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## Headspace Analysis

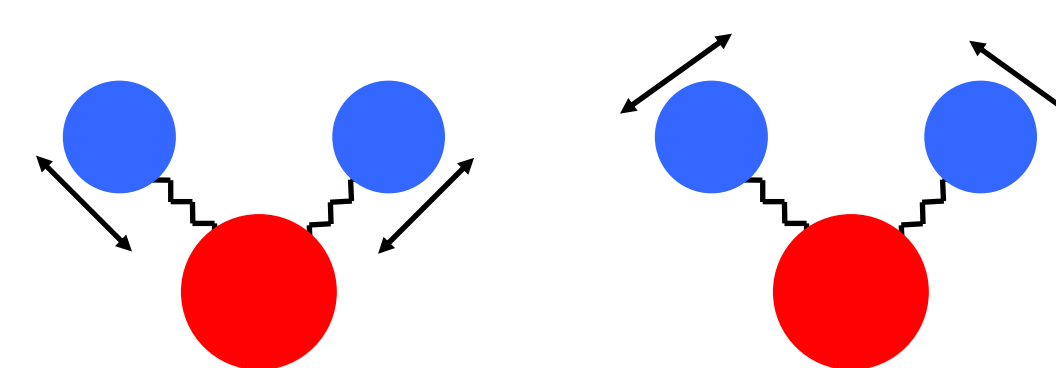
- Shelf life
- Corrosion
- Degradable polymers
- Drug potency
- Package permeability
- Sterilization optimization

## Challenges

- Sample Volume
- Range
- Specificity

## Gas Phase FTIR

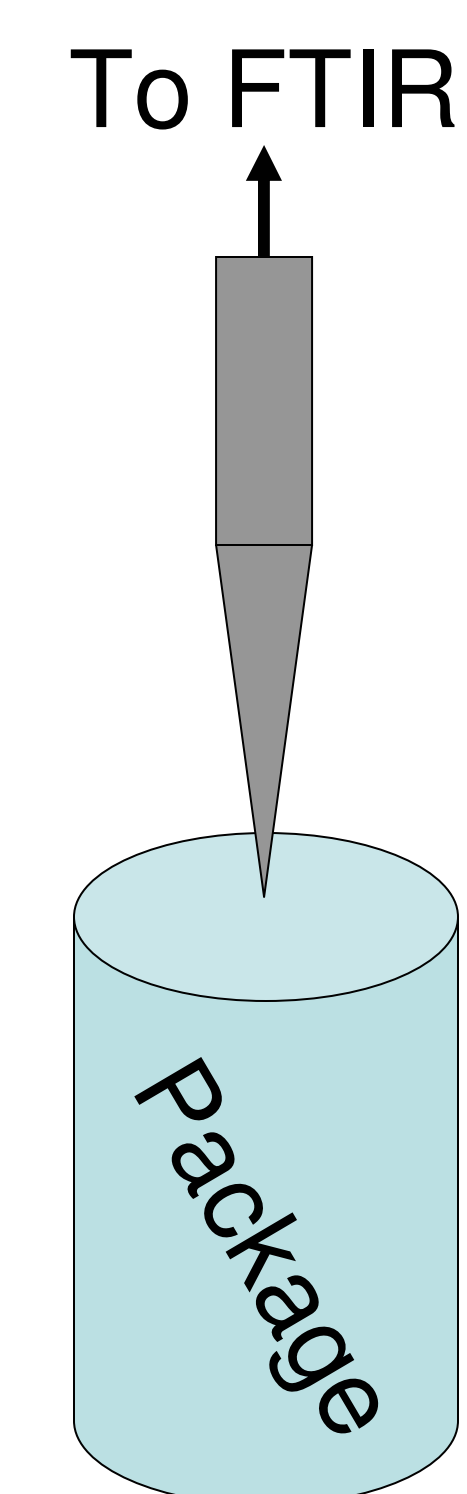
Quantitative analysis using high resolution gas phase Fourier transform infrared spectroscopy (FTIR).



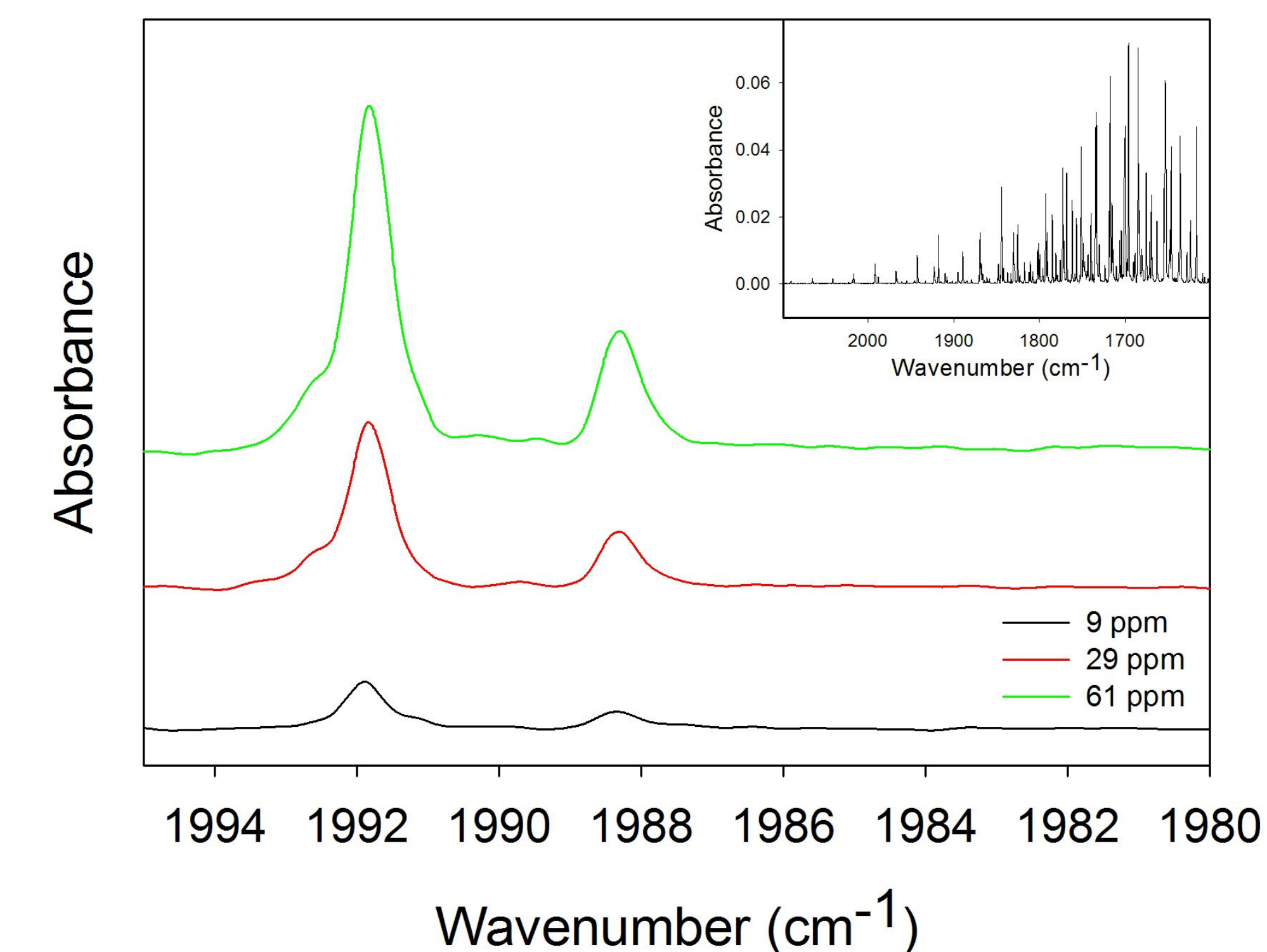
Beer's law

$$A_i = \sum_{j=1}^m L_s a_{ij} C_j$$

$A_i$  is absorbance at wavenumber  $i$ ,  $L_s$  path-length,  $a_{ij}$  the molar absorptivity at  $i$ ,  $C_j$  concentration, and  $m$  the number of compounds.

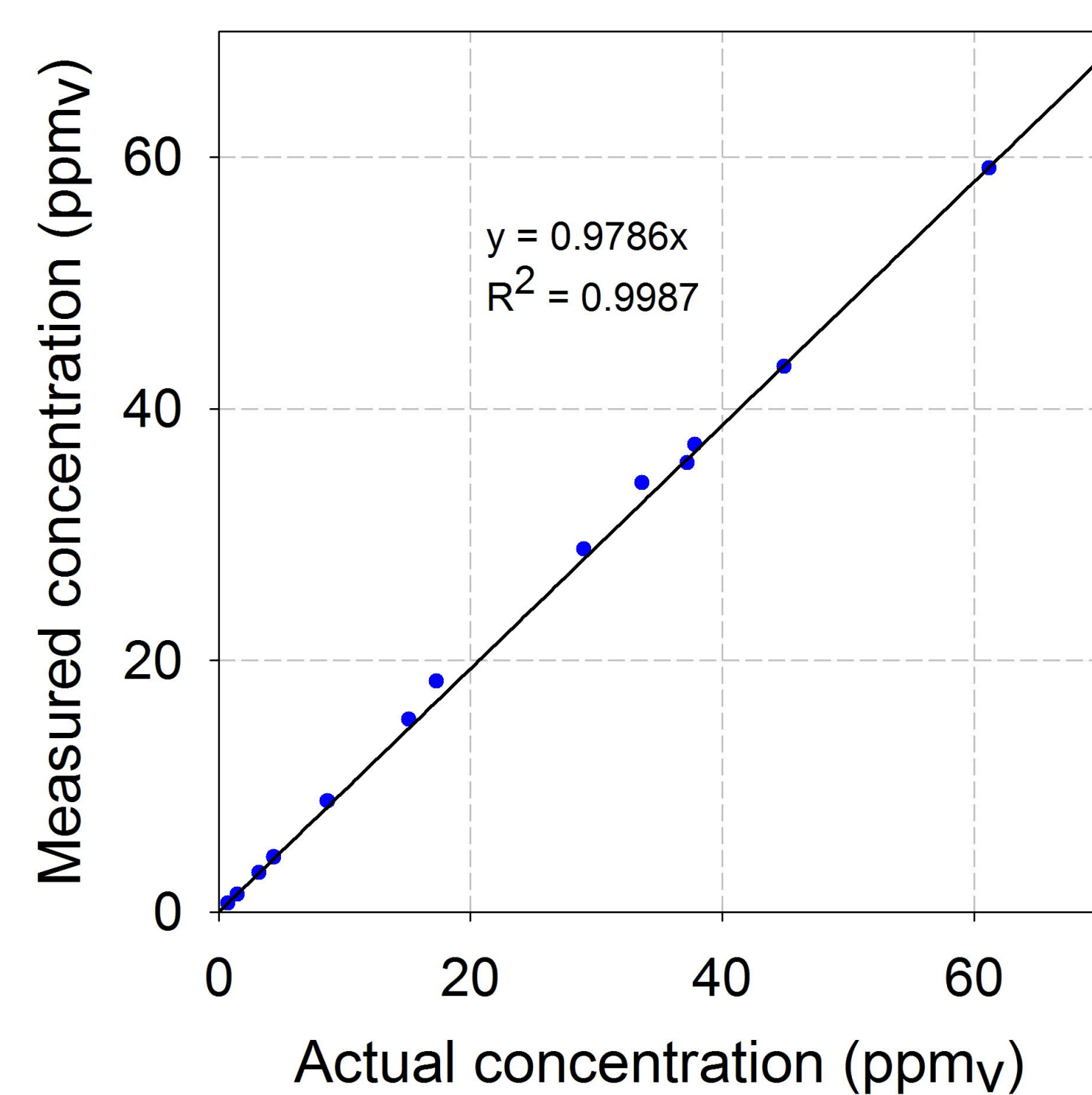


## Moisture Spectra



Moisture chosen as proof of concept.  
Ethylene oxide, residual solvents, etc.

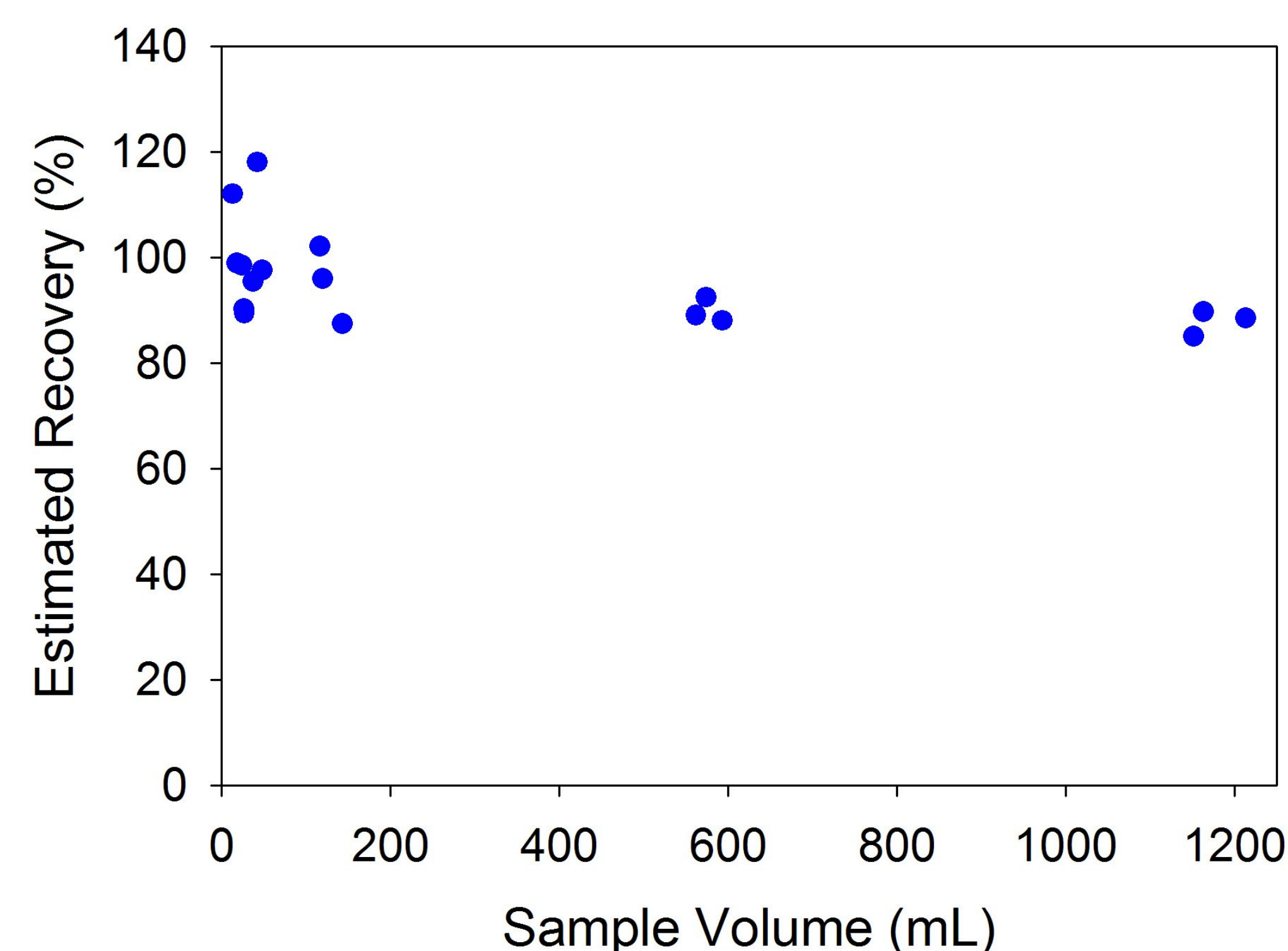
## Sample Concentration



Example of linearity and recovery from calibration curve.

Headspace concentration range 5 ppm<sub>v</sub>– 50%RH

## Sample Volume



Sample volume range 10 - 5000 mL

## Conclusions

- Chemical specificity.
- Simultaneous quantification of multiple compounds.
- High sensitivity.
- Wide range of concentrations.
- Wide range of package volumes.
- Short analysis time.