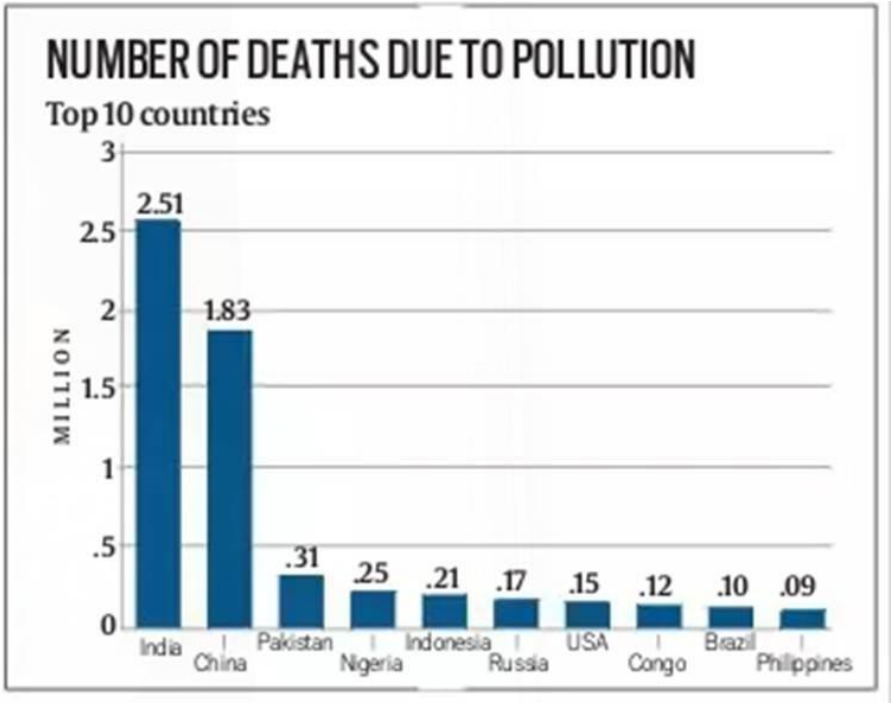
Investigation and Implementation of *Opuntia Basilaris* for Purification of Contaminated Water

Thousand Oaks High School
AP Research

- ★ Pollution's Worldwide Impact
- ★ Water Pollution Specifics
  - ○ Causes
  - ○ Global Impact
  - ○ Industrial Wastes Role in Pollution
  - ○ Arsenic
- ★ Background of ***Opuntia Basilaris***
- ★ Hypothesis and Methods of Study
- ★ Results and Discussion
- ★ Conclusion
- ★ Limitations
- ★ Actions to be taken for the future

Pollution Basics

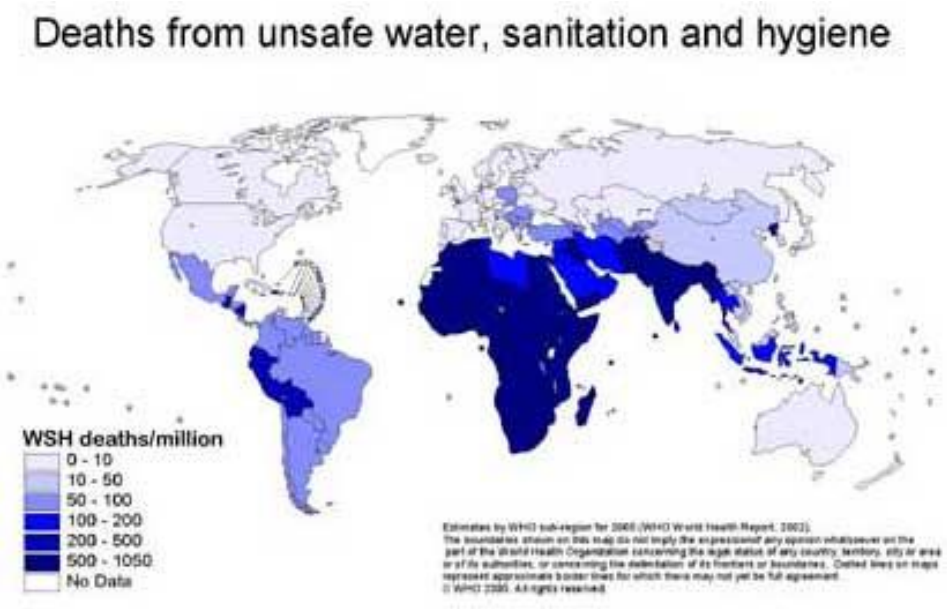
- ★ Types of pollution
  - Air
  - Soil
  - Light
  - Nuclear
  - Water
- ★ 16% of global deaths



https://pakwired.com/india-tops-list-pollution-linked-deaths-study/

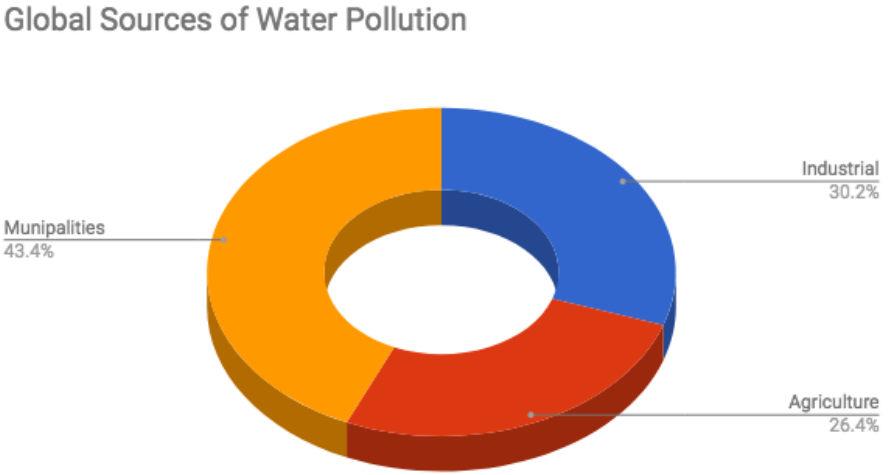
Water Pollution

- ★ Global Threat
  - Developing countries
- ★ Waste Contamination
  - 500 Tons/Year
- ★ Continuous Occurrence



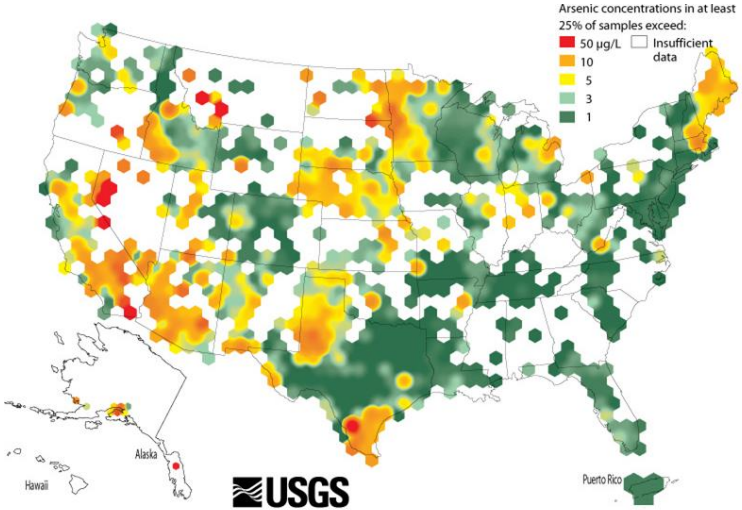
Industrial Role in Pollution

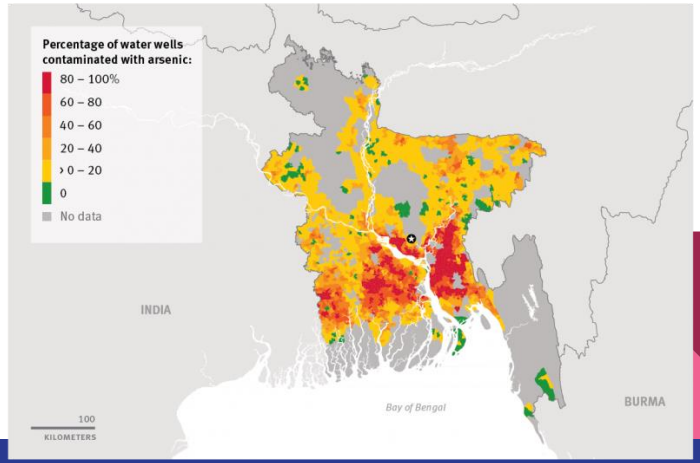
- ★ 2nd Largest Cause
- ★ Industrial Revolution
  - ○ 1780-1830
- ★ 70% Waste into Freshwater
- ★ Toxic Heavy Metals
  - ○ Lead
  - ○ Chromium
  - ○ Arsenic



Arsenic (As)

- ★ Highest Toxicity Heavy Metal
- ★ Arsenic Poisoning and Impacts
  - Diarrea - 842,000 DPY
  - Cancer - Liver, Pancreas, Lung
  - Keratosis - Skin condition
- ★ Heavy Concentration
  - USA
  - India
  - Bangladesh





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Opuntia Basilaris

- ★ Species of Cacti
  - ○ Prickly Pear
- ★ Southwest Coast
  - ○ Southern Canada-> Mexico
- ★ Mucilage
  - ○ Gel-Like Substance
  - ○ Polysaccharides
- ★ Significance

Research Question

★ Is using Opuntia Basilaris mucilage a feasible, natural method that can successfully clean Arsenic (As) contaminated water in developing countries?

Hypothesis

★ ***Opuntia Basilaris(OPB)*** mucilage will effectively extract Arsenic as well as other heavy metals from sediment contaminated water and would prove successful in developing countries who are in need of water purification

NULL

★ The wide scale of pollution will not be able to be contained by the natural method using OPB mucilage due to capacity restrictions put upon the cactus

Methods

- ★ Systematic
  - Reading 40-50 research papers
  - Sources - EbscoHost, Google Scholar, CSUCI Library
- ★ Selection Criteria
- ★ Primary Research Followed - Ph.D Norma Alcantar

Describing the Results

- ★ Water synthesised to match those at risk were tested
- ★ 3 Varied Arsenic (As) to water concentrations studied
  - ○ 63% As
  - ○ 56% As
  - ○ 90% As
- ★ Compare forms ***OPB*** mucilage tested in
- ★ Effectiveness ***OPB*** Mucilage vs. Chlorine

Form	% Concentration AS pre-mucilage treatment per ug/L	% Concentration of Arsenic per ug/L-after
Processed mucilage	63	15
Opuntia Basilisas pads	63	23
Ferric salt + OP Mucilage	63	7

Form	% Concentration Arsenic cleaned with Mucilage-before	% Concentration of Arsenic per ug/L-after
Processed mucilage	56	30
Opuntia Basilisas pads	56	32
Ferric salt + OP Mucilage	56	6

Form	% concentration of arsenic per ug/L	% Concentration of Arsenic per ug/L-after
processed mucilage	90	43
Opuntia Basilisas pads	90	47
Ferric salt + OP Mucilage	90	19

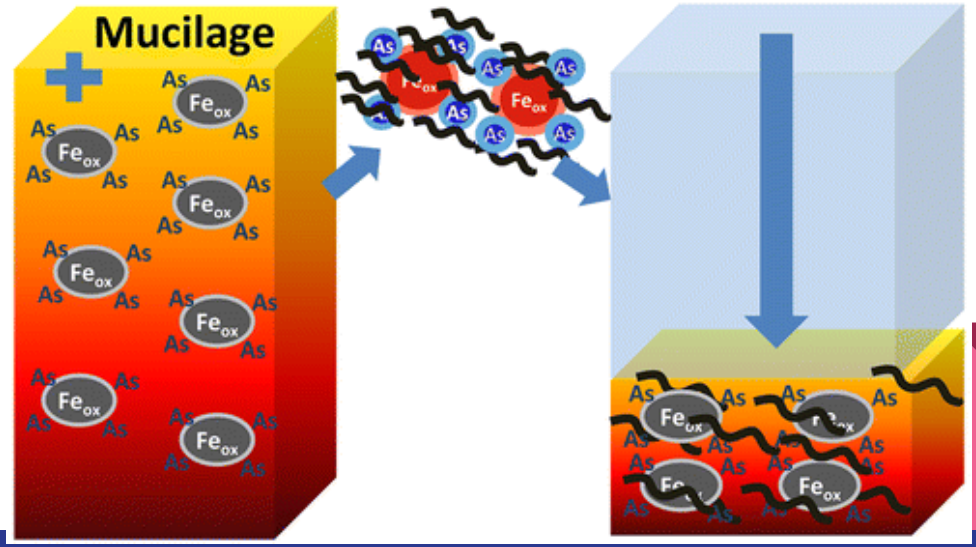
Significance

- Graphpad T-Test
- P value < 0.01
- Reject null hypothesis

Discussion

- ★ *OPB* Mucilage proven effective
  - 75% - 90% As concentration reduction
- ★ Ferric Salt Addition = Even Better Results

- ★ How?
  - Flocculation - Coagulation

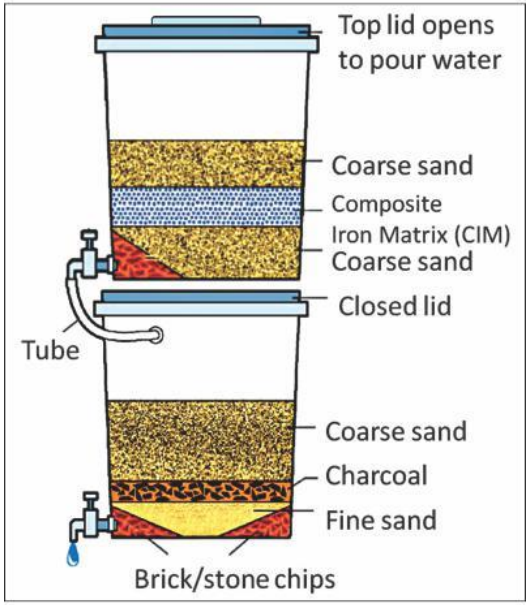


Proven Success

- ★ 2010 - Haiti Earthquake
- ★ Oil Spill dispersant
- ★ Fish Farming
- ★ 2008
  - ○ Northern - Central Mexican Tradition proven effective in Purification

Comparison to Other Methods

- ★ Sewage Plants
  - Effective in cleaning Human waste, not Industrial
  - Expensive
- ★ Chlorine
  - Mixes with Arsenic, Making Ineffective
    - DOES NOT REMOVE
- ★ SONO
  - Patented Filtration System
  - Professor Hussam - 2007



The Sono water filter invented by Prof Hussam.

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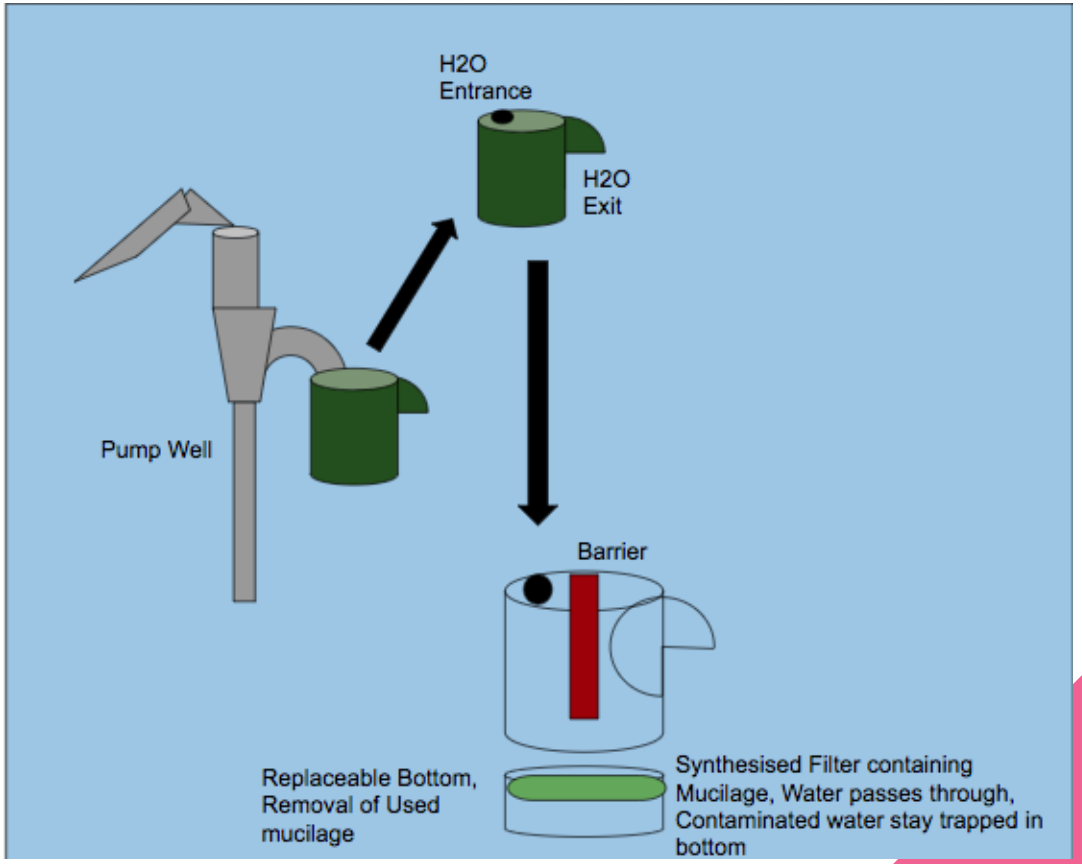
Conclusion

- ★ *OPB* Mucilage with Ferric Salts clear 85 - 90 % of As concentration
- ★ Effectivity ranks above previous Method
- ★ Proven to Work under large scale operations
- ★ Natural and cost- effective
- ★ Implementation should occur in Developing Countries

Further Work

- ★ Plan for Implementation
- ★ Develop Purification system
- ★ Guidelines
  - ○ Best Suited for Pump wells
  - ○ Renewable
  - ○ Accessible
  - ○ Feasible

Theoretical Solution Model



Acknowledgements

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