

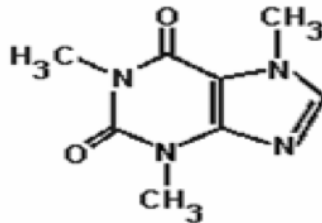
Determination of Caffeine in Coffee – Effect of Brew Time

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Determination of Caffeine in Coffee

- Caffeine is prevalent alkaloid in brewed coffee.
 - ~2 % (w/w) in coffee beans.
 - ~100 mg per eight ounce serving of brewed coffee.
 - ~2.3 mM caffeine in brewed coffee.



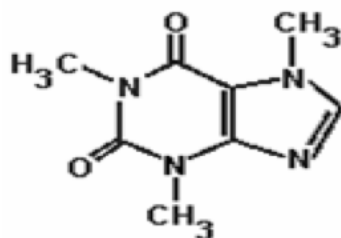
Caffeine Structure

Determination of Caffeine

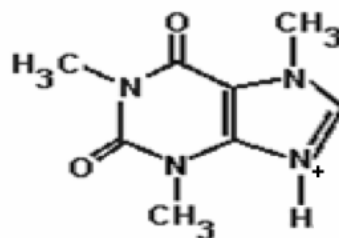
- Many methods reported in the literature:
 - HPLC
 - Gravimetric
 - Potentiometric
 - Iodometric Titration
 - FTIR
 - UV-Vis
- UV-Vis is preferable because of speed, accuracy, precision, and ability to use small samples.

Determination of Caffeine

- Caffeine is extracted from alkalized analyte using non-polar solvent.
 - Example of liquid-liquid extraction procedure.



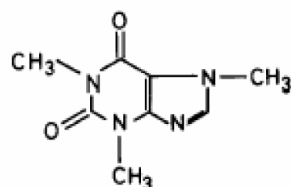
Caffeine in
Basic Solution
Non-polar



Caffeine in
Acidic Solution
Polar

Molar Extinction of Caffeine

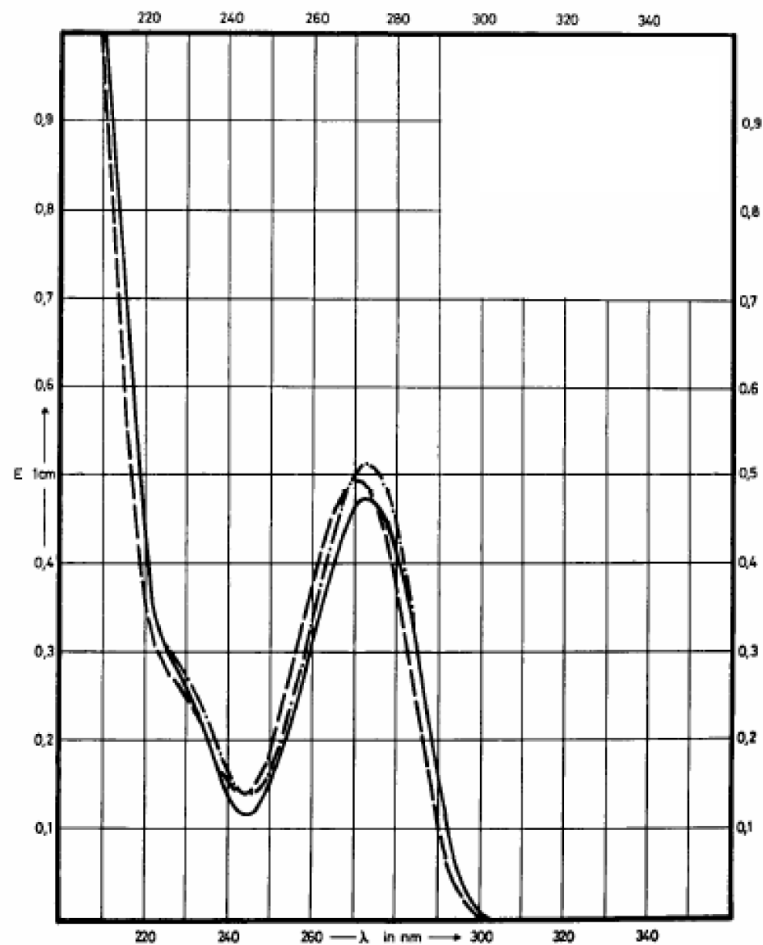
Name CAFFEINE



M_r 194.2

Concentration 1 mg / 100 ml

Solvent Symbol	Methanol	Water	0.1 M HCl	0.1 M NaOH
Maximum of absorption	273 nm	273 nm	270 nm	273 nm
$E_{1\%}^{1cm}$	475	515	495	510
ϵ	9220	10000	9610	9900



Protocol

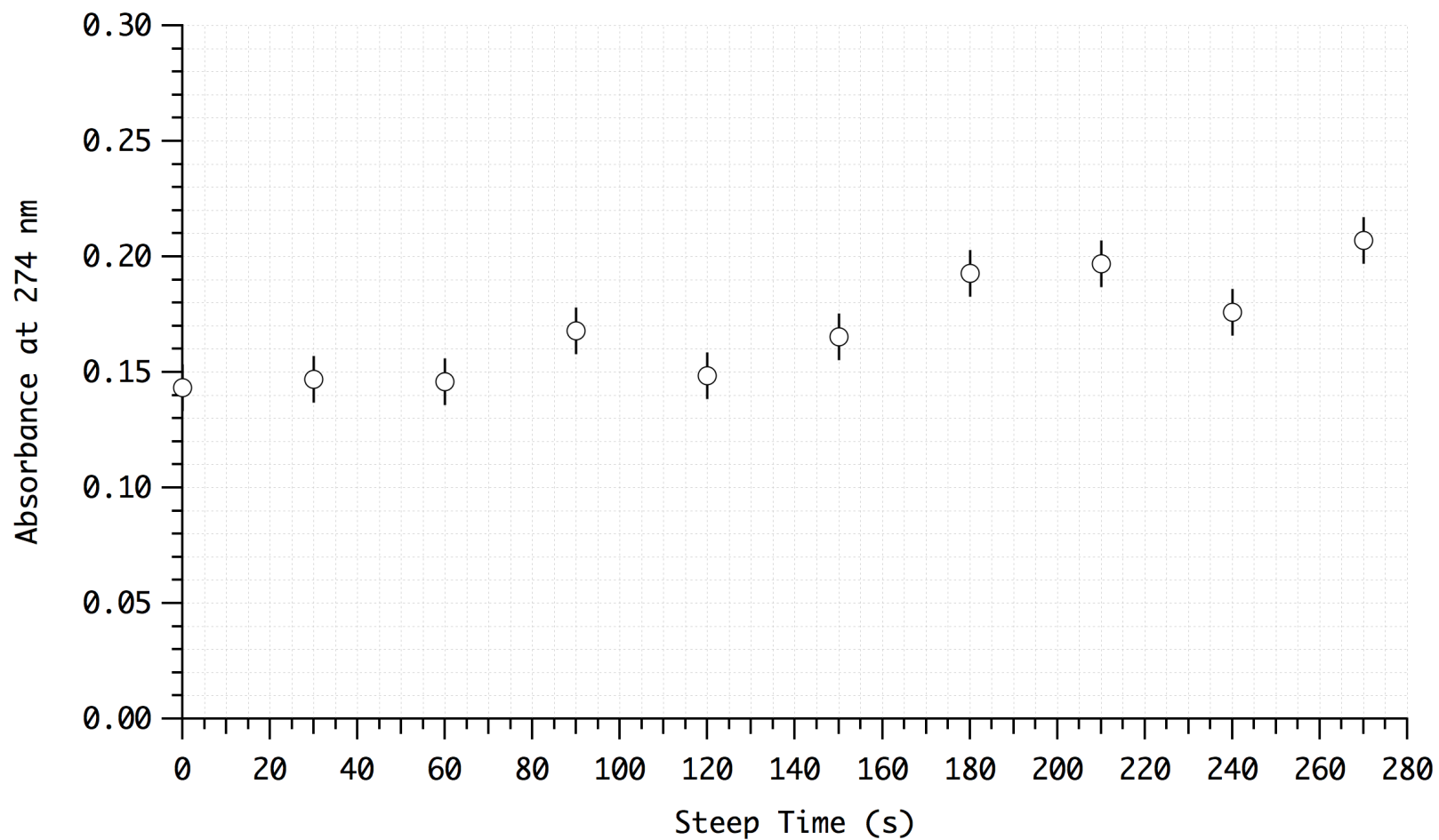
- Expose 2.0 g coffee grounds to 50 mL boiling water for varying time intervals.
- Quickly quench water extraction.
 - By vacuum filtration of grounds.
- Make up water filtrate to specified volume.
 - 100 mL
- Mix
 - 1.0 mL water extract
 - 1.0 mL 1 M NaOH + 1 M NaCl
 - 2.0 mL hexane
- Measure UV-Vis spectrum of hexane layer
 - Use hexane as blank.

Brewed Samples

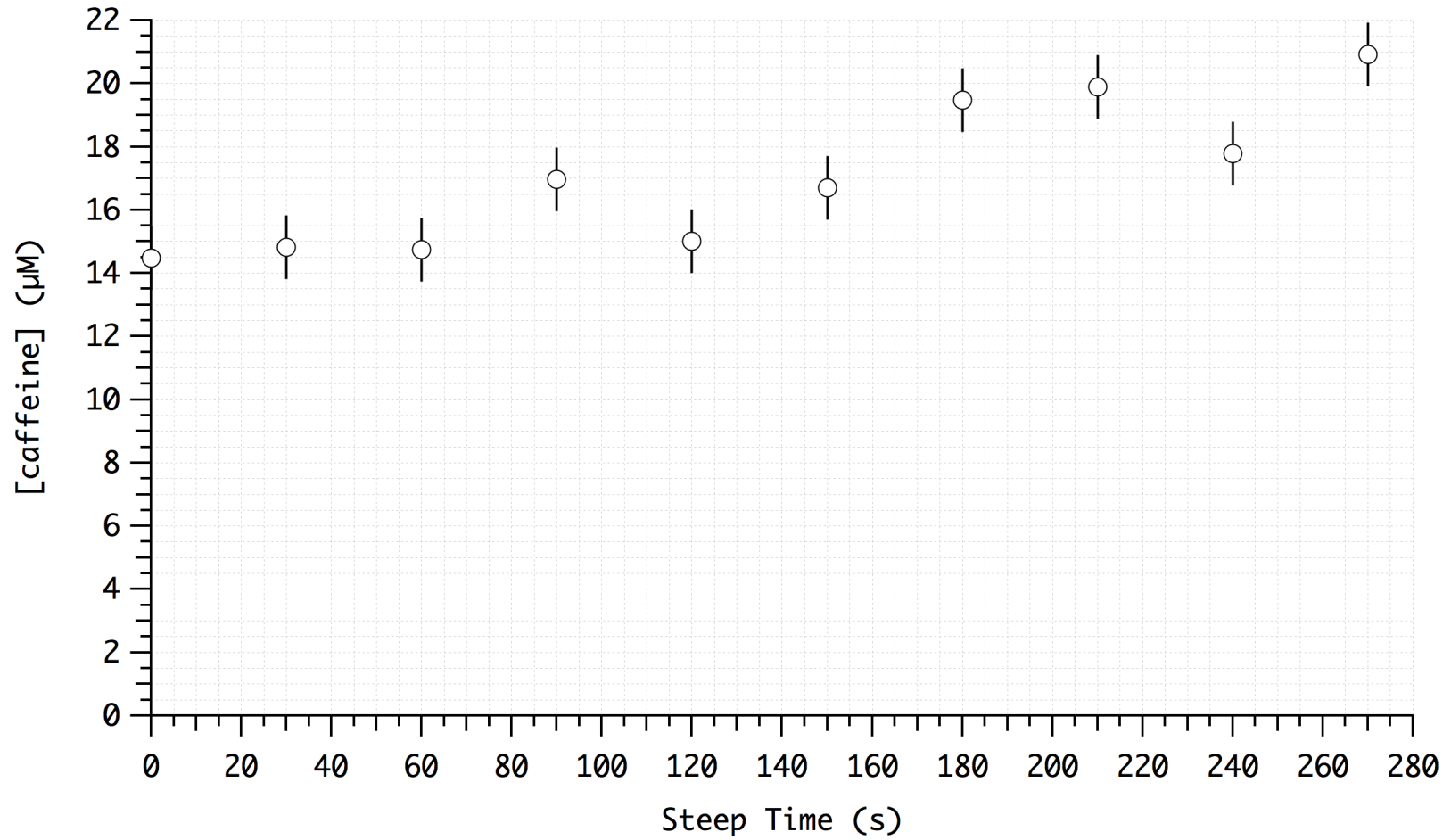


0 30 60 90 120 150 180 210 240 270
Seconds of Extraction (Brew) Time with Boiling Water

UV Absorbance of Extracted Samples



Concentration of Caffeine



Future Plans

- Measure visible spectrum also.
 - To quantify brew color.
- Use black tea leaves as sample.
- Use different water extraction temperatures.
 - ~25 °C temperature => “Sun Tea”
- Measure titratable acidity also.
 - Proxy for tart or bitter.