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Overview

Sample preparation techniques can be complicated and often the most time-consuming steps in analysis of a variety of food samples. Directly ionizing samples using DART-MS can eliminate this preparation necessity. Combining a DART source with a versatile sample introduction module called the 24-Pin Sampler was used to improve throughput and facilitate sampling of several different food matrices. Forgoing most sample preparation, the 24-Pin Sampler directly dips into matrices like meat, olive oil, as well as into 384/96 well plates before being analyzed directly by DART-MS. This sampling is useful in obtaining replicates for characterization of food varieties by statistical analysis, screening for specific adulterants, and provides higher-throughput analysis of 24 samples in less than a minute.



Methods

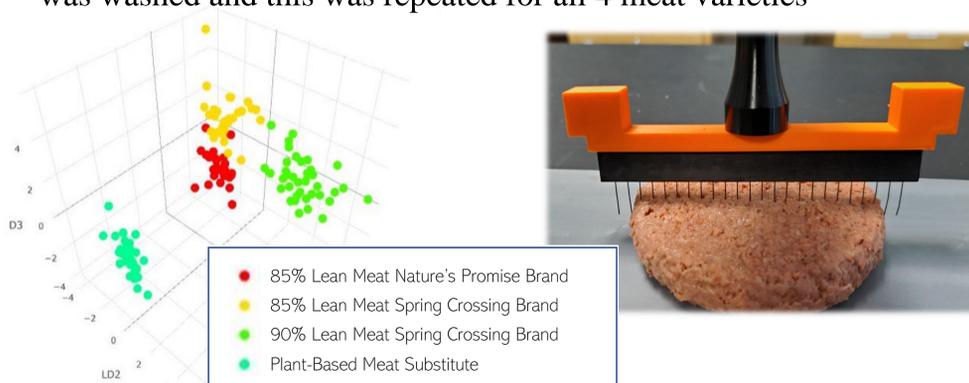
A DART-SVP ionization source is interfaced to a Waters QDa mass spectrometer. The 24-Pin Sampler was directly dipped into various food matrices and placed onto an automated linear rail for analysis.

- 1) Meat varieties directly sampled with the 24-Pin Sampler creating 24 data files in one run for statistical processing into PCA-LDA plots by LiveID software
- 2) EVOO and cheap vegetable oils were sampled with the 24-Pin Sampler, with cheap oils spiked into EVOO between 5-50%. LiveID created PCA-LDA plots to discriminate between adulterated oils.
- 3) Black cohosh supplement extracts are spiked with PDE-5 inhibitor sildenafil, and displayed in a 96 well plate. 24-Pin Sampler is dipped into the well plate for DART analysis. These data files are parsed in AnalyzerPro XD, and target adulterant compounds were displayed with heat mapping when detected.

Experimental:

Characterizing Beef & Plant-Based Meat Varieties with PCA-LDA

- The 24-Pin Sampler was directly inserted into the frozen patty followed by 1 minute DART analysis of 24 samples. The sampler was washed and this was repeated for all 4 meat varieties



- PCA-LDA plot distinguishing meat varieties (organic vs non-organic, brand, and by meat vs plant-based) show **correctness score of 82.50%**

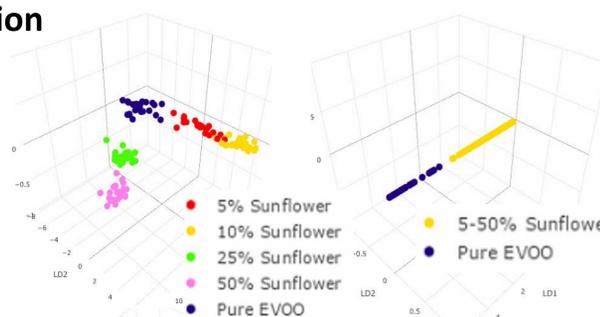
Detecting Sunflower Oil & Sesame Oil Adulteration in Pure EVOO

- Both Sesame and sunflower oil were spiked into pure EVOO at levels between 5-50%
- The 24-Pin Sampler was directly dipped into samples before analysis with no sample prep



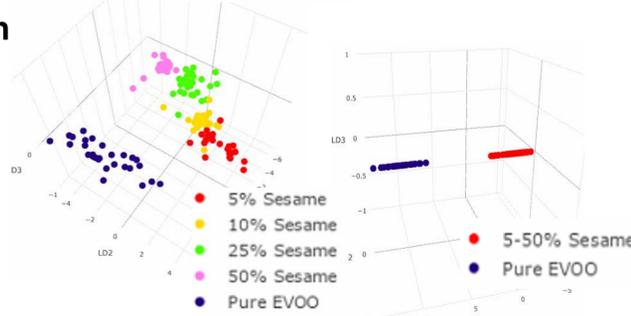
Sunflower Oil Adulteration

- PCA-LDA plot with 5, 10, 25, 50% & pure EVOO groups show **correctness score of 81.43%**
- LDA plot with 5-50% & Pure EVOO groups show **correctness score of 92.14%**



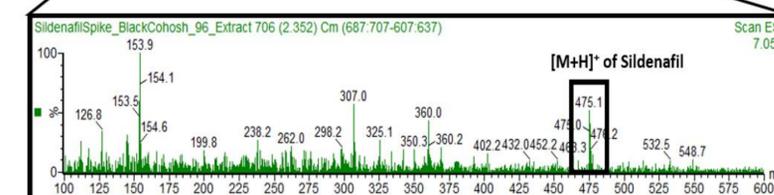
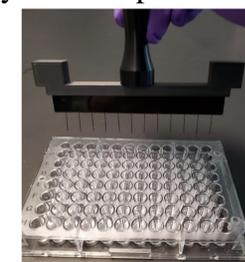
Sesame Oil Adulteration

- PCA-LDA plot with 5, 10, 25, 50% & pure EVOO groups show **correctness score of 88.15%**
- LDA plot with 5-50% & Pure EVOO groups show **correctness score of 97.04%**



High-Throughput Screening for Contaminants in Black Cohosh Supplement Extract

- Black cohosh supplement was dispensed into a 96 well plate, and a few wells were spiked with 1 or 10 ppm solutions of the PDE-5 inhibitor sildenafil.
- The 12-Pin Sampler for 96 well plates (equivalent to 24-Pin Sampler for 384 well plates) was dipped directly into the plate followed by DART-MS analysis of the pins
- The data files generated were parsed with AnalyzerPro XD. The target mass 475 m/z of sildenafil was searched and displayed in the well-plate format with heat mapping when the contaminant was detected



Conclusion

- The 24-Pin Sampler with DART-MS analysis is a versatile tool for screening food matrices with little to no sample preparation. The metal pins are formatted to fit in 96/384 well plates, and consistently pick up viscous liquid like oil or solid residue from burgers
- The 24 pins help quickly create sample replicates for building statistical models to help in characterization and authentication in food such as meat varieties and vegetable oils.
- The 12 or 24-Pin Sampler is formatted to directly dip into 96/384 well plates for screening. Combining this with the targeted heat mapping of contaminants in AnalyzerPro XD allows for a quick and easy screening technique.