

Purification of Sediment Contaminated Water Using *Opuntia basilaris* and its Possible Implementation in Developing Countries

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Is using *Opuntia Basilaris* mucilage a feasible, natural method that can successfully clean arsenic (AS) contaminated water in developing countries?

Abstract

With the threat of sediment contaminated water impacting the population's health in many developing countries, a method is needed that will efficiently clear the poisonous metals being brought into the water. After proving its characteristics of purification, *Opuntia Basilaris* (OP) has been researched to the point where we know it can filter Arsenic, a heavy metalloid.

Purpose

Pollution of all types is present in water sources around the globe, and due to the extensive list of often fatal medical concerns that can be caused by water pollution, it is important to make every effort to fully filter harmful contaminants before people are exposed to it. Beginning during the industrial revolution of the eighteenth century when factories began dumping waste into rivers, lakes and other water supplies, water pollution started to be recognized as affecting the health of people in cities and towns (Merchant, 2002). These dumping included Arsenic (As), the most toxic element of all. The people in poor areas of the world that can't afford life saving medications and medical practices often suffer more as these countries death toll increases at a greater rate as water pollution rises (WHO 2016). In these poor urban areas where pollution causes the most problem, there have been 3,000,000 documented cases of premature deaths recorded every year throughout China, India, and Bangladesh (Dennis 2016).

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 *Opuntia Basilaris* Cactus will not be able to purify contaminated water.

Methods

SYSTEMATIC LITERATURE REVIEW was completed in order to recognize the papers reviewed and to detail the content. Scholarly articles were identified from sources such as Ebscohost, Google Scholar, and ResearchGate. The articles were published from 2008-2016, making them valid today and reflective of the most recent studies done on the topic, while allowing enough time to show the evolution of the research.

Results

	% Concentration Arsenic cleaned with Mucilage-before	% Concentration of Arsenic per ug/L-after
Test 1 - 63%		
Processed Mucilage	63	15
<i>Opuntia Basilaris</i> pads	63	23
Ferric salt + OP Mucilage	63	7
Test 2 - 56%		
Processed Mucilage	56	30
<i>Opuntia Basilaris</i> pads	56	32
Ferric salt + OP Mucilage	56	6
Test 3 - 90%		
Processed Mucilage	90	43
<i>Opuntia Basilaris</i> pads	90	47
Ferric salt + OP Mucilage	90	19

Figure 6: Data Table Testing Different Mucilage Forms on Arsenic Contaminated Water

Discussion

Applying *OP Brasilaris* mucilage to Arsenic (As) contaminated water is effective in clearing 75% to 90% of the toxic sediment (Alcantar 2012). Tested within test tubes, the mucilage undergoes a FloC process that clumps together As and the different selected mucilage combinations and forms to indefinitely improve the conditions of the once contaminated water. The hypothesis was proven to be correct as all the tests showed a positive trend of high percentages of arsenic removal. In the developing countries that need this method of natural water purification, all various variables pertaining to type of mucilage administered worked. Three tests were found throughout the articles read which varied in the % concentration of Arsenic. These were tested to different forms of the mucilage to find which application was most effective. The combination of Ferric Salt and *OP Basilaris* mucilage proved most effective, averaging out a 85% removal percentage. Giving us a clue what to implement in the future development of water purification inventions, providing a liquid solution that can be mixed with other substances that can combat other metals of issue later to arise.

Conclusion

Opuntia Basilaris Mucilage successfully purified sediment, specifically Arsenic, contaminated water. While different methods and tests were completed, including a variety of forms of mucilage tested to the Arsenic Levels given.

Figure 1 - Percentages of Different Water Pollution Causes

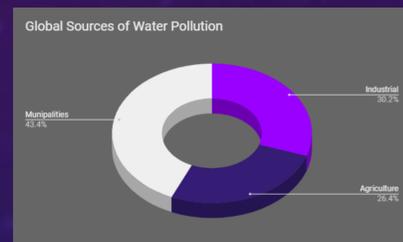


Figure 2: Deaths Globally for Unsafe Water

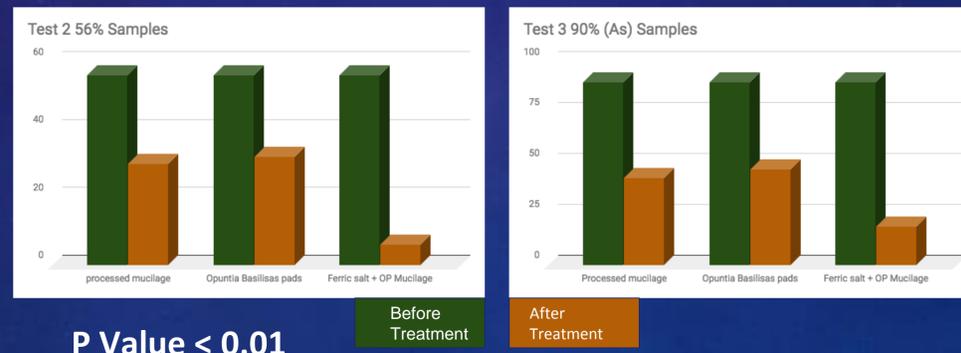


Introduction

What started as a tradition in a Mexican household has grown into a new method of water filtration, the use of the mucilage from the prickly pear cactus. Also known as the gum (Edward 2010), this method of using prickly pear cactus mucilage to filter water has been studied extensively at the University of South Florida (USF), where it's effectiveness as a water filtration medium has been demonstrated. In 2011, *Opuntia Basilaris* (prickly pear), was used to clean up an oil spill by absorbing the oil and breaking it up into smaller droplets, allowing the oil to break down faster (Alcantar 2012). This type of cactus has also demonstrated the ability to filter arsenic, which could support its implementation in water filtration systems to remove harmful heavy metal-type substances and to reduce the residual risk of diarrhea, cancer and keratosis caused by arsenic contamination that is not addressed by many current filtration systems, particularly in developing countries.



Figure 3,4,5: Visual Representation of *Opuntia Basilaris*



P Value < 0.01

Figure 7,8 : Charts Found from Data off Figure 6

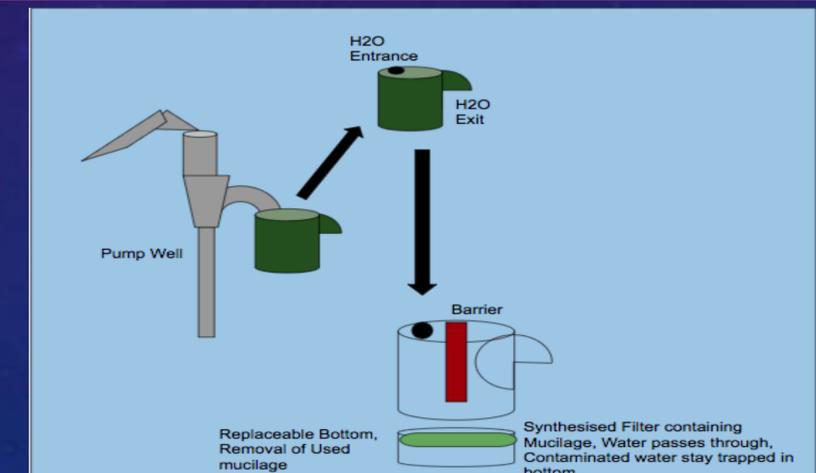


Figure 9 : The Theoretical Water Purifying Model that incorporates the Mucilage Natural Technology

Further Work

Development and implementation of the theoretical ATP (Arsenic Treatment Purifier) would be the next step in this research to prove if the hypothesis to the research question presented is correct. Developing the purifier and evaluating its performance under a variety of tests would be required its effectiveness under the stress of different water sources. Research could also be done on what other metals are possible to get filter out of in the heavy metal water, and if mucilage has the ability to do so. Additionally, different combinations of mucilage with other natural materials should be studied to improve the Ferric Salt *OP Basilaris* combination, however as of now this is the best combination identified to date. Additionally, if the *OP Basilaris* was desired to be grown locally to save costs, research would need to be conducted to understand if the *OP Basilaris* would affect the ecosystem, potentially causing more harm than good.

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