Developing a Method for Monoethanolamine (MEA) Detection

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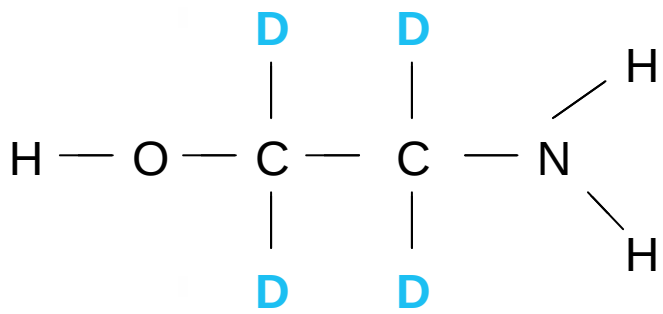
What is MEA?

- Used to scrub carbon dioxide from the air
- The National Institute for Occupational Safety and Health (NIOSH) and the Occupational Safety and Health Administration (OSHA)
  - 3 ppm
- Submarines
  - Approximately 0.5 ppm
  - No major health problems reported
    - Skin and respiratory irritant
    - Kidney and liver damage

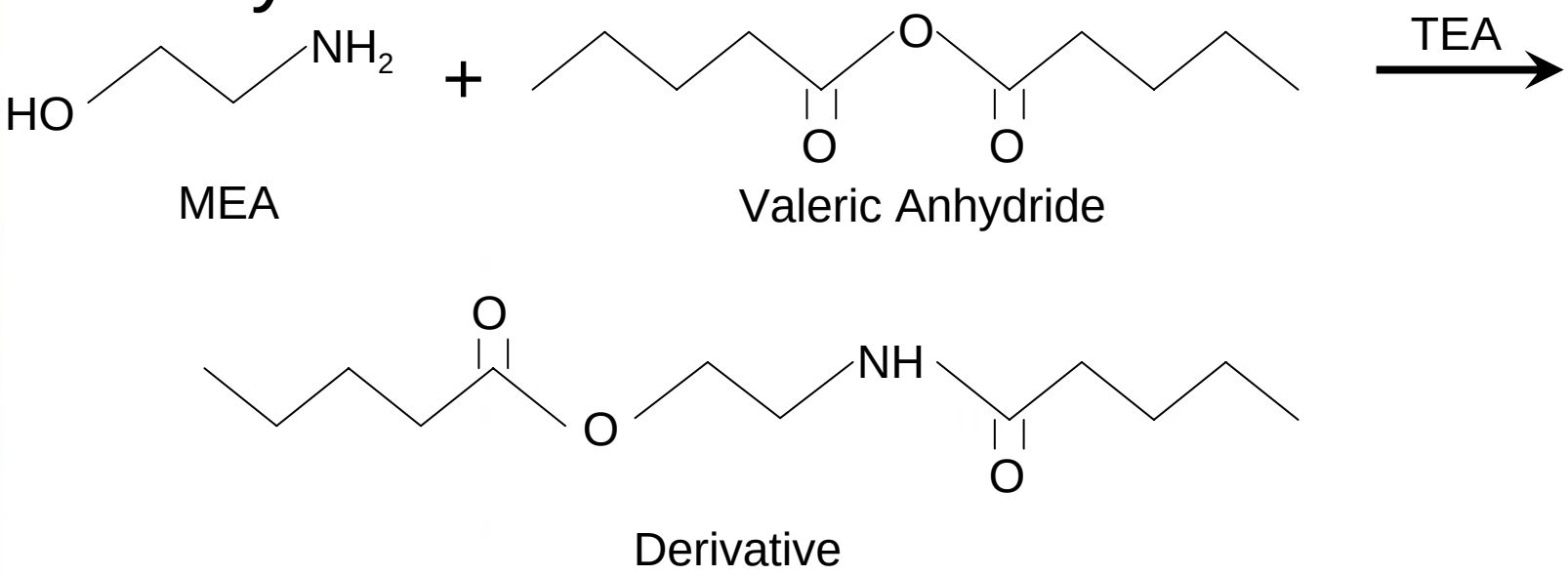
Method of Detection

- Air samples are collected using an absorbent material then suspended in an organic solvent
- Deuterated MEA (D4) was used as the internal standard



Method of Detection

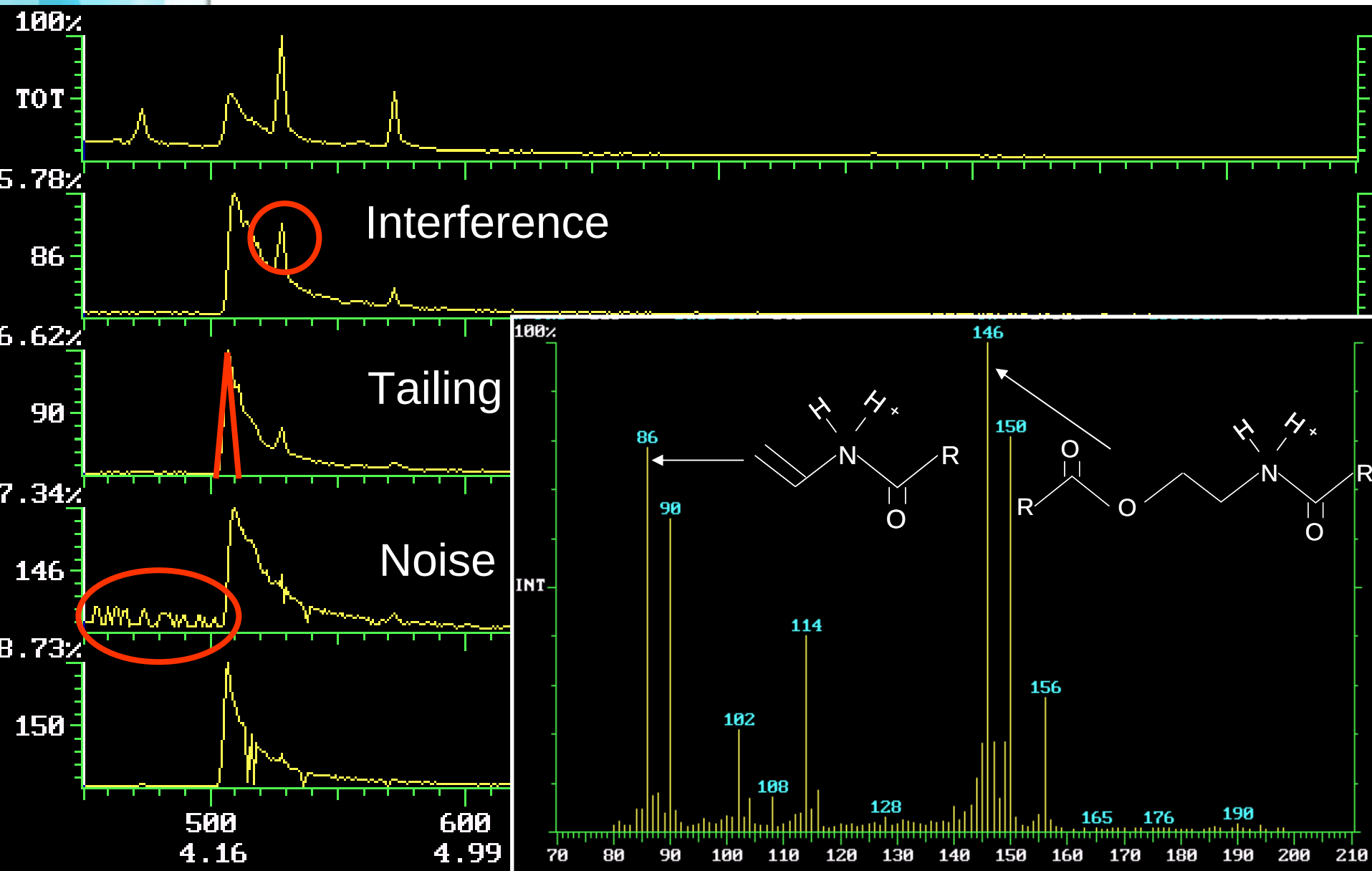
- An anhydride derivatizes MEA and D4 to improve analysis by GC/MS
- Triethylamine (TEA) added as a catalyst



Variables for Assessment

- Determine the most efficient extraction method
  - Derivatizing Agent
  - Solvent
- Extraction efficiency
- Reproducibility
- Limit of detection

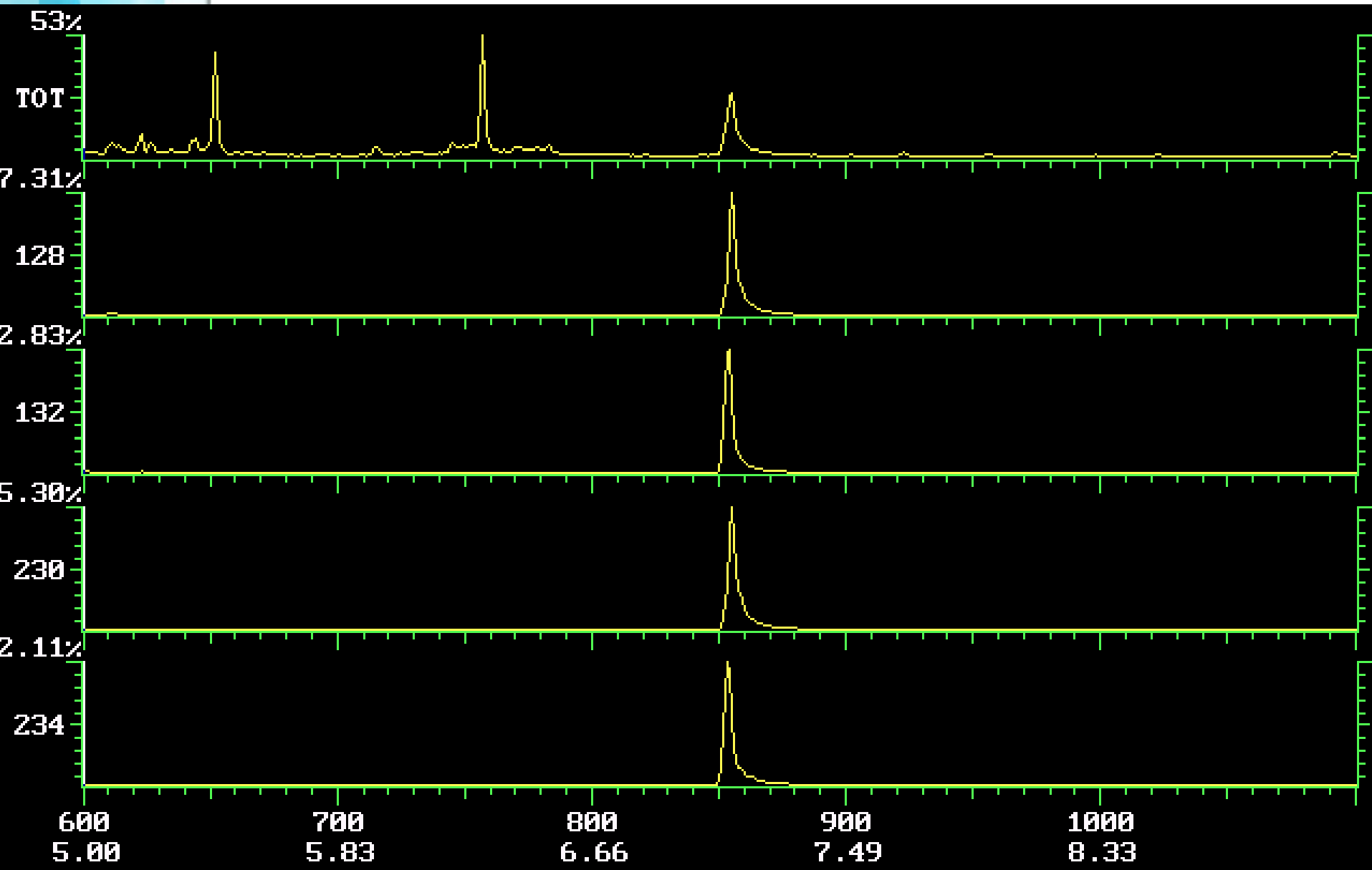
Preliminary Tests



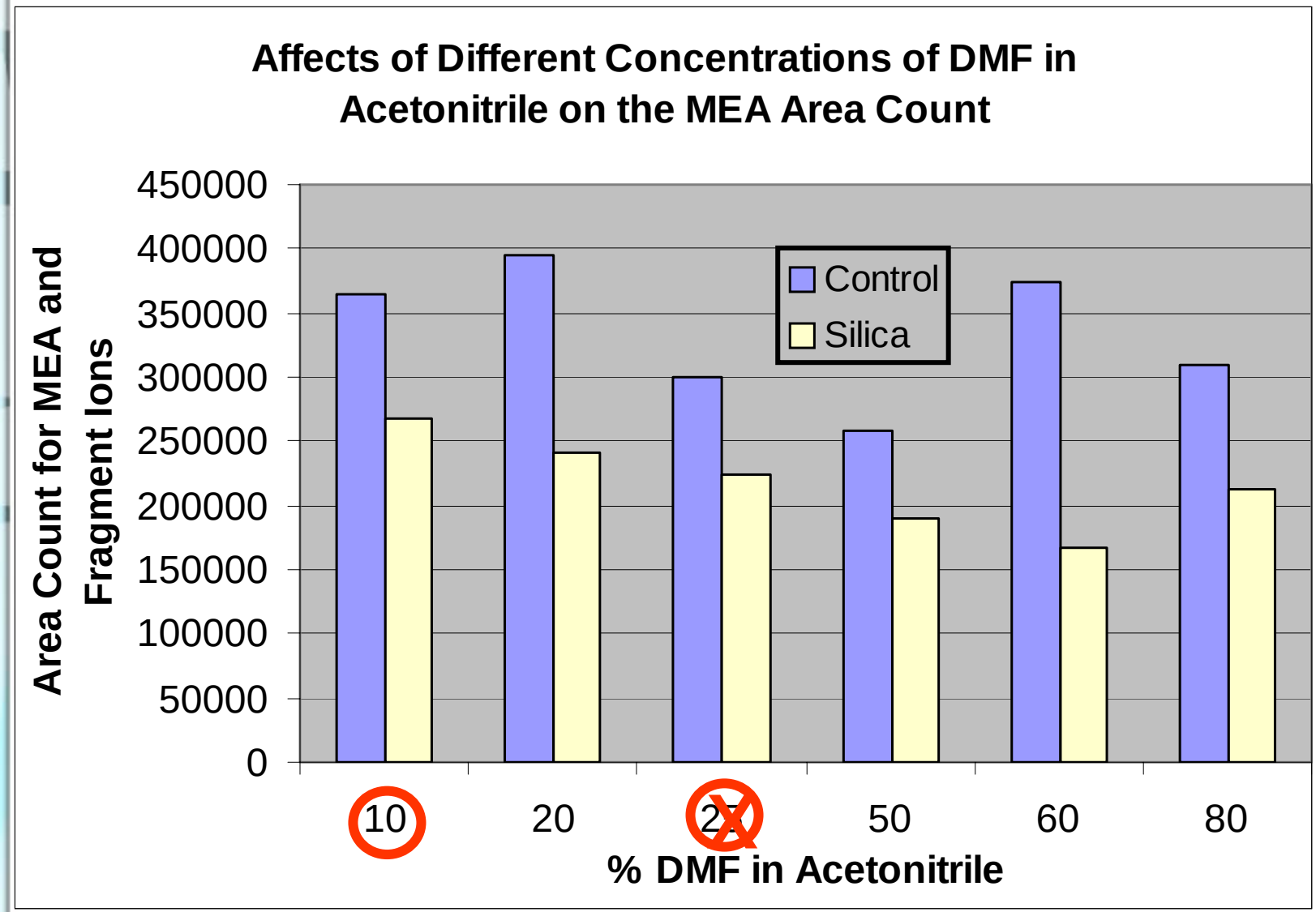
Derivatizing Agents

- Acetic Anhydride
- Succinic Anhydride
- Propionic Anhydride
- Butyric Anhydride
- Valeric Anhydride
- Trifluoroacetic Anhydride
- Pentafluoropropionic Anhydride

Valeric Anhydride



Solvents


Affects of Different Concentrations of DMF in Acetonitrile on the MEA Area Count
Area Count for MEA and Fragment Ions
450000
400000
350000
300000
250000
200000
150000
100000
50000
0
Control
Silica
10
20
25
50
60
80
% DMF in Acetonitrile

Extraction Efficiency and Reproducibility

- Extraction Efficiency
  - 89%
- %Relative Standard Deviation (%RSD)
  - Intraday
    - 2.90% without silica
    - 2.98% with silica
  - Interday
    - 6.67% without silica
    - 5.73% with silica

Limit of Detection

- Curve range 0.1µg/mL to 30µg/mL
- LOD could be improved by concentrating the sample under nitrogen then reconstituting the sample in a lower volume
  - Studies are in progress for LOD and reproducibility of the “blow-down” method

Conclusions

- The final method
  - Valeric Anhydride
  - 10% DMF in Acetonitrile
- Lower detection limit and faster reaction
- Intraday reproducibility with silica matches reproducibility without silica
- Studies in progress to better define our limit of detection

Thanks

My mentors, Dr. Susan Rose-Pehrsson and Mrs. Kimberly Williams

QUESTIONS?