from food as it cooks.

Methods/Materials
I used a black and white camera combined with a diffraction grating, a slit, and three lenses to create a spectrometer to observe the spectral reflectance of various foods at different times during the cooking process. The diffraction grating split the monochromatic light into separate wavelengths and produced an image of the spectrum on the camera sensor. I was able to convert these images from the camera into graphs of relative reflectivity as a function of wavelength. I calibrated my spectrometer by using a fluorescent light source.

Results
Using the spectrometer I built, I measured the brightness of the reflected light of raw and cooked food. I normalized much of my data in order to compare the relevant portions of the spectrum. When the broccoli was boiled, most of the nutrients were destroyed in the heat and the boiled broccoli lost color at 500nm-650nm. The steamed broccoli reflected less 450nm-650nm than the raw broccoli. After it was cooked, the beef#s spectral reflectance increased at 500nm-600nm (green). The shrimp#s spectral reflectance changed at 600nm-700nm (red). But the blue (400nm-500nm) and green (500nm-600nm) stayed relatively the same.

Conclusions/Discussion
My hypothesis was correct. By using the signature of the spectrum of raw and cooked food, I was able to detect the change in reflectance of broccoli, beef, and shrimp at various points during the cooking process.

Summary Statement
I determined I could detect the change in raw and cooked food by measuring the spectral reflectance by using a spectrometer.

Help Received
I borrowed a camera and lenses from CFE Services