

IPRO 355: Pilot Study in Mexico for KlarAqua Water Filtration System and Business Planning

Advisors: Nasrin Khalili
Team Leader: Laura Grimmer

Design and Testing Team
Amanda Gilliam - Leader
Shea Lemley
Laura Grimmer

Business Team
Brandon Lloyd – Leader
Petre Ikonov
Samantha Staley
Kit Hadou
Snehalata Topgi

Project Overview:

The main objective of the IPRO is to improve health conditions in low-income societies, specifically Mexico, by the design and implementation of a water filtration system. In previous semesters, the filtration system has been preliminarily designed and tested. A pilot study was conducted in on Oct 19-22 and the results are still being processed and interpreted. The testing portion of the project is essentially completed, waiting only on clay to arrive for Mexico to test a system made with native clay. The business plan has been 90% completed, and the only parts lacking are those which are dependent on results from the pilot study. The other major objective left this semester is to do well in the International Idea 2 Product which we have been invited to compete in for a grand prize of \$25,000. The next month's work will focus on aiding our two presenters with any information or documentation that they need.

Revised Objectives:

The original schedule of deliverables is summarized below with our progress marked.

Date	Event
Sept 5	Set up iknow and igroup accounts - COMPLETE
Aug 29	General IPRO briefing and division into lab and business groups- COMPELTE
Sept 5	First draft of Executive Summary and Vision statement - COMPLETE
Sept 7	Design business cards and shirts-COMPELTE
Oct 3	Develop User Manuals for filtration and potter, test on students- COMPLETE

Oct 30	Business Plan
Nov 8	Website- COMPLETE
Oct 15	Brochures
Nov 25	Partnership
Nov 8	Legal entity
Nov 8	Patent- FILED
Oct 30	Effectiveness against bacteria -COMPLETE Lifespan of silver effectiveness Flowrate- COMPLETE

In addition to these objectives, the following objectives have also been completed, with italics indicating objectives which are still in progress:

I2P International Competition

- One page and five page summaries were written and sent to judges
- Meetings with appropriate advisors regarding our presentation strategy
- Development of Presentation*

IIT Board of Trustees Presentation

- Meetings with advisors to discuss KlarAqua's Nov 8 presentation
- Development of Presentation*

Mexico Pilot Study

- Five students and one advisor spent 4 days in Monterrey Mexico
- Meetings with Monterrey Tech counterparts
- Visits and interviews in underdeveloped communities
- Visits and interviews with potter

Results to Date:

Listed by team, the following tasks have been accomplished to date by our team:

Design Team:

Amanda Gilliam- Leaders

- Taught Shea how to make filters (molding, firing, glazing)
- Made new molds that would account for shrinkage of filters
- Reworked heights of filters to fit inside the bucket
- Bought materials to use in the system manufacturing process (10 quart pails, 2 gallon buckets with lids, valves, sealant)
- Determined optimum glazing scheme
- Produced 3 full working systems for use in the Mexico pilot study
- Developed 3D renderings of the system for use in presentations, abstracts, posters, and brochure
- Brainstorming ideas of how to make an effective housing for activated aluminum to be used in removing arsenic
- Took pictures for use in the user manuals
- Wrote initial 1 page paper for I2P in Austin, TX
- Meeting with Jake Elster to strategize for I2P Competition
- Portions of business plan

Laura Grimmer

- E. Coli Bacterial Testing (results in Appendix A)
- Psuedomonas Aeruginosa Testing (results in Appendix A)
- Flowrate testing
- Silver treatment of all manufactured products
- Wrote initial 1 page paper for I2P in Austin, TX
- Portions of business plan
- I2P Midterm Report
- 5 page summary for I2P

Shea Lemley

- Learned to produce filters
- Calculations to adjust for shrinkage
- Attempts to increase flowrate by composition alteration
- Helped identify pilot study communities
- Participated in Pilot Study

Business Team:

Brandon Lloyd- Leader

- Assigning and compiling business plan components
- Cost estimates
- Portions of business plan

Petre Ikonov

Used different programs to make the website interactive

- Flash (the website itself with interactive content)
- Dreamweaver (make the layout with background waves)
- Photoshop (edit all images)
- 3D max (rotating water drop)

Brainstorming ideas of how to make an effective housing for activated aluminum to be used in removing arsenic

Wrote initial Manufacturing and Operations Plan (portions of business plan)

Snehalata Topgi

Designing and order KlarAqua t-shirts

Contacting potential partners

Attempt to establish non-profit organization

Researched WHO testing

Preparations for Mexico Pilot Study

Updated and printed brochure

Creating of household and potter's manual

Creation of village education program

Participated in pilot study in Monterrey

Portions of business plan

Sam Staley

Wrote project plan

Co-authored executive summary

Portions of business plan

Designed business cards

Photographed process for use manual

Creation of logo for products

Kit Hadou

Participated in Pilot Study

Portions of business plan

Contacting potential partners

The team members have identified the following tasks to be completed before the end of the semester:

Website Development:

Blog on the website

Pictures from trip on the website

Business plan on the website (when finished)

Video on the website

User manual on the website

Presentations

- Form presentation for I2P Competition, Board of Trustees, and IPRO Day
- Prepare 5 page technology paper for I2P
- Win \$25,000 at I2P
- Make presentation posters for IPRO Day

Testing

- Test current filter design with clay from potter in Monterrey, Mexico
- Discuss with lab partner the feasibility of recommendations from project partners in Monterrey, including
 - Increasing the height of the first filter
 - The top filter will hold enough water to filter through overnight and provide for a family's daily needs
 - Water will filter more quickly through the first filter because of the increased head, while other filters
 - Increasing the flow rate without compromising antibacterial ability
 - Testing resin as a replacement for one or more filters where water hardness is a problem
- Work with partners in Mexico to produce larger prototypes for the test

Business Plan

- Incorporation of Pilot Study results into business plan
- Continues cost research

Conclusion

The team is moving forward at the expected pace, and will complete the proposed objectives by the expected deadlines.

Appendix A: Testing Results

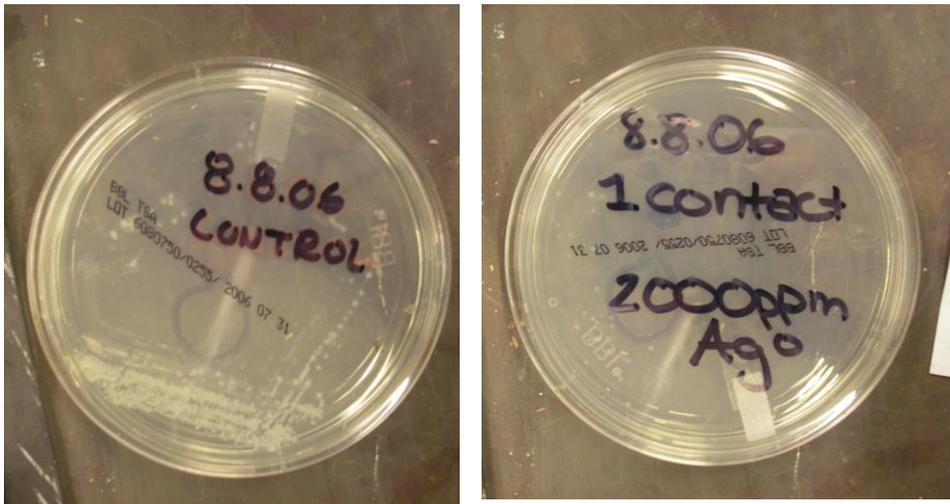
Aug 8, 2006- Test #1: One Time Contact E. Coli

2000ppm solution of colloidal silver (as distributed by www.n-ergetics.com) was used. Each side of the bowl was brushed with ½ oz of solution. This was done the day prior to testing and the bowl dried over night. When water was run through, however, it came out an opaque bronze color, indicating this was too much silver. Water was run through the filter until it ran clear, and then the test proceeded.

The bacteria solution was prepared by a different method than previous experiments to obtain a lower concentration. Bacteria was taken from a plate culture and added to 500mL of distilled water. The amount of bacteria taken was equivalent to 3 loop-fuls on a standard inoculation loop.

500mL of bacteria solution was ran through the filter, followed by 200mL of distilled water to rinse out any bacteria in filter. The original solution (control) and final water were plated and photographed 24 hours later.

The control had 500+ colonies. After 1 contact with silver, only 25 colonies were seen. Pictures are below.



Aug 11, 2006- Test #2: Multiple Contact E. Coli

The same procedure for applying silver to bowls was used, and water was run through until it emerged clear. The same procedure was used for preparing the bacteria solution. Using 3 separate bowls, samples were taken after 1, 2, and 3 levels of contact. The results were photographed 48 hours later (which explains the larger colony size compared

to Test #1). There were 500+ colonies in the control, 10 colonies after 1 level of contact, and no colonies present after 2 and 3 times of contact.

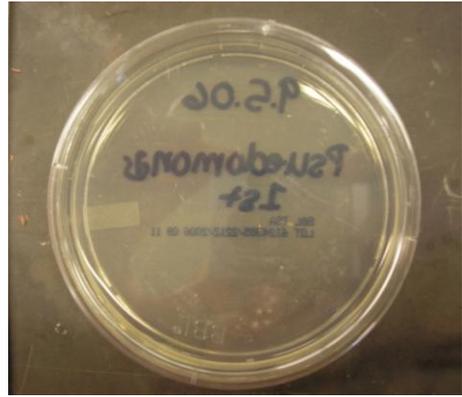


Sept 26, 2006- Test #3: Multiple Contact *Pseudomonas Aeruginosa*

The same procedure as described above was used for *Pseudomonas Aeruginosa*, and the pictorial results are shown below, including samples taken after 500mL and 1000mL of run through.



Control



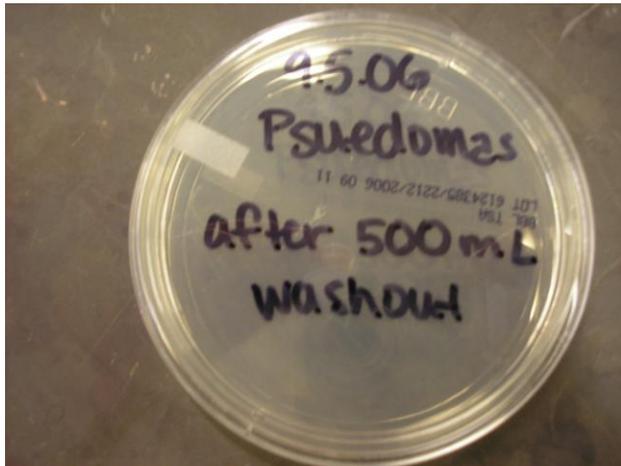
1st Contact



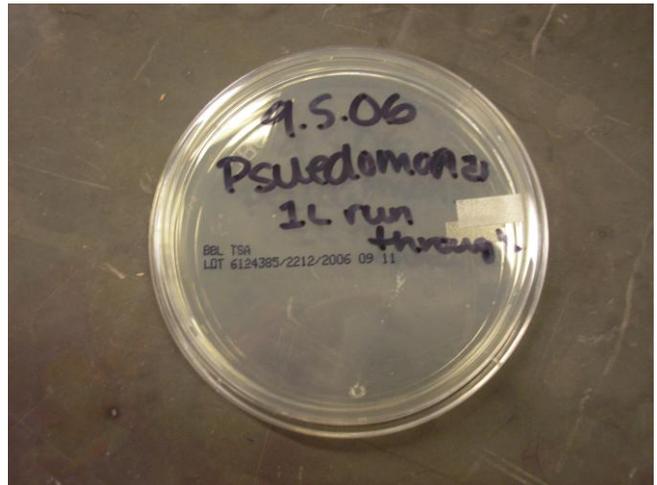
2nd Contact



3rd Contact



after 500mL of water



after 1L of water

Sept 26, 2006- Test #4: Flowrate

3 bowls of inner and outer glazed: 0.428 L/hr 0.400 L/hr 0.352 L/hr

1 bowl of outer only glazed: 0.250 L/hr