

Comparison of Two Analytical Chemistry Techniques

A Lab Experience for High School
Chemistry Students

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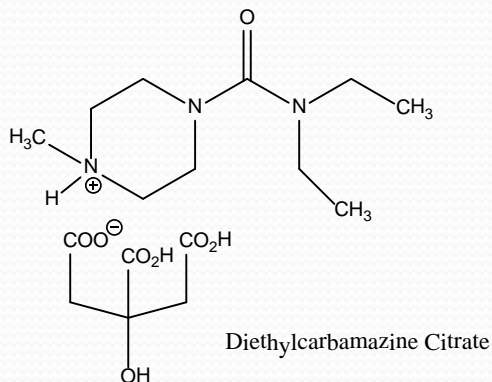
Clay High School

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Teaching Goals

- Students would be introduced to acid base back titrations as a tool to measure concentration of diethylcarbamazine (DEC) citrate.
- Students would be introduced to a method of determining accuracy of a procedure.
- Students would learn a technique to compare two sets of data.



The Role of DEC in Fighting a Tropical Disease.



Man with limb swollen due to effects of LF. Carter Center Photo: E. Staub

- Lymphatic Filariasis (LF) affects 120 million people with more than a billion at risk. Over 40 million people are permanently disabled by this disease making it a leading cause of disability in the world. Consuming salt fortified with diethylcarbamazine (DEC) has been found to be a safe and effective method of prevention for LF¹.
- This titration was developed at the University of Notre Dame and is used for quality control of DEC citrate fortified salt in Haiti
- *1. Fifth Meeting of the Global Alliance to Eliminate Lymphatic Filariasis.* Rep. The Global Alliance to Eliminate Lymphatic Filariasis, Apr. 2008. Web. 24 July 2009. <http://www.filariasis.org/documents/GAELF5reportEnglish.pdf>



Student Activities



Bon Sel salt contains DEC citrate to prevent lymphatic filariasis

- Produce a standard curve by titration of known samples.
- Measure DEC citrate concentration using the acid base back titration method
- Comparison of measured concentrations vs. actual concentrations
- Comparison of DEC citrate concentrations measured by titration method vs. HPLC method



The Titration Procedure



A student titrating DEC citrate.

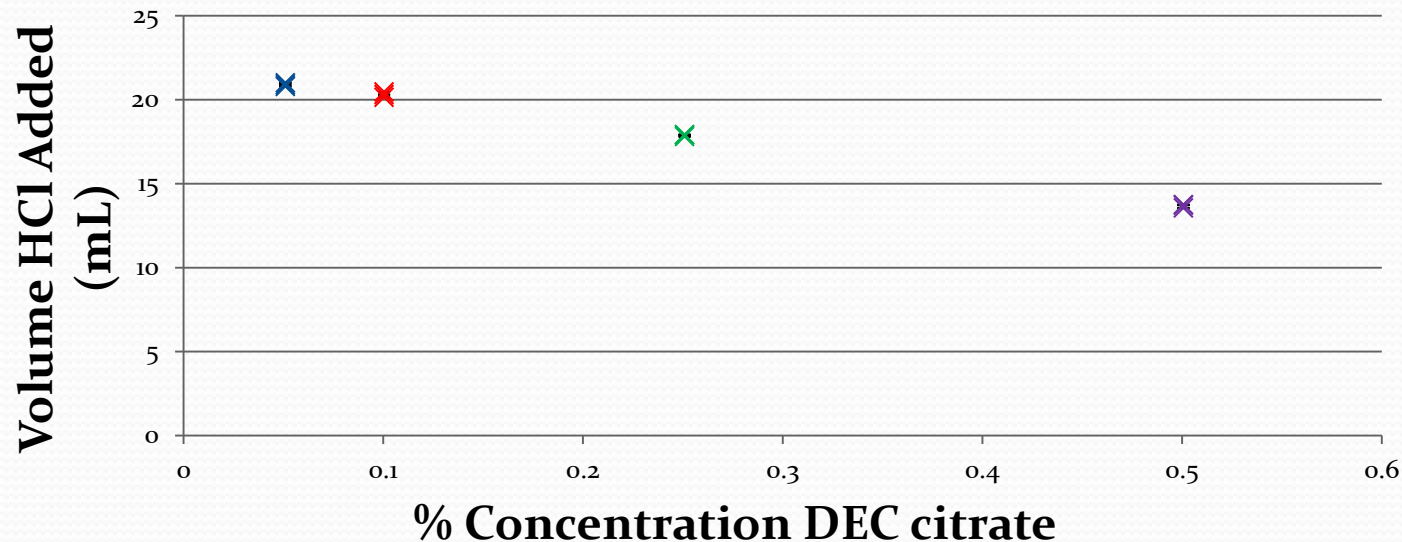
- An acid-base back titration is one method used to quantify DEC citrate
- The titration method uses the following sample:
 - 10.00mL solution of DEC citrate in 10% saline
 - 10.00mL of 0.01M sodium hydroxide
 - 2 drops phenolphthalein
- The sample is titrated with 0.004M hydrochloric acid to a clear endpoint.



Student Lab Work

- 1) Using samples of known DEC citrate concentration students can produce a standard curve.
- 2) Using the standard curve students can determine the concentration of DEC citrate in titrated unknowns.

DEC Citrate Standard Curve

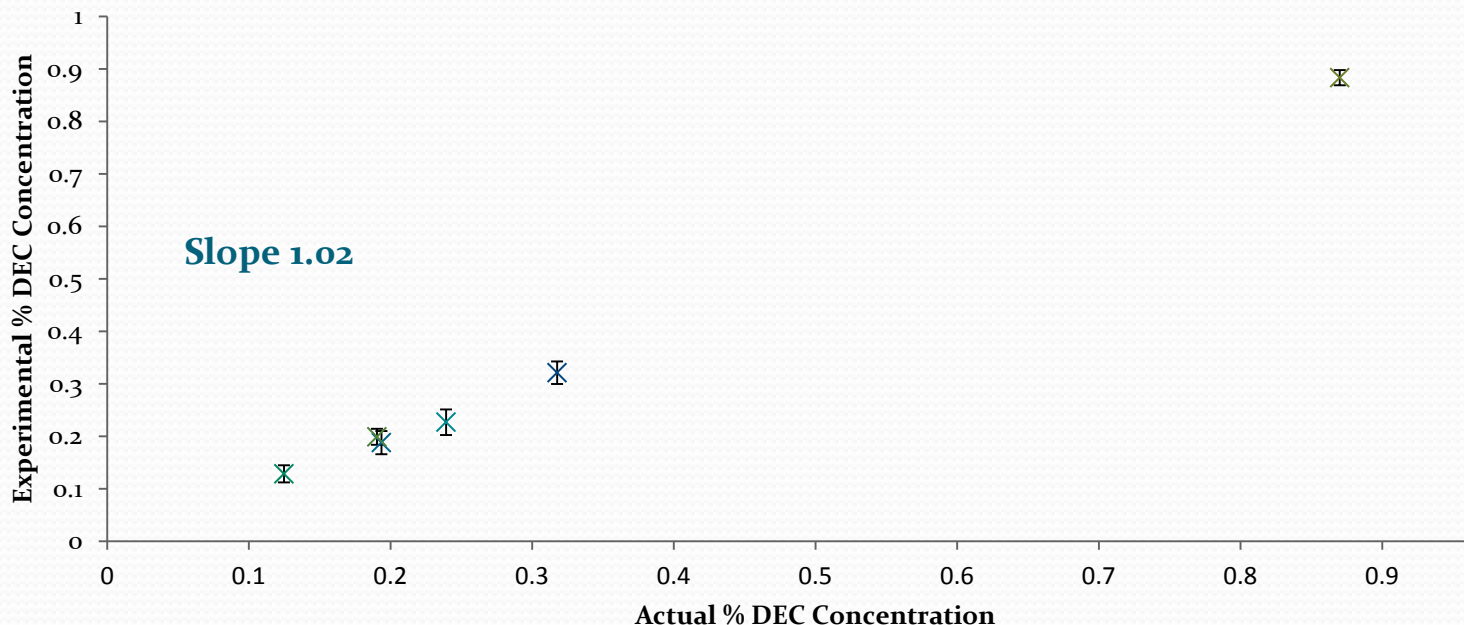


Accuracy of DEC Citrate Titration

Data analysis

- *Students can graph their titration concentrations versus the actual concentration to estimate accuracy.
- *A slope of 1.00 indicates accurate measurements.

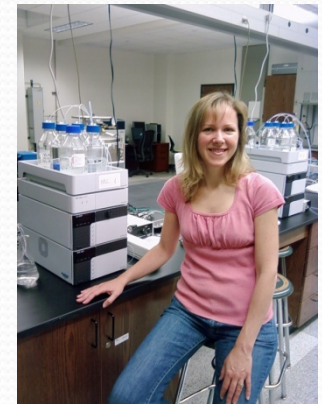
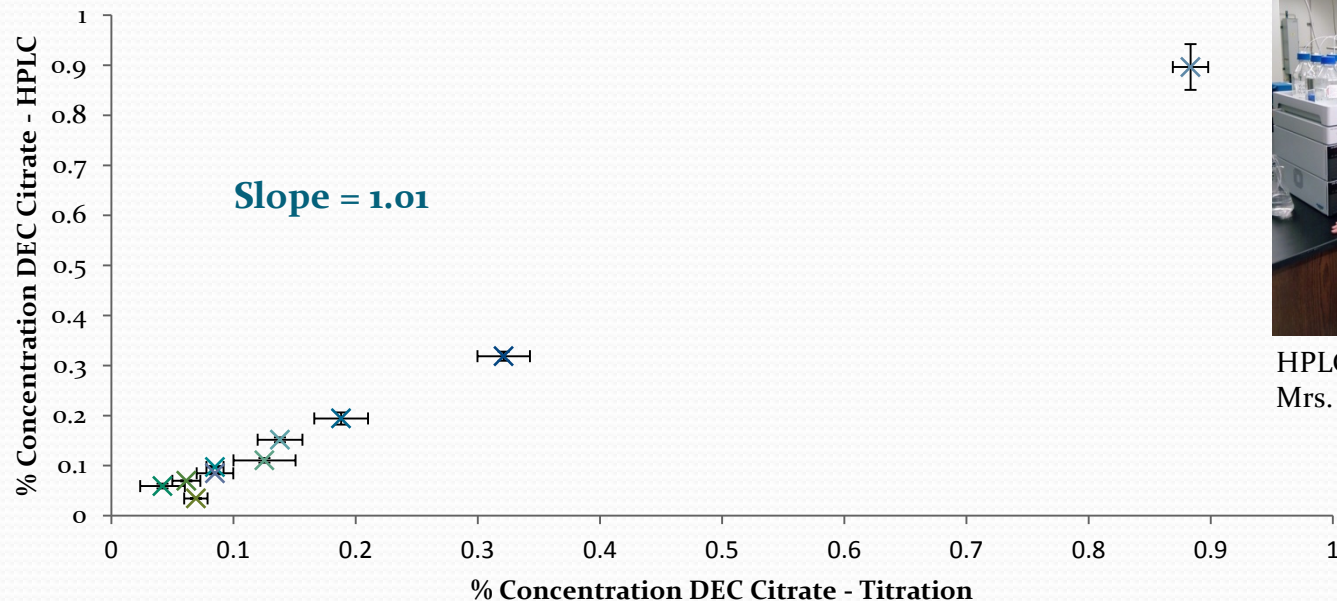
Actual vs. Experimental % DEC Citrate Concentration



Comparison of Two Methods

- Students can compare their results to measurements acquired by another technique.

% DEC Citrate Titration vs. HPLC



HPLC data collected by Mrs. Weaver



Conclusions



A Haitian chemist testing DEC fortified salt
Photo: Sarah Miller, University of Notre Dame

- Students gain experience with an acid base back titration
- Students learn methods to evaluate an analytical procedure
- Students gain experience graphing with EXCEL
- Students learn real world application of a titration
- Concentrations of compounds used pose no health or safety concerns to students

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