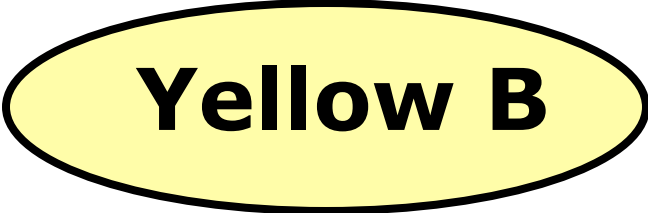


Aquatron

A yellow oval with a black border, containing the text "Yellow B".

Yellow B

water purifying devices is a major problem

- 1.2 billion people in developing countries lack access to safe drinking water
 - No water available
 - Available water is unsafe to drink



<http://www.africanwellfund.org/>

Boiling is the most common way of purifying water; this is a major waste of energy

-
- Freshly cut “green” wood fuel has a

30 million people drink 1 quart boiled water a day

- 900 million lbs wood per year

Market

Market Set in small villages, schools or communities

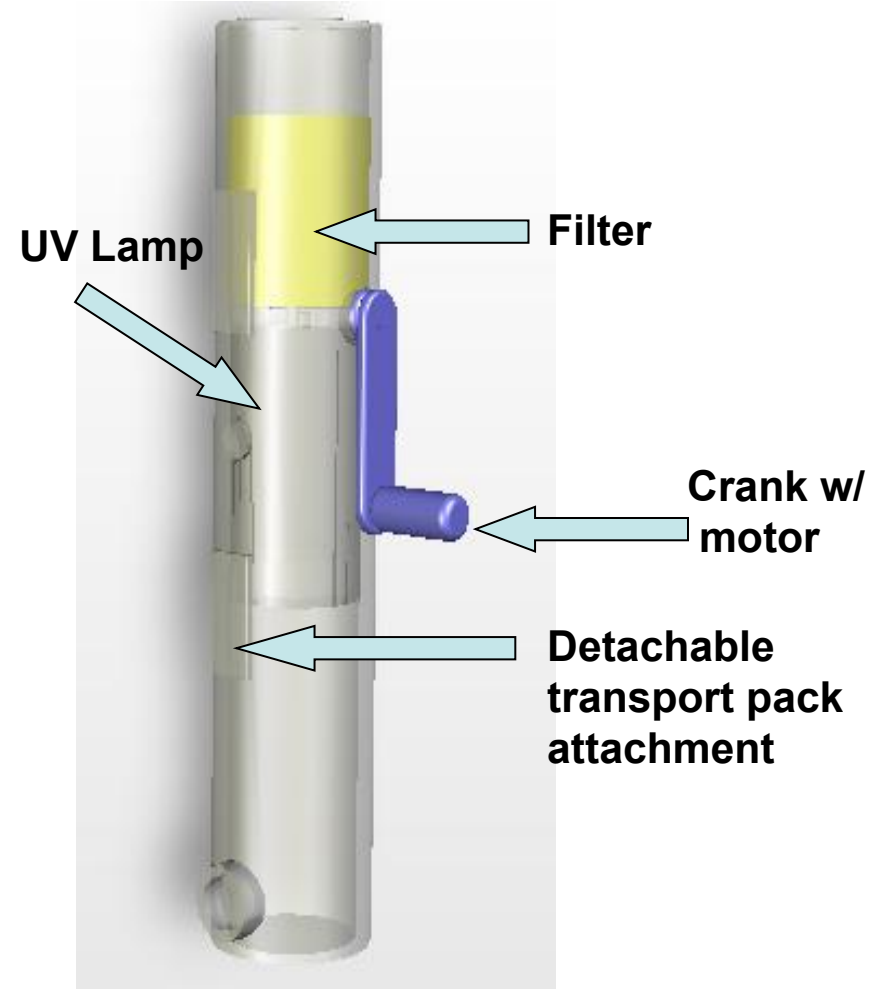
day



www.nickbuxton.info/

Hand powered UV lamp eliminates need for boiling water

- Filter cleans most sediment and chemicals from water
 - Still deciding on filter type (demo)
- Hand crank powers UV lamp to kill viruses and bacteria
 - Need to have $16,000 \mu\text{ws}/\text{cm}^2$
 - Degrades DNA in virus and bacteria
- Valve restricts water flow unless UV light is powered
 - Required to ensure all water is UV exposed
 - Solenoid (demo)



30 watts from UV light

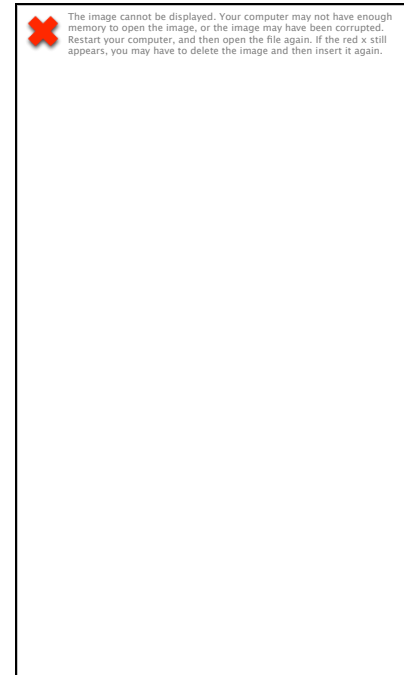
UV effectiveness depends on light intensity and exposure time

Power intensity at R $I_p(r) = \frac{W}{2\pi RL}$

Time water flows by light $t = \frac{L}{v}$

$$I(r) = I_p(r) * t = \frac{W}{2\pi RL} \cdot \frac{L\rho\pi R^2}{\dot{m}} = \frac{WR\rho}{2\dot{m}}$$

Calculations:



Conclusion:

$$I(r) = \left(\frac{1.00 \times 10^{-2} \text{ W}}{7.00 \times 10^{-5} \text{ s}} \right) = 14,300 \frac{\text{W}}{\text{s}} \text{ cm}^2$$

$$\text{---}(r) = 20,300 \mu\text{W} \cdot \text{s/cm}^2$$

Moving forward we need to focus on safety, design, and solidifying a contact

Safety

- **Project will require independent water testing**
 - **Kits and laboratories available**

Design

- **Optimal cranking and water storage design**

Contact

- **D-lab may be available to work with**
- **Contact: Susan Murcott**
 - **Working with MIT environmental engineering masters students**
 - **Would focus the project on Ghana**

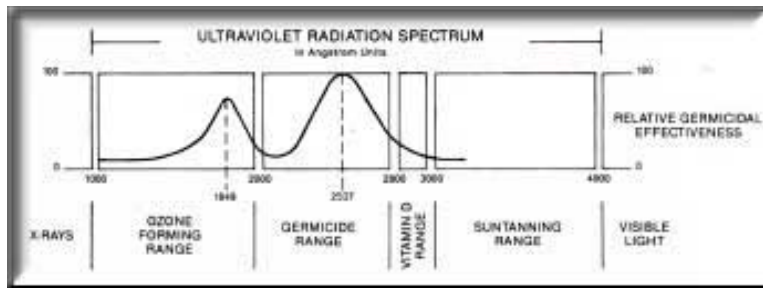
Conclusion

- Aquatron is feasible, low cost and is greatly needed in the third world countries.
- The feature of hand-crank powered energy eliminate the need for other sources of energy for the third world countries.
- The use of UV light to purify water is energy friendly and safe.
- The Aquatron will reduce wood burning and improve quality of life

More information about UV light

UV works by degrading the DNA in viruses and bacteria to prevent reproduction

- Point disinfection
- 16,000 $\mu\text{ws}/\text{cm}^2$ (2)



http://www.aquatechnology.net/Ultraviolet_systems.html

(2) <http://www.dwc-water.com/technologien/uv-technologie/index.html>

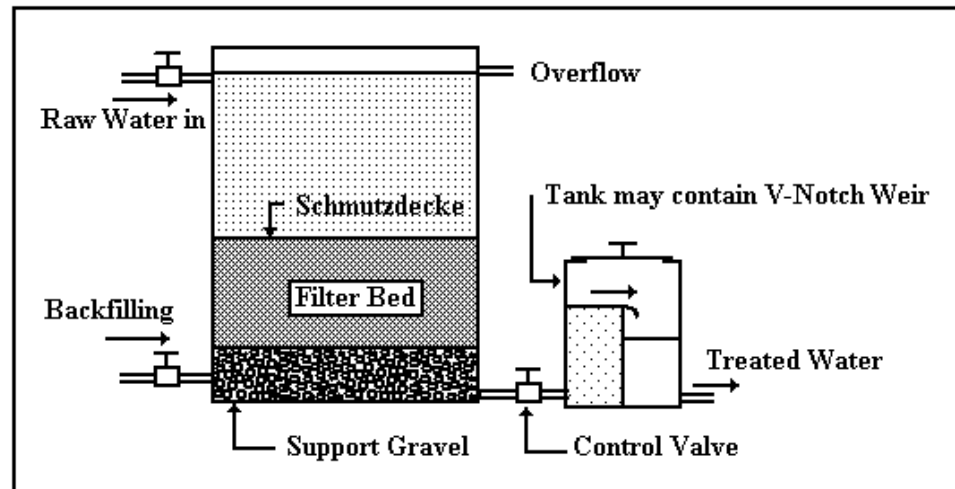
Ultraviolet Dosage Required For 99.9% Destruction of Various Organisms ($\mu\text{W-s}/\text{cm}^2$ at 254 nm)			
Bacteria		Mold Spores	
<i>Bacillus anthracis</i>	8,700	<i>Aspergillus flavus</i>	99,000
<i>B. enteritidis</i>	7,600	<i>Aspergillus glaucus</i>	88,000
<i>B. Megatherium</i> sp. (vegetative)	2,500	<i>Aspergillus niger</i>	330,000
<i>B. Megatherium</i> sp. (spores)	52,000	<i>Mucor racemosus A</i>	35,200
<i>B. paratyphosus</i>	6,100	<i>Mucor racemosus B</i>	35,200
<i>B. subtilis</i> (vegetative)	11,000	<i>Oospora lactis</i>	11,000
<i>B. subtilis</i> (spores)	58,000	<i>Penicillium digitatum</i>	88,000
<i>Clostridium tetani</i>	22,000	<i>Penicillium expansum</i>	22,000
<i>Corynebacterium diphtheria</i>	6,500	<i>Penicillium roqueforti</i>	26,400
<i>Eberthella typhosa</i>	4,100	<i>Rhizopus nigricans</i>	220,000
<i>Escherichia coli</i>	7,000		
<i>Leptospira interrogans</i>	6,000		
<i>Micrococcus candidus</i>	12,300		
<i>Micrococcus sphaeroides</i>	15,400		
<i>Mycobacterium tuberculosis</i>	10,000		
<i>Neisseria catarrhalis</i>	8,500		
<i>Phytomonas tumefaciens</i>	8,500		
<i>Proteus vulgaris</i>	6,600		
<i>Pseudomonas aeruginosa</i>	10,500		
<i>Pseudomonas fluorescens</i>	6,600		
<i>Salmonella enteritidis</i>	7,600		
<i>Salmonella paratyphi</i>	6,100		
<i>Salmonella typhimurium</i>	15,200		
<i>Salmonella typhosa</i> (Typhoid)	6,000		
<i>Sarcina lutea</i>	26,400		
<i>Serratia marcescens</i>	6,200		
<i>Shigella dysenteriae</i> (Dysentery)	4,200		
<i>Shigella paradysenteriae</i>	3,400		
<i>Spirillum rubrum</i>	6,160		
<i>Staphylococcus albus</i>	5,720		
<i>Staphylococcus aureus</i>	6,600		
<i>Streptococcus hemolyticus</i>	5,500		
<i>Streptococcus lactis</i>	8,800		
<i>Streptococcus viridans</i>	3,800		
<i>Vibrio cholerae</i>	6,500		
		Algae / Protozoa	
		<i>Chlorella vulgaris</i> (algae)	22,000
		Nematode eggs	92,000
		Paramecium	200,000
		Virus	
		Bacteriophage (<i>E. coli</i>)	6,600
		Hepatitis virus	8,000
		Influenza virus	6,600
		Polio virus	6,000
		Rotavirus	24,000
		Tobacco mosaic	440,000
		Yeast	
		Baker's yeast	8,800
		Brewer's yeast	6,600
		Common yeast cake	13,200
		<i>Saccharomyces cerevisiae</i>	13,200
		<i>Saccharomyces ellipsoideus</i>	13,200
		<i>Saccharomyces</i> sp.	17,600

Figure 2. Dosage Requirements to destroy various common microorganisms.

More information about slow sand filtration

Slow sand filtration may be a viable way for the aquatron to filter water

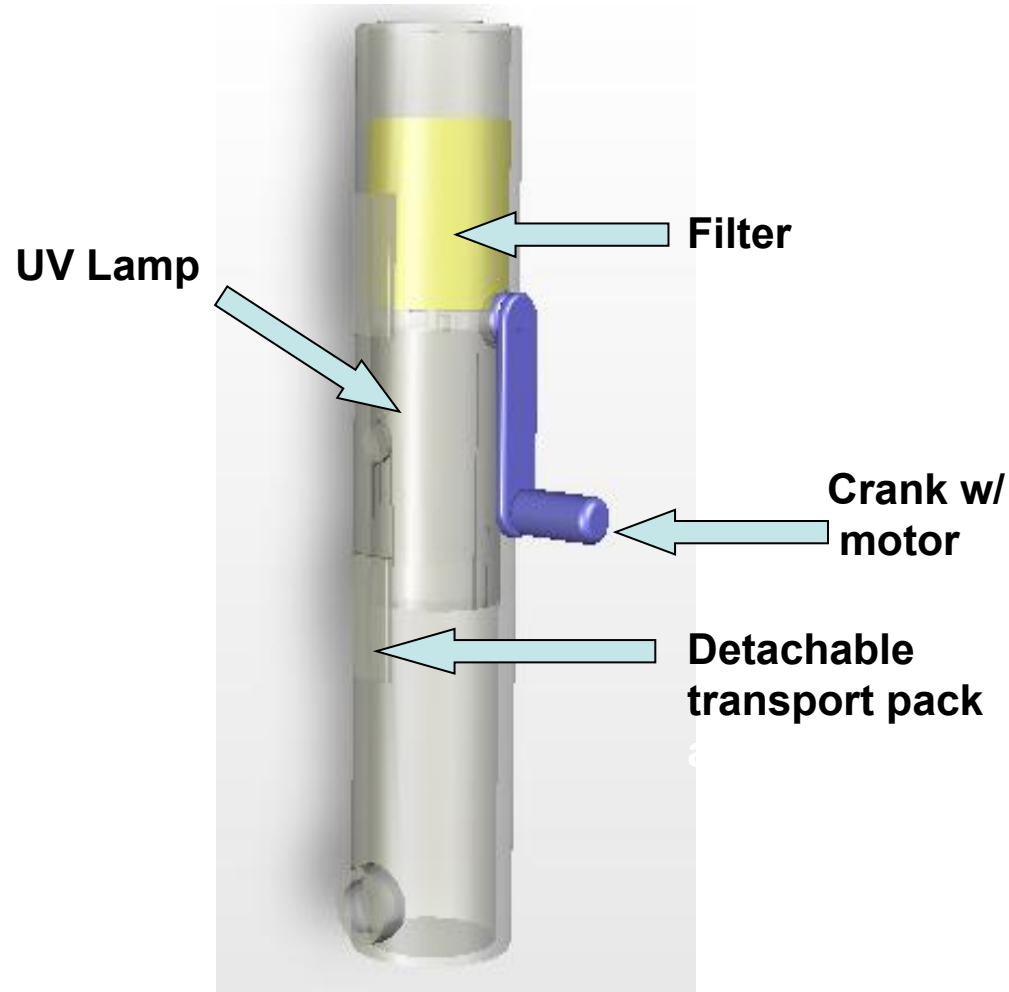
- Carbon water filter requires large pressure difference
 - Gravity fed usually are hung to gain potential energy
- Slow sand filtration
 - Simple and effective⁽¹⁾



The Aquatron uses mechanical power to

The Aquatron uses mechanical power to

- Purifies water
 - Purifies water
 - UV light
 - UV light
- Durable
- Durable
 - Replaceable parts
- UV light easily
 - Eliminate wood burning
- Mechanical power
- Movable



conscious then other devices

Other Devices

Aquatron

- Uses only filtering

used