Bamboo Bio Char

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Outline

I. Intro
   a. Water contamination has always been a concern world-wide.
   b. Thesis—In order to develop a water system, it is important to know the countries most affected by water contamination, the routes that have unsuccessfully been taken in reducing water pollution, and to find new, self-sustaining water purification system.

II. Body
   a. Continents most affected by water contamination
      i. Asia—Sri Lanka
      ii. Africa
   b. Water-borne diseases
      i. Diarrhea
      ii. Cholera
      iii. Malaria
   c. Various purification options
      i. Chlorine
      ii. Sanitation
   d. Bio char through bamboo
      i. Previous research done
      ii. Benefits of bamboo
         1. Various types
         2. Stability
         3. Various uses
      iii. Simplicity of bio char ovens
         1. What a bio char oven does
         2. How to make a bio char oven

III. Conclusion--Out of all the possible contributions to the water purifying project, bamboo bio char is the most inexpensive, self-sufficient solution. Teaching the citizens of third world countries, such as those in Asia and Africa, to create their own water purifying system will save money, time, and countless lives.

Water contamination has always been a concern world-wide, especially after World War II. After World War II, nations across the world suffered a wide variety of environmental pollution, the worst of it concerning water ("Pollution, Water," n.d.). Since then, governments, communities, and organizations have worked to revolutionize water purification. Sadly, water constitutes 1.4 billion km^3 of the earth's volume, but still only 200,000 km^{31} of it is drinkable; this is less than 1% of all fresh water in the world ("Freshwater: Facts for All," 2012). With over 3 million people dying each year from contaminated water—1,000 of those deaths in the United States alone—it is imperative that a reliable water purification route is quickly found and established in the affected countries ("Water Pollution and Contamination," 2012; Hoyle, 2008). In order to develop a water system, it is important to know the countries most affected by water contamination, the routes that have unsuccessfully been taken in reducing water pollution, and to find new, self-sustaining water purification system, such as the bamboo char method.

Water contamination affects every nation in the world (including America), but it is most devastating to developing nation, especially those in Africa and Asia ("Freshwater," 2012). In 2011, water pollution led to the deaths of almost 2000 children due to a water lead content of more than 10 times the amount allotted by the World Health Organization (Tietvorst, 2011). In Sri Lanka, water contamination caused 30,000 people, from school children to seniors, to be infected with various water-borne diseases ("Cleaning up Sri Lanka's Water," 2012). In both Africa and South Asia, most of the deaths and malnutrition problems are caused by diseases contracted from contaminated water sources ("Water Pollution," 2012). In Lebanon, almost 70% of urban water sources are contaminated, and this rate is even higher in rural areas

(Massoud, Al-Abbady, Jurdi, & Nuwayhid, 2010). There are many other countries within these continents that are affected; the disease-ridden, deadly results are the same.

The most common ailment associated with water contamination is diarrhea, which causes about 2.2 million deaths annually; of these 2.2 million deaths, 15% are children under the age of five (Massoud, et al., 2010). This illness is commonly associated with diseases such as amebiasis and giardiasis. Amebiasis is caused by a parasite found in human waste and is transmitted through the consumption of fecal-contaminated water. Giardiasis, commonly called the "beaver fever," is also caused by an intestinal parasite. Although diarrhea is the most common side effect of these diseases, the effects, if untreated, can eventually spread to the liver, lungs, or brain, resulting in death (Hoyle, 2008). Another well-known ailment associated with water contamination is cholera ("Water Pollution," 2012). Like amebiasis and giardiasis, cholera is also linked to human feces, but causes a higher rate of dehydration and includes vomiting ("Cholera," 2001). Almost 120,000 people die of cholera per year, and most of these deaths occur in developing nations (Ali, Lopez, Young, Young, Sah, & Mastery, 2012). Last, but definitely not least, water pollution is also a main cause of malaria. Although malaria is most commonly associated with mosquitos, mosquito larvae also carry the disease. Since mosquitos breed in water, especially unclean water, malaria can be spread through the consumption of larvae-infected water ("*Water Pollution and Your Health*," 2012). Malaria is the cause of over 1,000,000 deaths per year and is commonly associated with chills and high fevers ("About Malaria," 2012). Besides these three common diseases, water pollution can also cause typhoid, intestinal worms, and trachoma. These diseases and their ensuing death rates are the reasons behind the importance of a successful water purification system.

So far, various purification options have been attempted all around the world. The most common procedure against water contamination involves a disinfectant, such as chlorine ("EPA Drinking Water and Health," 1999). This is a useful resource for countries that can afford the price of chlorine. However, chlorine costs 15 cents per 100 grams of chlorine ("Chlorine Element Facts," 2012). Lake Fundudzi in Africa is 4,926,687 gallons ("Pond Volume Calculator," 2012). In order to have enough chlorine to purify Lake Fundudzi, Africa would have to pay $600 million dollars. In 2001, the average gross income of an African country was only $2 billion (Hanke, 2001), and its income declined in 2011 ("African Economic Outlook," 2012). The expense of chlorine would not be able to be supported by Africa's economy, much less the poor countries of Asia. A second popular option regarding water purification is to teach third-world countries proper sanitation, specifically water sanitation ("EPA Drinking Water," 1999). Doctors Joseph Eisenberg, James Scott, and Travis Porco claim that water-related diseases occur mostly from community exposure to contaminants. In their thesis, "Integrating Disease Control Strategies," they concluded that in order to combat waterborne diseases, countries must implement health-awareness strategies (Eisenberg, Scott, & Proco, 2007). However, countries continue to suffer despite the need for hygiene awareness, mostly because their governments feel there are more pressing issues than water purification (Massoud, et al., 2010). The two most popular routes towards water purification are not functioning as fast or effectively as the effects of polluted water.

A well-known proverb (attributed to Lao Tzu) states, "Give a man a fish, and you feed him for a day; show him how to catch a fish, and you feed him for a lifetime" (qtd. in Hayworth, 2007). This saying obviously refers to the fact that if a man learns how to do something on his

own, it will sustain him for as long as he lives. This is the approach we should use towards water purification. A recent study on bio char, done by Josh Kerns, a student at the University of Colorado, was geared toward helping people solve their problems themselves. Using common products, such as paint buckets and tin cans, Kerns produced his own energy-efficient stoves that are capable of producing bio char. According to Kerns, this is a 4,000-year-old technique and can be created using bamboo or corncobs (Anas, 2012). This system could be effectively developed in suffering countries where people could learn to use bio char as a purification resource that can be inexpensively successful for generations.

Bio char is created when biomass is burned in a limited oxygen and low heat environment, which turns the biomass into bonds of charcoal. The charcoal created in fine-grained and organically carbon enriched (Yarrow, 2008). Bio char is very different from the charcoal found at the bottom of a fire pit; bio char has anywhere from little to no toxins left (Picard, 2010). Some of the main functions of bio char are reducing phosphorous runoff and nitrogen-leaching in water; it also reduces the large, harmful amounts of iron in water (Yarrow, 2008). A recent study done by Gauhati University in Assam tested the effectiveness of bamboo bio char in reducing the iron contaminants in water. The result showed that four types of bamboo successfully reduced the iron content of water, the most effective bamboo being Bhaluka bamboo (Baruah, Medhi, & Misra, 2012). Besides the positive results of this experiment, the effectiveness of bio char is theorized to last up to 100s or 1000s of years, a prospect that far surpasses other productions of water purification (http://www.biochar-us.org).

Creating bio char from bamboo, which has proven successful at the University of Colorado, is an ideal route towards water purification because it is available to all countries, it has more than one use, and it is a resource that the people of suffering countries can learn to cultivate on their own. The countries of Asia and Africa have differing climates that can range from wintery cold to uncomfortably humid to extremely arid and hot ("Climate," 2005). Bamboo is a perfect resource for these two continents because there are over 1200 different varieties of bamboo with at least one that is ideal for one or more of these climates. Stone bamboo, Congesta bamboo, Bissetti bamboo, and Red Margin bamboo are all bamboos that are ideal for a cold climate. The Bissetti bamboo can even grow up to 30 feet high with minimum sunlight. Warmer climate zones are ideal for Slender Crookstem bamboo and Giant Japenese Timber bamboo, both of which can grow up to 70 feet. Bamboos such as the Houzeau or Pigskin are ideal for mild climates (Lewis, 2002). These are only a few of the bamboos that can grow in the climate ranges of these two continents, and they are hardy enough to grow fast.

Bamboo is an efficient, immediate answer to water pollution because it grows fast, it is hardy, and it has multiple uses. Bamboo can grow up to 2 inches per day, which means in two weeks, it would be almost 2 ½ feet tall. At this rate, people could start using a minimal amount of the bamboo to purify small amounts of water needed for cooking, cleaning, and drinking. Bamboo also can withstand the erratic weather of Asia and Africa; it is powerful enough to survive 52,000 pound per square inch. The fast-growing, hardy element of bamboo makes it not only useful for producing bio char, but it also can be used to provide housing, boats, food, and other necessities to the countries in need. In fact, one of the only downfalls to using bamboo is

that it might eventually become an unstoppable nuisance, which to a third world country, would not seem annoying (Cusack, 2011).

The reality that bamboo bio char is an ideal solution to water pollution would only be effective if people were able to easily and inexpensively make the stoves needed to produce bio char. As seen from Kern's experiment, this type of oven can easily be made using paint buckets or tin cans (Anas, 2012). The construction of a bio char stove is actually very simple. For example, if someone had a paint can and a small tin can, all s/he would need is a sharp, preferably pointy, utensil and bamboo. The paint bucket would be empty of all the paint, and the lid would be replaced on top of the can. A series of holes, which depend on the size of the can, would be placed at even integrals on the bottom of the paint can; then the paint can would be placed slightly, but stably, off the ground to allow minimal irrigation. Next, a small hole would be cut in the lid of the paint can that is small enough for the tin can to cover. Once the hole in the lid of the paint can is cut, then the bottom would be cut out of the tin as well, making it like a piece of pipe. The tin can would be placed on top of the hole and stabilized. At this point, the bamboo would be put inside of the paint can and the contraption placed in the sun until it breaks down into carbon charcoal ("The UBI Concept," 2012). (See Figures 1.1 and 1.2 on the next page for more clarity.) Metal cans are available in every country in overabundance and could easily be employed for production instead of pollution.

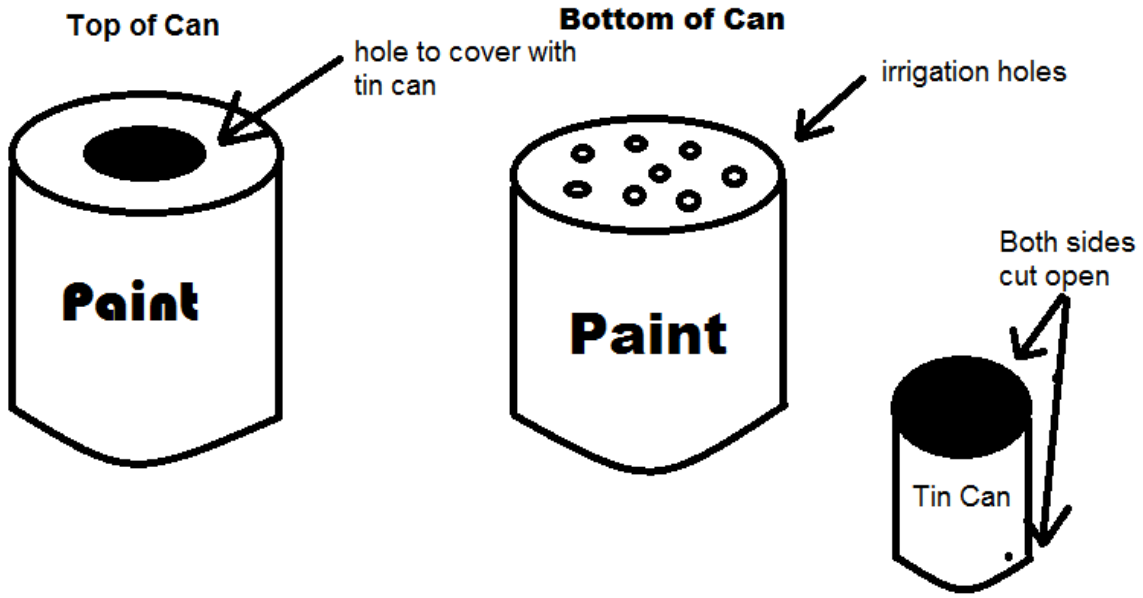

Figure 1.1 showing the parts of a bamboo char stove.

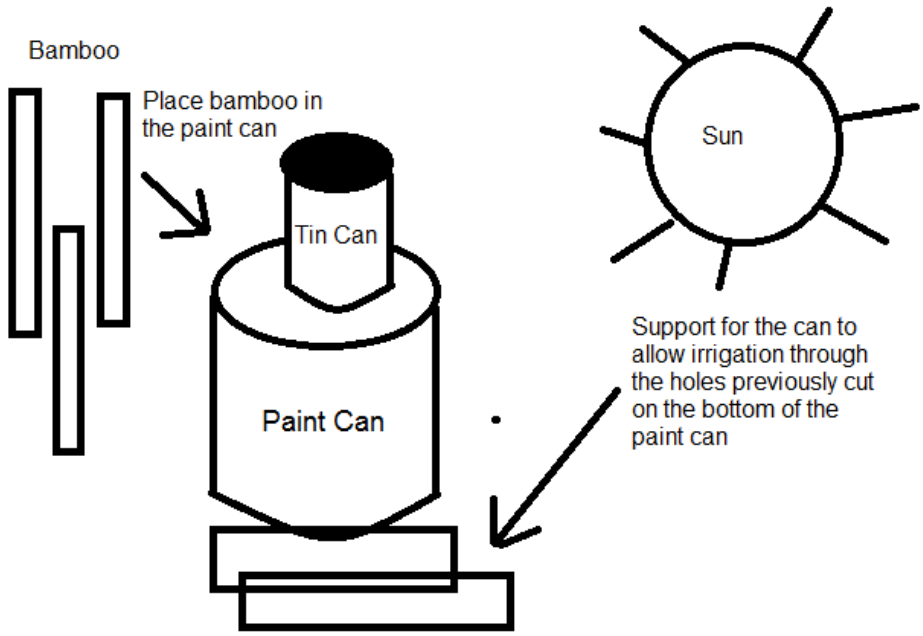

Figure 1.2 showing how to assemble the simple bamboo char stoves.

Out of all the possible contributions to the water purifying project, bamboo bio char is the most inexpensive, self-sufficient solution. Bamboo is inexpensive, fast-growing, capable of surviving in a wide range of temperatures, and strong. Bio char ovens are easy to make, and they are constructed of simple elements, such as tin and metal, which might normally become pollutants themselves. Teaching the citizens of developing nations, such as those in Asia and Africa, to create their own water purifying systems will save money, time, and countless lives. Also, it will create a whole new field of money-making production for the nations. Josh Kerns was definitely on the right track when he announced that bamboo bio char could improve millions of people's health while focusing on "simple, sustainable technologies" (Anas, 2012). It is vital to introduce bamboo bio char-making strategies immediately to the third-world countries that desperately need it, while furthering the research surrounding it, in order to provide a more informative and successful production of this inexpensive water-pollutant solution.

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