CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY

Name(s)

Nidhya Shivakumar

Project Number

38144

Project Title

Spoiner Alert! An Arduino Sensor-Based Approach to Detecting Food Spoilage

Abstract

Objectives/Goals

Each year, approximately 600 million people fall sick and 420,000 people die from food poisoning. Often, people consume spoiled foods because there is no significantly visible sign of food spoilage. As foods decay, they give off gases such as methane, ethylene, and ammonia. The purpose of this study is to see if Arduino based sensors can be used to detect early food spoilage before signs are visible. Based on my research, my hypothesis is that, as foods decay, they emit certain gases which can be detected by arduino based-sensors, and the levels of these gases will vary depending on the extent of decay.

Methods/Materials

I used 3 arduino based gas sensors capable of detecting methane, ethylene and ammonia respectively. To measure food spoilage over time, an arduino circuit was assembled and placed inside an airtight container. A hole was drilled into the corner of the box and the wire to connect to the computer for data collection was run through it. The appropriate food items were placed into medium sized weighing boats, and equal weights of food was used for each test condition.The levels of methane, ethylene, and ammonia at the appropriate time points were recorded.

Results

The Arduino based gas sensors were able to sense gases well before visible signs of spoilage such as mold or odor were observed. The level of emissions of these 3 gases correlated with the degree of spoilage of food. The arduino-based gas sensors were sensitive enough to pick up low amounts of emissions of methane and ammonia which is generated by decaying food. When visible signs of decay started to show, the levels of the gas emissions were very high (>20-fold) relative to control. While I was able to observe these results in berries, the levels of gases in other foods that were tested such as rice and milk were much lower.

Conclusions/Discussion

Detecting naturally emitted gases such as Methane, Ammonia and Ethylene as foods decay can be used to detect food spoilage. The arduino gas sensors are able to detect gas emissions from food items even before the presence of any visible signs of spoilage. Using sensors to detect the presence of these gases among foods can help detect food spoilage early and prevent consumption of spoiled food. These techniques can be further developed to include other types of gas sensors and foods to increase the sensitivity of such detection methods.

Summary Statement

I created an arduino-based sensor system to prevent food poisoning by measuring the gases released during the process of early spoilage of foods.

Help Received

My parents purchased the materials required for the project and provided feedback on the experimental design.