



Environment Testing
America

Analysis of 6PPD-quinone in a Variety of Matrices

California DTSC, July 29th 2021



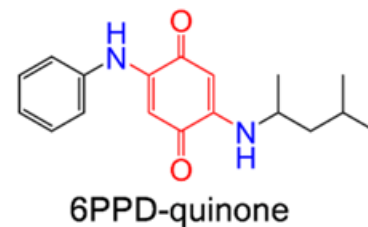
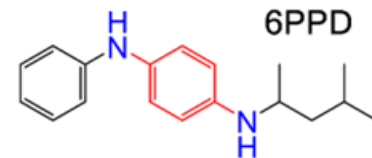
Andrew Patterson,
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6PPD ≠ 6PPD-Q

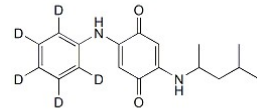
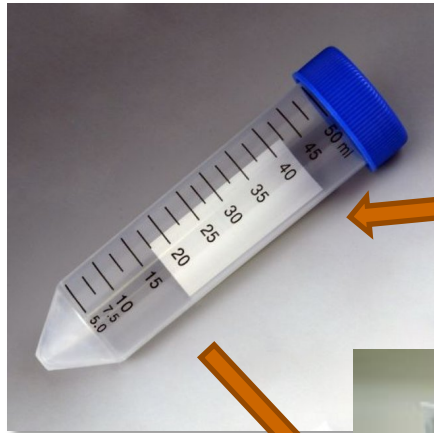


- PPD family of compounds added to tires to achieve safety standards
- 6PPD and other PPDs are added to tire components during manufacturing up to percent-level composition and can vary by tire component
- 6PPD-quinone is not added to tires and only forms in the process of protecting the tire from oxygen

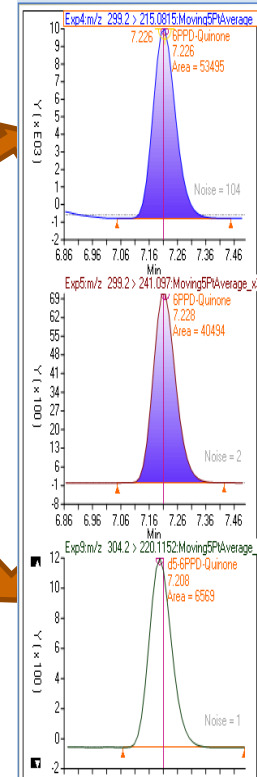
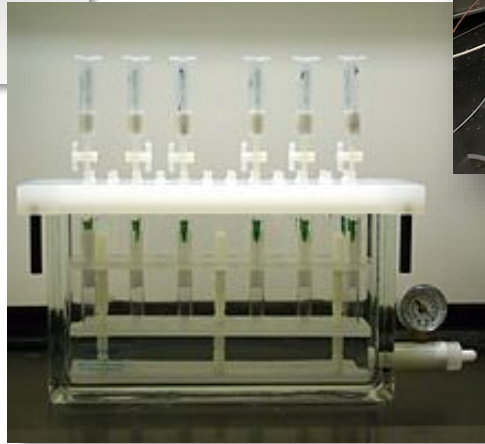


-University of Washington; Z. Tian *et al.*

How is the Analysis Performed?



Stable isotope of 6PPD-quinone



Why use a QTOF?

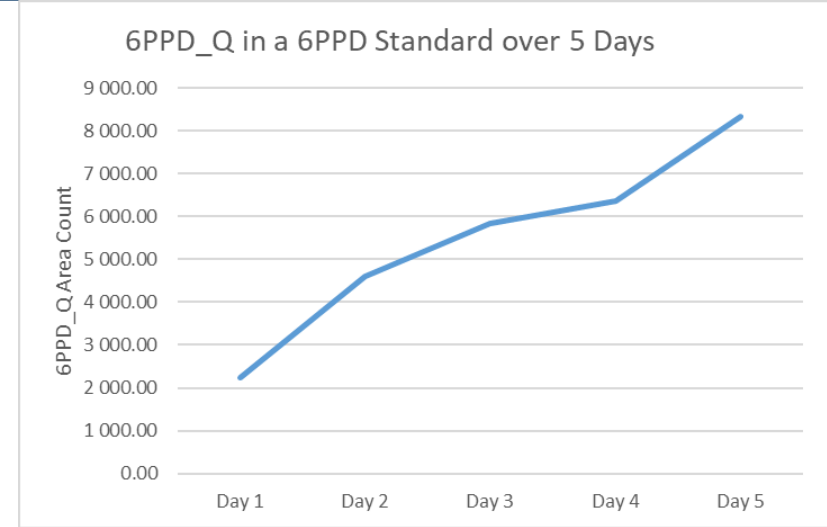
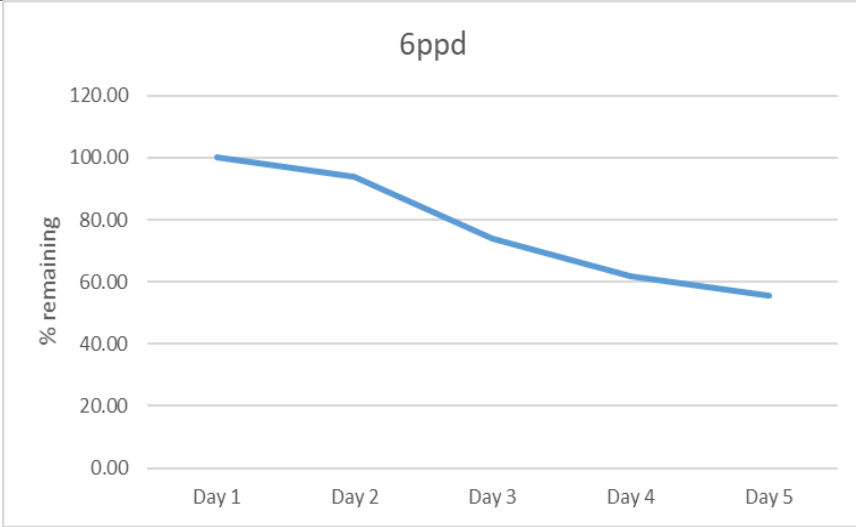


- In general: As resolution increases, false positives decrease
- Instrument measures the Time-of-Flight of compounds and precisely determines mass
- Exact mass data can be gathered on the parent compound or unique fragments of it
- Possible to move to an MS/MS after careful observation



High-resolution data add confidence by mitigating the potential for interferences

Parent Compound (6PPD) Instability

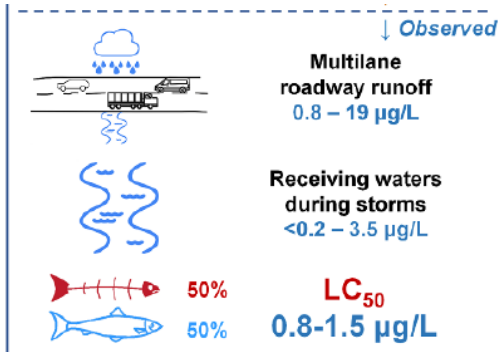
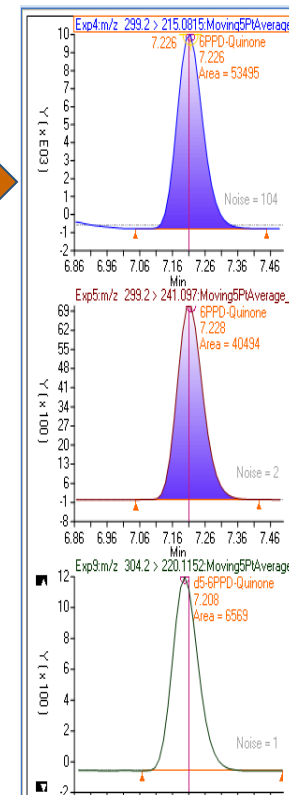
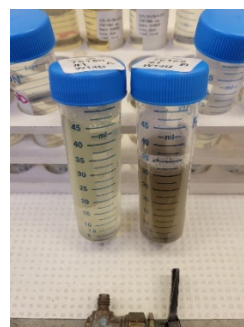


- 6PPD Standard in Methanol, in the dark, at 4C.
- New vials injected each day

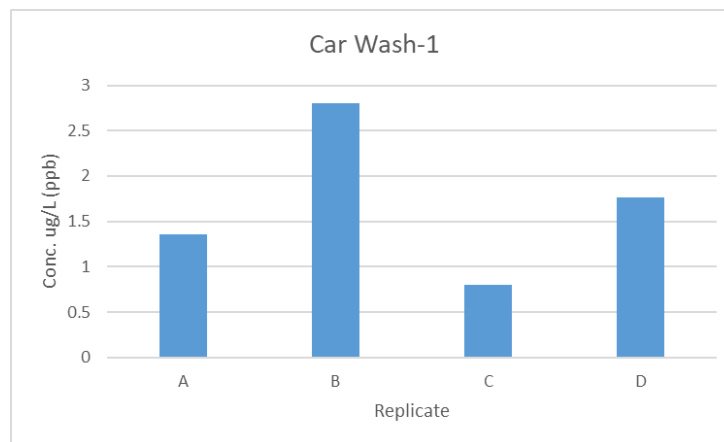
- Purging with Nitrogen did not slow degradation
- pH changes did not slow degradation

Quantitation of parent compound, 6PPD, unreliable and indefensible

Artificial Rain: Car Washes



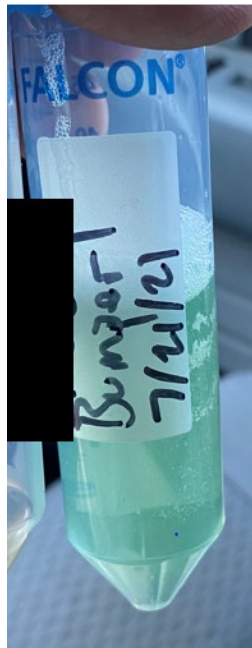
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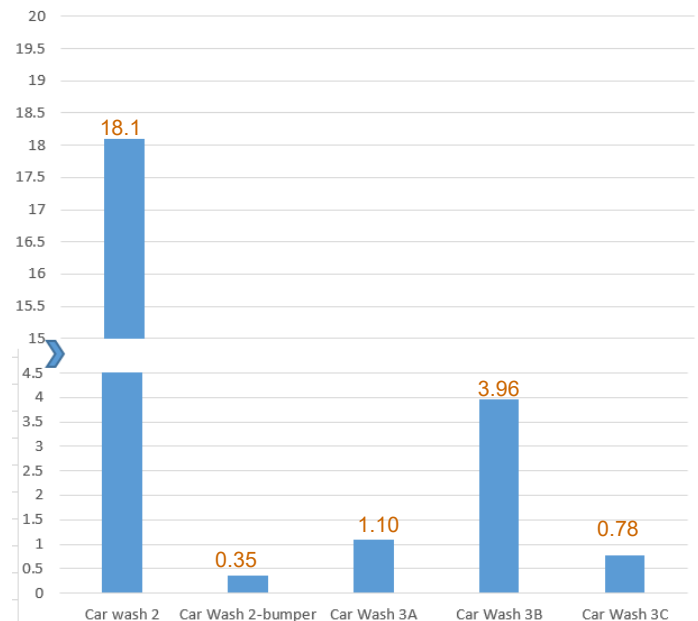
Car Washes 2.0



Sample Master-3000

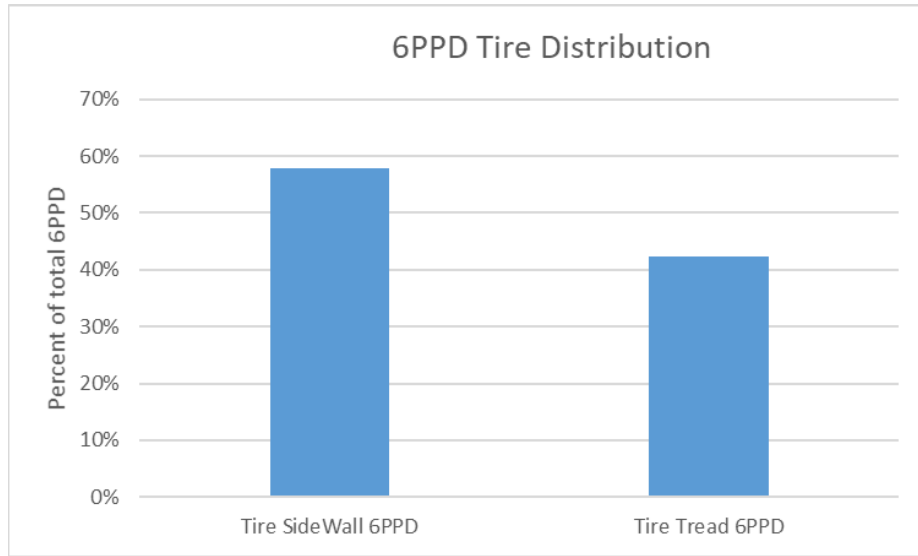
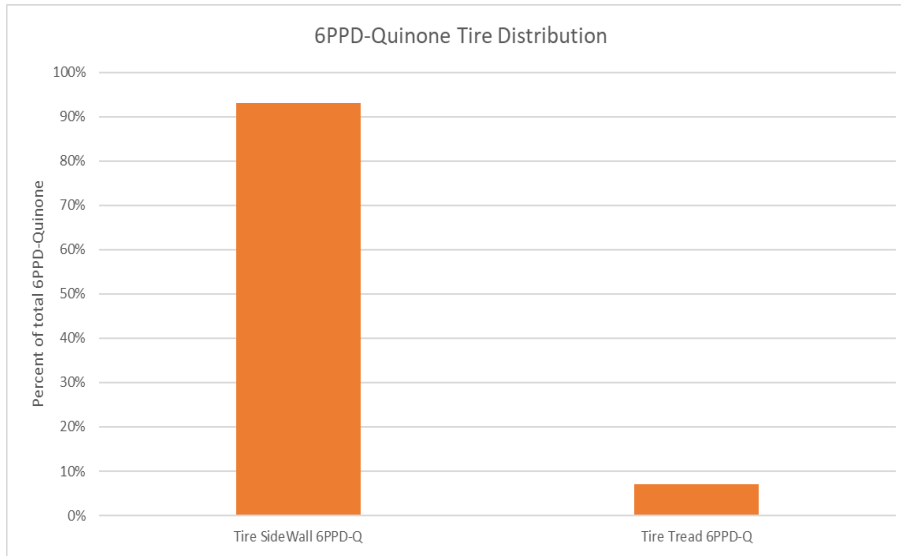


Additional Car Washes, ug/L (ppb)



- HDPE bottles taped to bumper
- Containers open for the entire car wash
- Importance of isotope dilution

Tire Distribution of 6PPD-Quinone



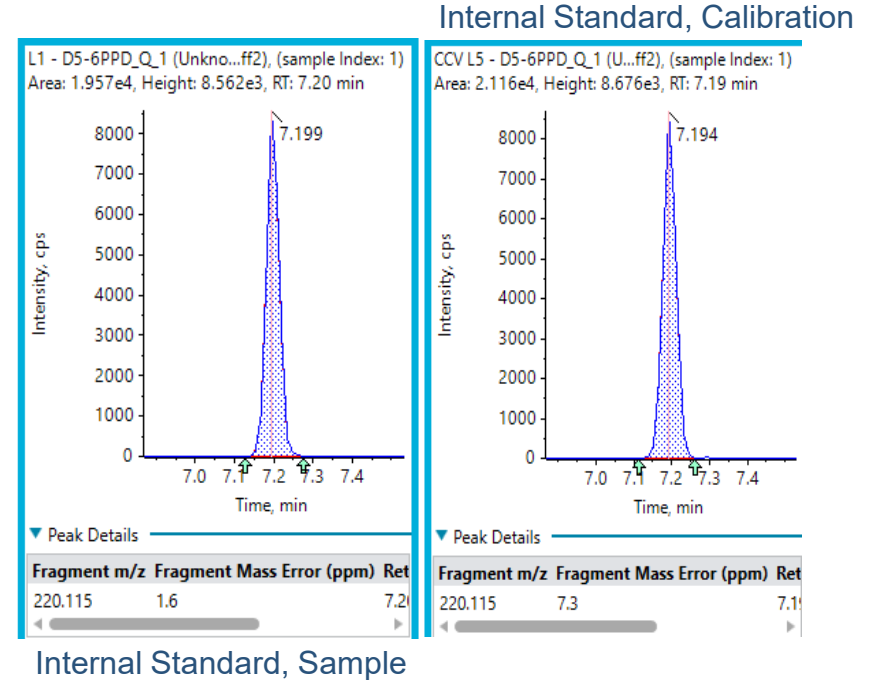
- 6PPD sidewall and tread distribution does not match 6PPD-Quinone distribution.

- Tire was not mounted on a vehicle
- Tire had ~50% of life left on tread

Honey: Method Performance Test



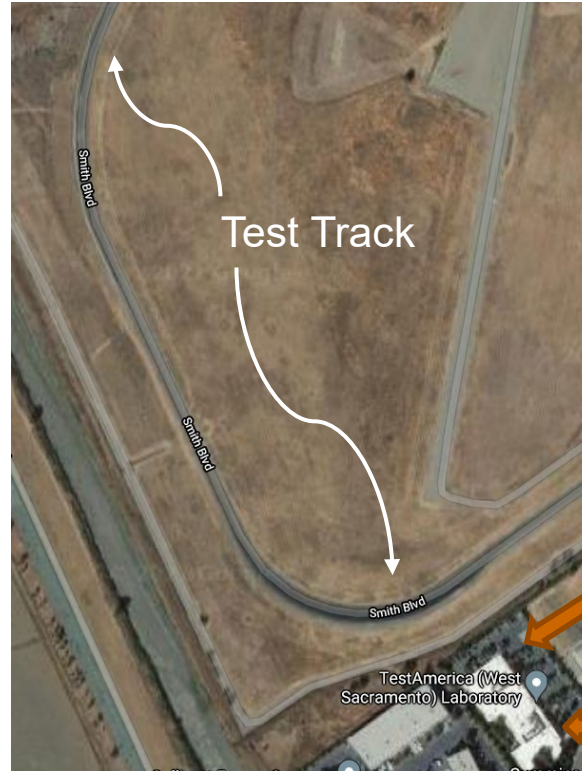
- All three honey samples: **Non-Detect**
- Reporting Limit = 0.25 ng/g (ppb)
- Average Internal standard recovery: 73%



Planter Box Detection



- 5ng/g (ppb) 6PPD-Q in planter box soil
- Non-detect for 6PPD (Monitored, but not quantitated)
- What is the mechanism for deposition in the planter box?
 - Splashing from rain/sprinklers?
 - Tire wear particles?
 - Atmospheric deposition?



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Questions?

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