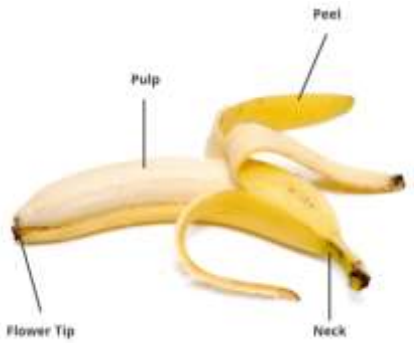
Signal Processing Project
Detection of Fraudulent Banana Labelling

Despite they may not look like, fruit markets are very competitive. Nowadays, the authenticity of Plátano de Canarias, a banana variety that has a higher price due to its Protected Designation of Origin (PDO), is a significant concern. Fraudulent labelling of cheaper bananas coming from other countries occurs, undermining market integrity and consumer trust. To combat this, optimised analytical methods are employed to distinguish genuine Plátano de Canarias from other bananas. In this regards, Liquid Chromatography is a common analytical technique used for this purpose. It allows for the separation, identification, and quantification of the unique chemical compounds present in the food.

For this project, samples from various bananas have been analysed to identify markers indicative of their true origin. Four different parts have been analysed: pulp, peel, flower tip, and neck. The focus will be on analysing the chromatography data to detect the presence of specific compounds or markers that are characteristic of the Plátano de Canarias. The process involves also examining how sample preparation techniques, such as concentrating the extracts of the pulp, peel, flower tip, and neck, affect the detection of these markers. This evaluation will help in understanding how to enhance the sensitivity of the tests, ensuring the accurate identification of the Plátano de Canarias.



In this exercise you need to do what the analytical chemistry team at the Food Safety Authority of Ireland (FSAI) do, by examining samples from 10 bananas (labelled 1 to 10). In some of these bananas which arrived at the Dublin port, there is a suspicion of fraudulent labelling. Your goal is to analyse the provided samples to determine if any of the bananas have been labelled wrong in purpose to obtain more benefit.

Objectives

- Review the chromatography data for indications of fraud. Focus on the chromatograms, particularly the peaks, which may signify the presence of specific chemicals that differentiate the bananas.
- Determine the impact of concentrating the samples volumes on the detection of food fraud. Analyse how this treatment affects peak clarity, resolution, and the signal-to-noise ratio in the chromatography data.
- Determine if any of the parts of the banana is more significant of being a marker of fraudulent labelling.
- Summarize your analysis for each banana sample, comparing the 10 samples. Discuss the reliability of your findings and consider any limitations of the techniques used.

A comprehensive report detailing all the points above is required, as well as the code used to generate the results. Use of Scilab is appreciated, but any other languages and software are also valid to process the data. This exercise challenges you to choose the best ways to process the signal, and apply the learned analytical techniques to real-world scenarios, interpreting complex data and considering the broader implications of your findings in the context of applied sciences.

This sets of data have been kindly donated by FSAI. Students are asked to work locally and avoid sharing the data or uploading the files in public repositories and websites.