Sanitation Technology for a Safe Environment in Floating Communities in Tonle Sap Lake, Cambodia

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Introduction

Families in floating communities on Tonle Sap Lake face serious health risks because of a lack of appropriate sanitation systems. Children are especially vulnerable (Brown 2013). Although drinking water is usually treated, water for washing vegetables and dishes is taken directly from the lake. As floating houses tend to be small, the lake is also the playground for children (Fig.1). WW! has designed and tested the HandyPod, a natural wastewater treatment system for floating houses which is one of the first technological solutions developed to effectively treating a household's latrine waste.

Figure 1. Children spend hours playing in contaminated water

The HandyPod

- The HandyPod is a simple structure, consisting of 1) a primary anaerobic digester and 2) an open floating Pod with water hyacinth, a plant with well-established water treatment capacity (Wouter 2003).
- The hyacinth Pod floats with the aid of empty water bottles stitched into the edge of the liner
- Small perforations in the liner allow for very slow, passive exchange of Pod content with ambient water.

Figure 2. The HandyPod contains and treats household wastewater to a level safe for recreational use.

Objective

1) Test a new design of flexible, sealed anaerobic digester, including optimizing size
2) Monitor water quality in two villages over time
3) Collect user feedback on HandyPods

Materials and Methods

Controlled study

- Anaerobic Pods of different volumes were inoculated with raw pig waste for a week before sampling.
- *E. coli* numbers were measured in the Pod every two days. Chromogenic RAPID'E. coli 2 Agar from Bio-Rad was used to perform plate counts of *E. coli*

Water quality monitoring

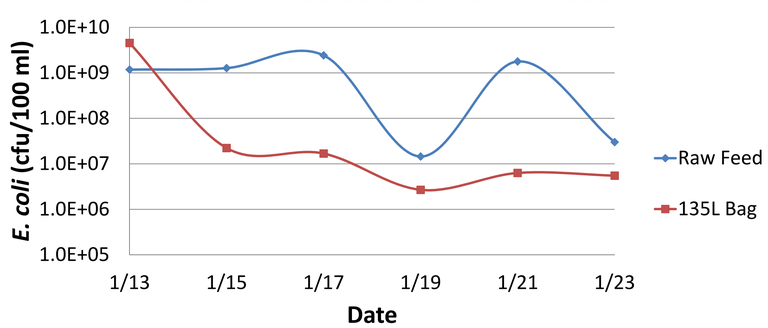
- *E. coli* monitored inside and outside of two floating villages over one year and on-going, using the same method as above

User testing of HandyPods

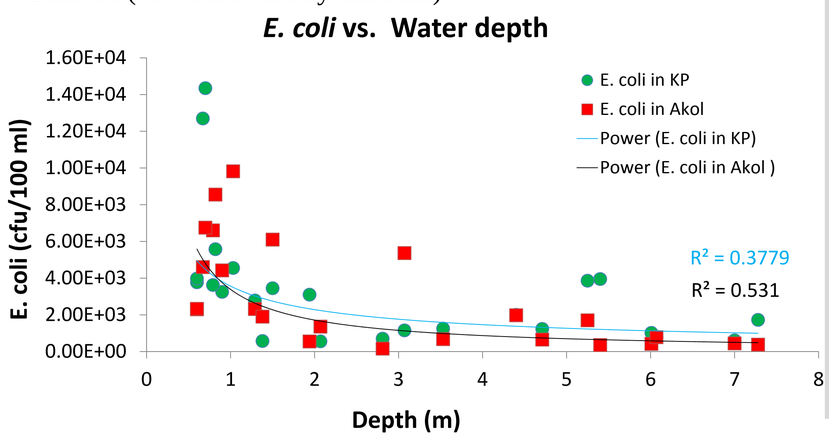
- Floating village households had HandyPods installed, and were surveyed after a year of use

Results

- 135 L was the smallest volume required for the anaerobic digestor to effectively reduce *E. coli*. **Further treatment in the floating Pod reduced *E. coli* an additional 3 log order, to below 1.0E+04**.



- Higher levels of *E. coli* were detected inside two villages during dry season. The ambient water was highly contaminated at depths under 2 meters (between February and June).



- User feedback was collected over the course of product testing as well as in a final survey. The following key insights emerged:
    1. Users were interested in the product as well as upgrades on the basic design
    2. By eliminating floating solid waste around houses, the HandyPod provides the immediate benefit of a more aesthetically pleasing environment
    3. An effective anaerobic digestor eliminates any concerns over smell
    4. The HandPod provides convenience to families, eliminating the need for long boat journeys out of the village in search of a private place to defecate

Conclusions

- An appropriate sanitation system has been developed for floating communities, adaptable to flood-prone communities including those impacted by climate change
- HandyPod treatment consistently reduces fecal coliform by 5 log order (which is equivalent to 99.999 % removal).
- A behavior survey in our demonstration village indicates significant desire for HandyPods.
- Village-wide use of Pods is expected to lead to fewer diarrheal events, thus improving child development.
- A variation of the HandyPod design may be a viable sanitation solution not only in waterborne, but also seasonally flooded communities.
- A sanitation marketing program is the next step needed to create the public and private demand for sanitation, as well as the supply of the treatment systems made and sold by local entrepreneurs.

Literature cited

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