

Iron Removal from Water Using Banana Peel Ash: Cochabamba, Bolivia Katie Burns with SODIS

Abstract

A small, household-size water filter was constructed in Cochabamba, Bolivia in order to address the issue of high iron concentrations in the water of the Chapare and Tipnis regions of the Cochabamba Department.

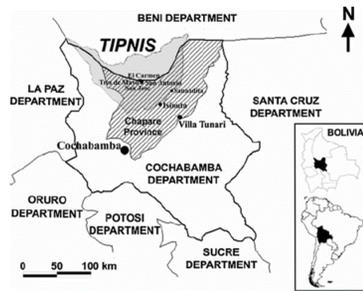


Figure 1: Map of Cochabamba Department and Surrounding Areas

The filter was constructed using the elements from a sand filter constructed by a previous engineer at SODIS and banana peel ashes collected by volunteers at Sustainable Bolivia. Overall, the banana peel ashes were found to remove iron from the water, however, further testing is necessary to determine the quantity of iron removed.

Introduction

- In the Chapare and Tipnis regions of Bolivia, the ground water can be contaminated with up to 30 mg/L of iron
- Many families in this area use ground water as their sole source of water in the home through the use of wells
- The World Health Organization (WHO) does not have any health limits for iron concentration in water
- WHO states that concentrations of iron below 0.3 mg/L should not affect the flavor of the water, but may still affect turbidity
- The removal of both undesired flavor and turbidity/color due to iron was the goal of this project

Project Description

- Banana peels were collected and dried outdoors, in the sun for 2 – 8 weeks, depending on when the bananas were consumed and collected.
 - Generally after 1 – 2 weeks the banana peels were dry enough (depending on the weather), but the dryer the peels are, the easier they are to burn
- Once dry, the banana peels were burned and the ash was saved to be used for design tests
- The previous sand filter was deconstructed and cleaned, then left in pieces in order to facilitate easier testing



Figure 2: Deconstructed Filter Pieces

- Iron-rich (IR) water was produced using 200 mg iron tablets purchased at a pharmacy dissolved in 473 mL of water, then diluted to a concentration of 30 mg/L
- 4 tests were conducted using the same concentration of iron in water (30 mg/L) with different amounts of banana peel ash in order to determine an appropriate amount to use per liter of water

Table 1: Test Matrix

	Trial 1	Trial 2	Trial 3	Trial 4
Amt of IR Water (L)	5.889	5.889	5.889	5.889
Number of banana peels present in ash	20	30	50	0
Time ash is in contact with water (mins)	60	60	60	0
Photo of Water Before				
Flavor before 0-5	1	1	1	1

Results & Discussion

Table 2: Trial Results

	Trial 1	Trial 2	Trial 3	Trial 4
Amt of IR Water (l)	5.889	5.889	5.889	5.889
Amt of Bananas in Ash	20	30	50	0
Time ash is in contact with water (mins)	60	60	60	0
Photo of Water Before				
Flavor before 0-5	1	1	1	1
Test results				
Photo of Water After				
Flavor after (0-5)	0	0	1	0.5
Color Reduced?	Yes	Yes	Yes	Yes
Flavor Reduced?	Yes	Yes	No	Yes

- Tests show that allowing for water to react with ash for 1 hour, filtering through a sand filter, followed by filtration through a Stefani candle filter (Table 2) removes both flavor and color from the IR water
 - Note: The Stefani candle filters are necessary to ensure all other toxins are removed from the water. These are the filters which SODIS sells through their microbusiness, AguaSegura.
- The overall goal of this project was to remove undesired turbidity/color and flavor from the water. These results meet that goal in trials 1, 2, and 4
 - Further tests should be run under these exact conditions to better confirm these results
- This filter is an excellent example of appropriate technology in Cochabamba
 - Bananas are grown in many people's backyards and are abundantly found across most of Bolivia, meaning there is no extra cost to the user to buy activated carbon or other oxidation media.

Recommendations

- The tests conducted in Bolivia should be repeated with some small changes
 - IR water should be collected from a tube well in both the Chapare and Tipnis regions to run these tests on
 - Water samples should be tested through a lab to determine the concentration of iron before filtration, after sand filtration, and after ceramic candle filtration
 - Each trial should be run at least twice to ensure better accuracy
 - A blind taste test should be performed in order to eliminate bias
- Conduct tests to determine exactly how many banana peels within a specific, previously successful window remove the most iron
- Rather than using sand filtration, use a mesh fabric with a small pore size to trap the insoluble iron particles near the bottom of the filter unit



Figure 3: The SODIS volunteers

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