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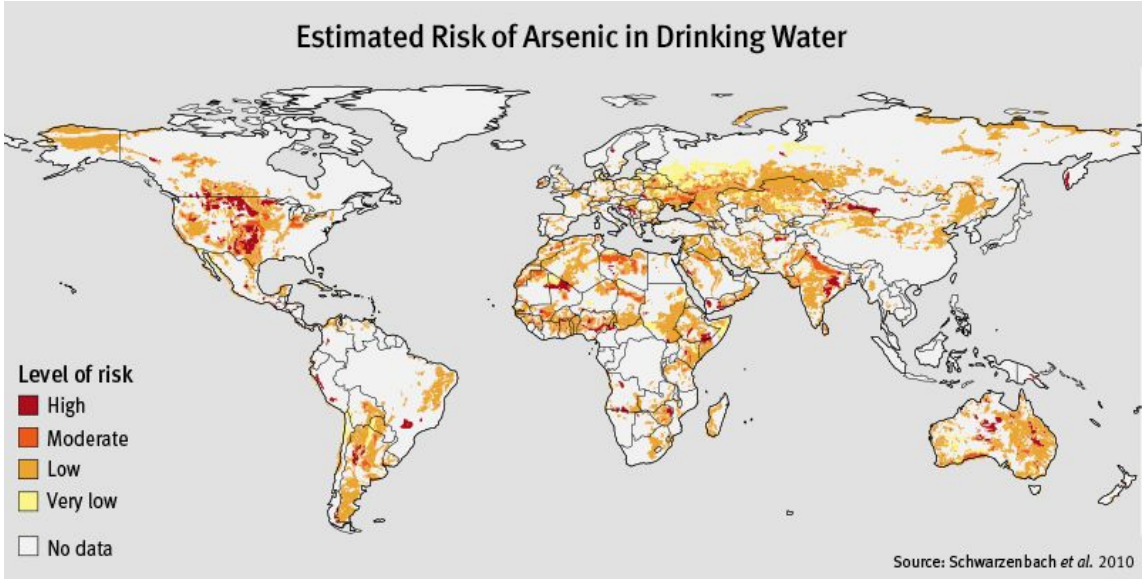
Arsenic Sensor

Designing a low cost, sensitive method for detecting arsenic in water using colorimetry and spectrometry.

Arsenic detection in drinking water is critical.



There are many complications in detecting arsenic in water.

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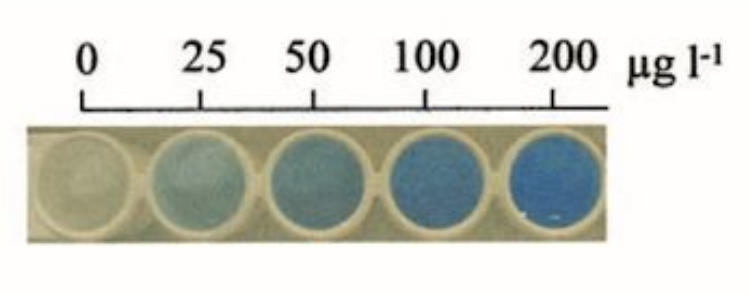
The original method proposed was expensive, complicated, and hazardous.

We attempted an alternative and more promising method.



This method claimed to remove phosphate interference.

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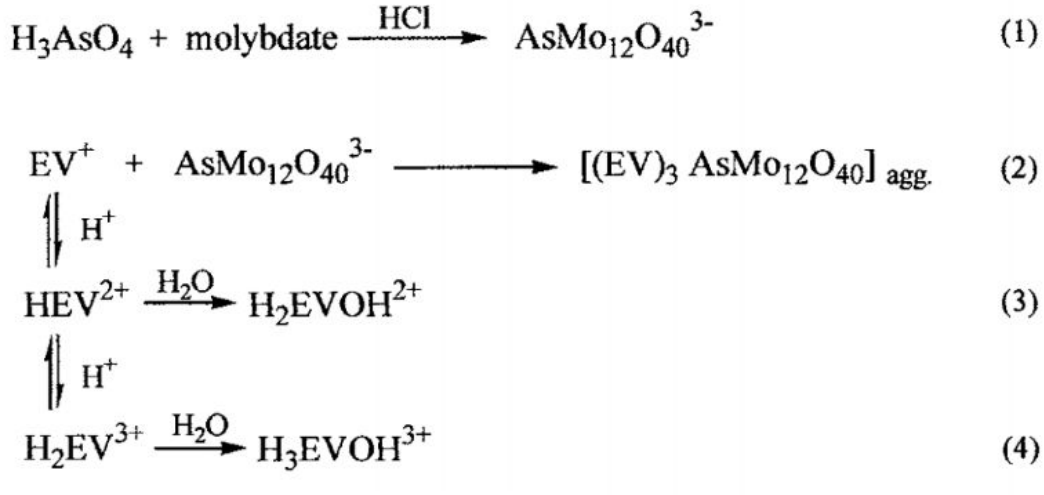
Ion	Tolerant limit/ mg l^{-1}	Molar ratio (foreign ion/As)	As found[a]/ µg l^{-1}	Recovery, %
Na^+	450	15000	98	98
K^+	936	18000	96	96
Ca^{2+}	280	5000	101	101
Mg^{2+}	163	5000	101	101
Cu^{2+}	100	1200	98	98
Mn^{2+}	119	1400	98	98
Zn^{2+}	102	1200	98	98
Fe^{3+}	87	1200	96	96
Al^{3+}	300	8000	96	96
Cl^-	690	15000	96	96
NO_3^-	507	5000	98	98
SO_4^{2-}	375	3000	96	96
SiO_3^{2-}	30[b]	700	98	98
PO_4^{3-}	50[c]	800	105	105

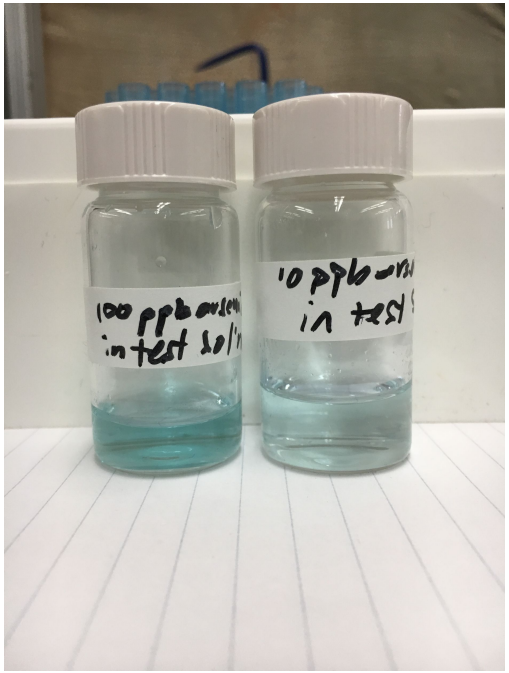
a. Average of three replicate analyses; As taken, 100 µg l^{-1} (1.3×10^{-6} mol l^{-1}).
b. With masking using sodium fluoride.
c. With pretreatment using anion-exchange resin.

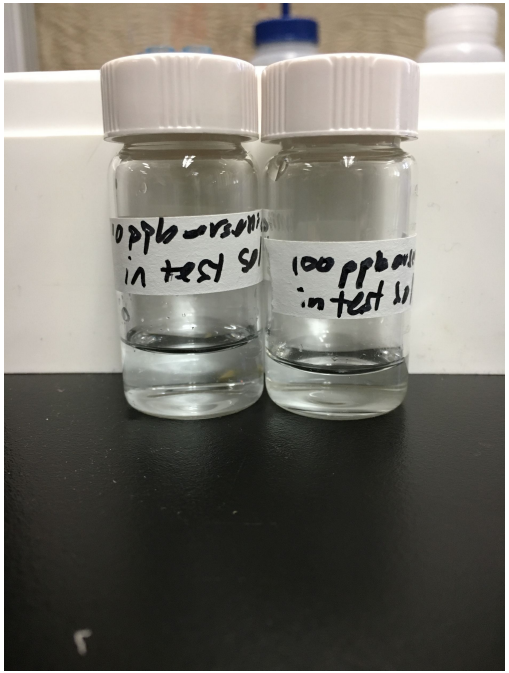
It was safer than other proposed methods.



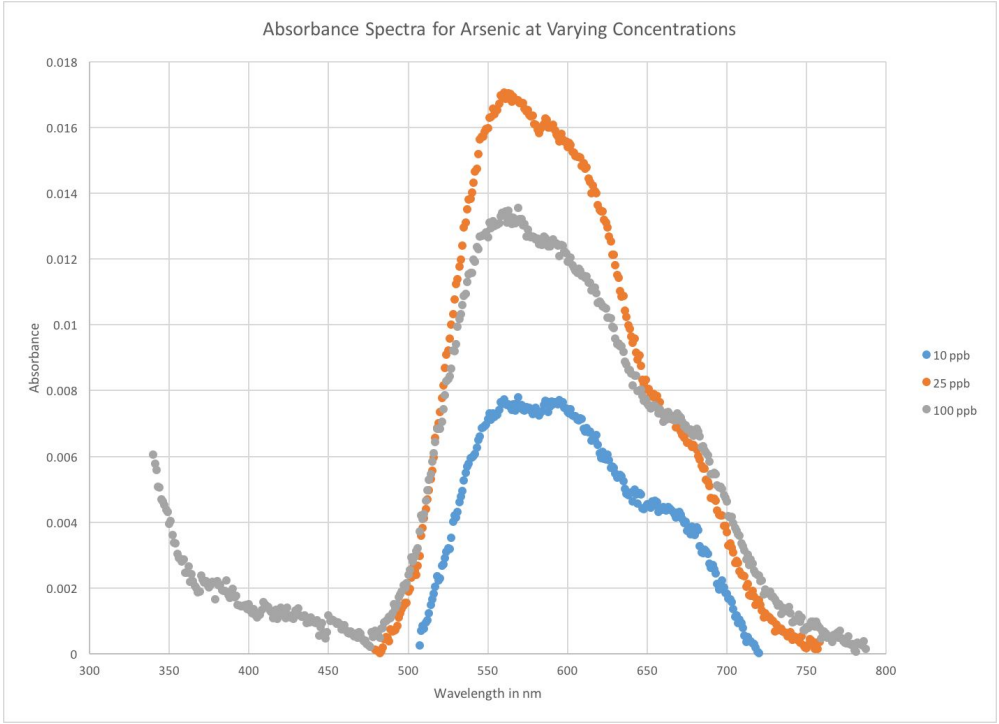
Scheme 1 Reaction scheme.

Inconsistent results arose from the order of chemicals added.





UV-Vis spectra highlighted inconsistencies.



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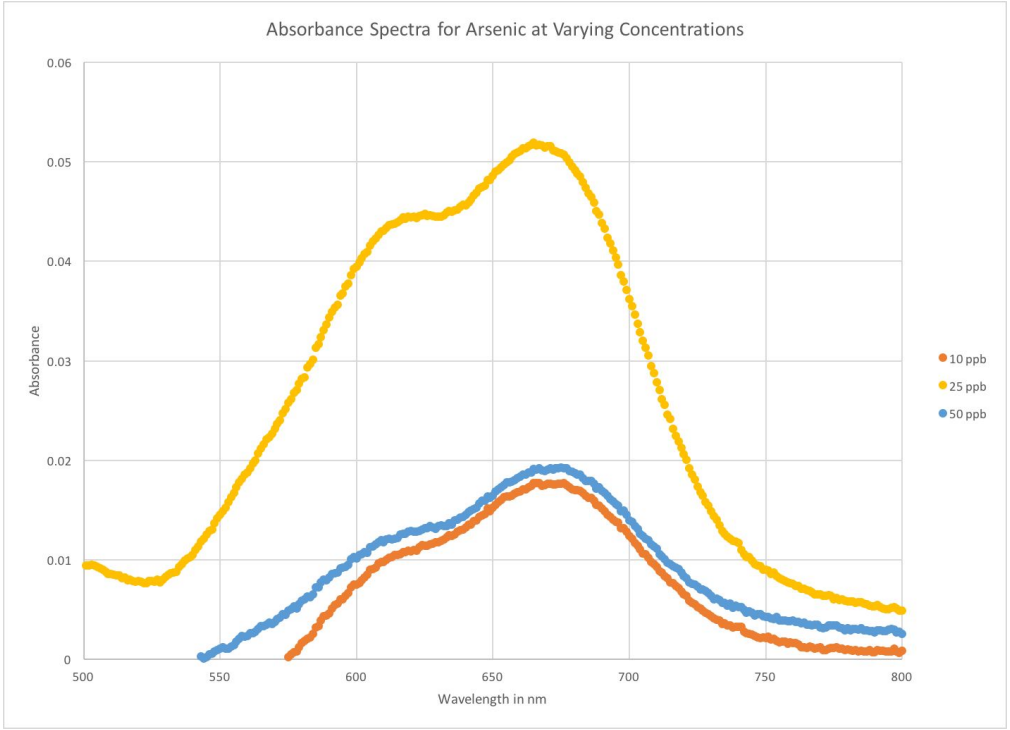

Future Tasks

- Look into other proposed methods for UV-Vis detection of arsenic in water that are comparable in cost and safety.
- Consider projects on arsenic removal.

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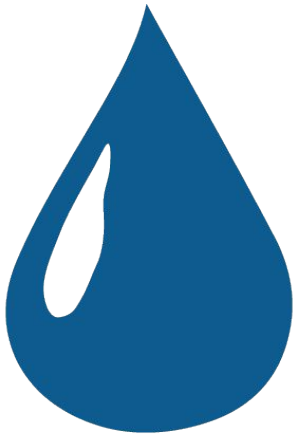
Questions and Recommendations



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Appendix Slides

Materials Required for Original Procedure

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- 50 ppb Arsenite (As (III))
- Potassium Monobasic Anhydrous 500g
- Potassium Iodate Reagent >98% Grade 100g
- 37% HCl Solution ACS Reagent Grade 500mL
- Sodium Metabisulfite >99% 500g
- Sodium Thiosulfate 99% 250g
- Sulfuric Acid ACS Grade 95.0-98.0% 500mL
- L-Ascorbic Acid Reagent 100g
- Ammonium Molybdate Tetrahydrate ACS Reagent 81.0-83.0% 100g
- Potassium Antimony Tartrate Hydrate >99% 500g

Cost > $500

Analysis of Materials for Second Method

Method 2							
Chemical	**molecular weigh**	**Cost**	**Safety Precautions**	**Stock Concentration (M)**	**Volume Used to Treat 50mL Water Sample (µl)**	**Sample Concentration (M)**	**Sample Concentration (mg/L)**
KIO3	214.001	$40/100g	Acute Toxicity and oxidizing agent	0.05	100	9.55E-05	20.4
HCl	36.46094	$30/500mL	Corrosive; dangerous fumes at high concentration	0.1	1000	1.91E-03	69.6
(NH4)6Mo7O24·4H2O	1235.9975	$40/100g	Acute toxicity; minor irritant	0.0315	150	9.02E-05	111.5
Ethyl Violet	492.15	$75/100g		0.0013	100	2.48E-06	1.2
Bis-Tris Buffer pH 7.4	?	$50/100mL		0.1	1000	1.91E-03	?
NaF (Only if Silica is an issue)	41.99	$50/250g	Acute toxicity; irritant	1	6	1.15E-04	4.8
Amberlite IRA-400 Resin	?	$60/500g		N/A	N/A		
Total		**$345**		total volume (µl)	52356		
Cost Per 50mL (based on the recipe)		**?**			0.052356		
10mL Polypropylene Column							
*Phosguard Possibility; cheap; mostly for use in fish tanks; aluminum oxide							
NaCl for pretreating resin		$40/1kg					
Glass Chromatography column 8mL							