Advancing Fingerprint Deposition Modeling through the Integration of Comprehensive Two-Dimensional Gas Chromatography and Time-of-Flight Mass Spectrometry for Age Estimation

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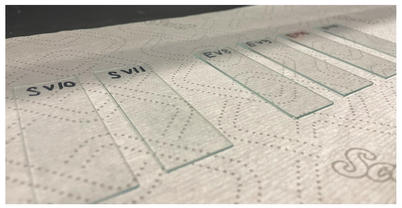
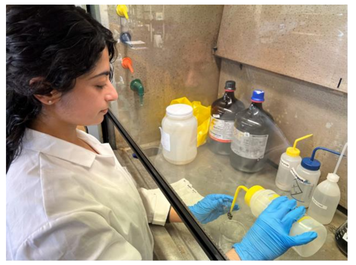
While the physical characteristics of fingerprints are widely used in forensic investigation, understanding the internal components of fingerprints can lead to developing an age estimation of fingerprint deposition. The goal of this research project is the understand how fingerprint components change with the age of the fingerprint and develop an aging model that will help forensic scientists.

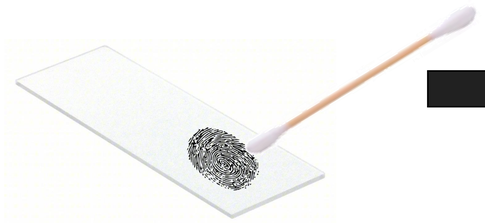


Fingerprints were extracted through solid - liquid extraction and analyzed with comprehensive two - dimensional gas chromatography combined with time-of-flight mass spectrometry (GCxGC-TOF/MS) to determine how the ratio between squalene and cholesterol changes throughout a five-hour period between two donors (ES and RS) in a controlled environment.



LECO's GCxGC-TOF/MS

Sample Extraction

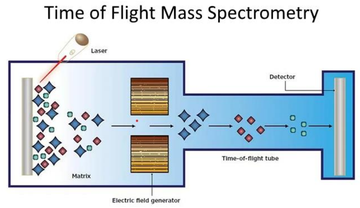


- Moisten cotton swab with dichloromethane and swab fingerprint from surface

- Prepare swab in micro-centrifuge tube and vortex
- Follow with centrifugation

- Separate compounds of interest: squalene and cholesterol

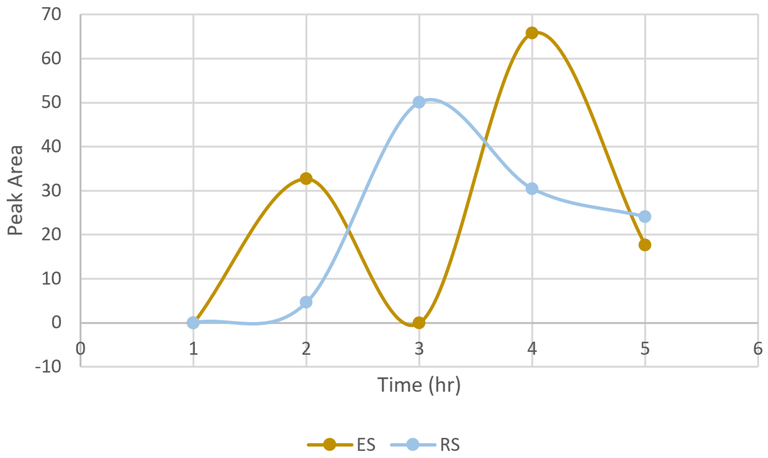
TOF/MS: LECO Pegasus BT



- Identifies and quantitates compounds of interest

LECO ChromaTOF Software

Results



- Peak areas of squalene and cholesterol were determined, and peak ratios were calculated

Time (hr)	Sample #	ES Peak Area Ratio	Sample #	RS Peak Area Ratio
1	ES1		RS1	
2	ES2	32.71	RS2	4.60
3	ES3		RS3	50.08
4	ES4	65.75	RS4	30.44
5	ES5	17.68	RS5	24.07

- Squalene/Cholesterol ratio calculated

Conclusions

- Cholesterol metabolite detected
- Squalene not detected in all samples
- Inconsistent ratio as time progressed
- NEXT: Revisit method and determine possible new compounds to detect

Acknowledgement to

- LECO
- CSULA Criminalistics Program

References

Figures from left to right, top to bottom: CHEMGLASS Microscope Slide. Grainger. *Web. Jan. 2, 2024;* Vortex-Genie 2T. Sci. Ind. Web. Jan. 2, 2024; Lab and Facilities. Dr. Vozka Research Lab. Web. Jan. 2,Pulsed Lasers Blog Post. RPMC. Web. Jan. 2, 2024; ChromaTOF Sync. LECO. Web. Jan. 2, 2024