

# Pesticide Residue on Organic Fruit Vs. Non-Organic Fruit



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## Introduction

- Pesticides are necessary in agriculture to protect crops from insect infestation, diseases and weed takeover.
- The United States has maximum residue levels (MRLs) set by the EPA which are enforced and monitored by the USDA.
- Americans trust the USDA to ensure the food we consume daily is within a healthy standard.
- Fruits and vegetables are categorized as organic and conventional/ non-organic.
- It is a common myth that organic foods do not contain pesticides, a myth most consumers believe due to miseducation

## Background & Literature Review

- Montiel *et. al* analyzed organic and conventional produce using QuEChERS with LC-MS/MS in Quebec, Canada and found higher level of detected pesticides for conventional than organics produce (Montiel, 2019).
- Tobin *et. al* similarly found in Ireland one or more pesticide residues in 15 out of 27 organic samples. In conventional samples, 17 had pesticide residues present out of 27 (Tobin, 2014).
- Bursi'c *et al.* in Siberia also tested an identical question sampling different produce from around Europe and found high pesticide residue for both and found 9 MRL violations on both organic and conventional apples (Bursi'c, 2021).
- An independent study has not been done in the United States outside of the USDA who is not region specific with their sampling.
- The USDA tested organic fruits and vegetables in 2010 and found 21 samples out of 571 in violation of USDA organic regulations and none in violation of EPA tolerances (USDA, 2012).
- The USDA uses LC-MS/MS for detection, identification and quantification. DART, a new method developed in 2005, proves by Farré *et al.* to be a novel method for quick food quality detection (Farré, 2013).

## Research Questions

What identity of pesticides can be found on organic fruit in comparison to conventional fruit within the Central Valley of California? What is the concentration of each pesticide found on various fruit samples in comparison to EPA tolerances?

## Method

A quantitative research approach will be implemented to detect and identify pesticides remaining on fruit and to quantify the concentrations of the pesticides found to compare against EPA MRLs.

### Samples

- Strawberries and apples are the commodities of choice. Strawberries are the #1 fruit with pesticide violations and apples are #5 (USDA, as cited by EWG 2021). Strawberries and apples are the 2<sup>nd</sup> and 3<sup>rd</sup> most bought fruits respectively after bananas (The Packer Fresh Trends, 2019).
- A standard container of USDA organic and conventional strawberries as well as a pre-sorted bundle of USDA organic apples and conventional apples purchased at a local grocer in Stanislaus County will be compared.

### Instrumentation

- DART-MS/MS coupled to a linear quadrupole ion trap will be used for direct, rapid detection of pesticides due to little sample preparation required, to screen for pesticides presence
- The USDA method of detection and quantification will then be used after DART. The QuEChERS method will be used to extract and isolate the pesticides residing on the samples, adapted from (Anastassiades, 2003). HPLC (High-Performance Liquid Chromatography) will then be used to perform analysis.

## Expected Results

- The number of pesticides detected residually on organic fruit will be less than the number found for conventional fruits.
- The concentration of each pesticide found for organic fruits will be less than the concentrations found on conventional fruit.
- Strawberries will have more pesticides detected than apples

## Significance

- The research aims to inform this region, the Central Valley of California, on the certain pesticides that reside on the fruit they consume.
- The public will be informed on how the levels of detected pesticides lie in terms of concentration compared to EPA MRLs.

## References

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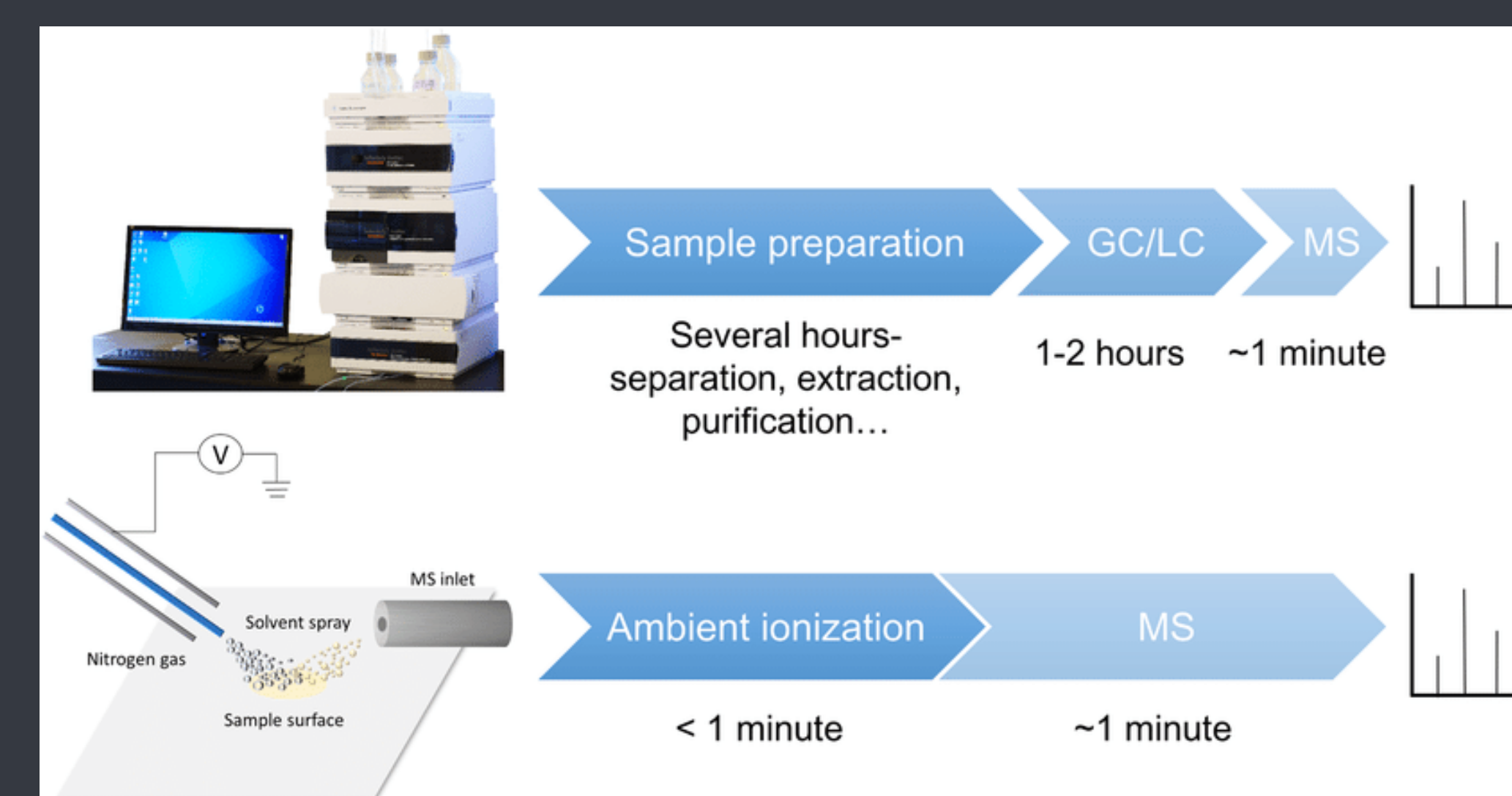
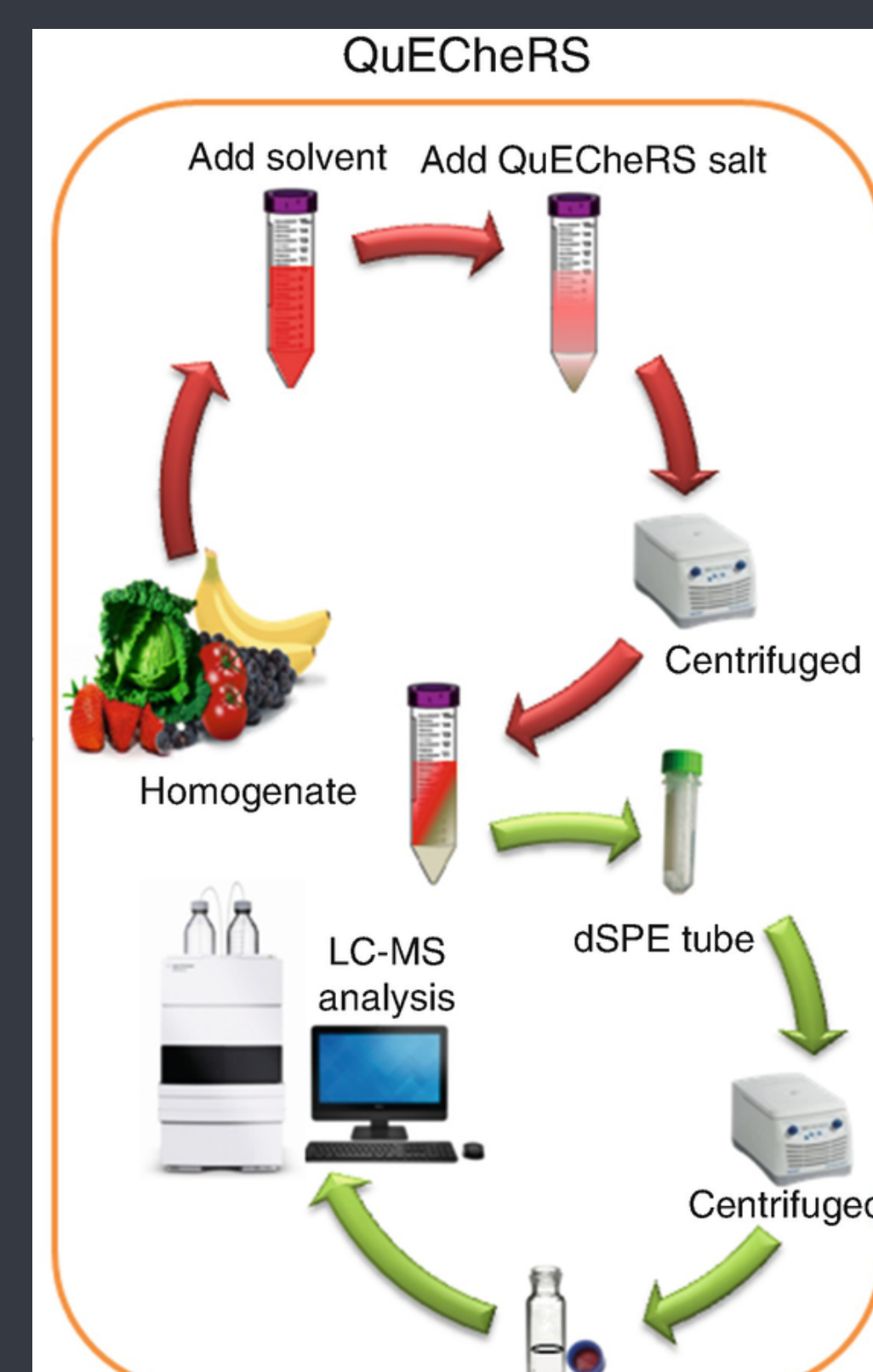


Figure 3: A comparison of LC/GC method (Top) versus DART (Bottom) in terms of time requirement for preparation and analysis.

Figure 2: The steps within the QuEChERS method that will be used.

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Figure 1: Centrifuge tubes that will be used to isolate the pesticides from the samples