Continual Flow Heat Treatment System for Container-based Toilets

Kate Bohnert

Jack Jones, Emily Woods

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Traditional Waste Treatment is Expensive

Designed to minimize risk of disposing feces

- Little consideration for reuse or cost recovery
- Traditional waste treatment is expensive
- <5% waste treated before disposal[1]

1. Gakubia, R., Pokorski, U., and Onyango, P. (2010) Upscaling access to sustainable sanitation. Kenya.

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A Service Delivery Model Approach to FSM

Sanivation's Business Model

Sanitation service

Waste treatment and transformation

Charcoal briquettes

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Original cost-effective solar design

A challenge to scale

Properties	Parabolic Design
Scalable	-
Replicable	+
Cost-effective	++

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How to treat more waste?

Designing a system to alleviate disposal of untreated waste

- Design pilot system to treat waste for 500 pp/day

- Replicate system in Kakuma Refugee Camp

- Determine cost-effectiveness

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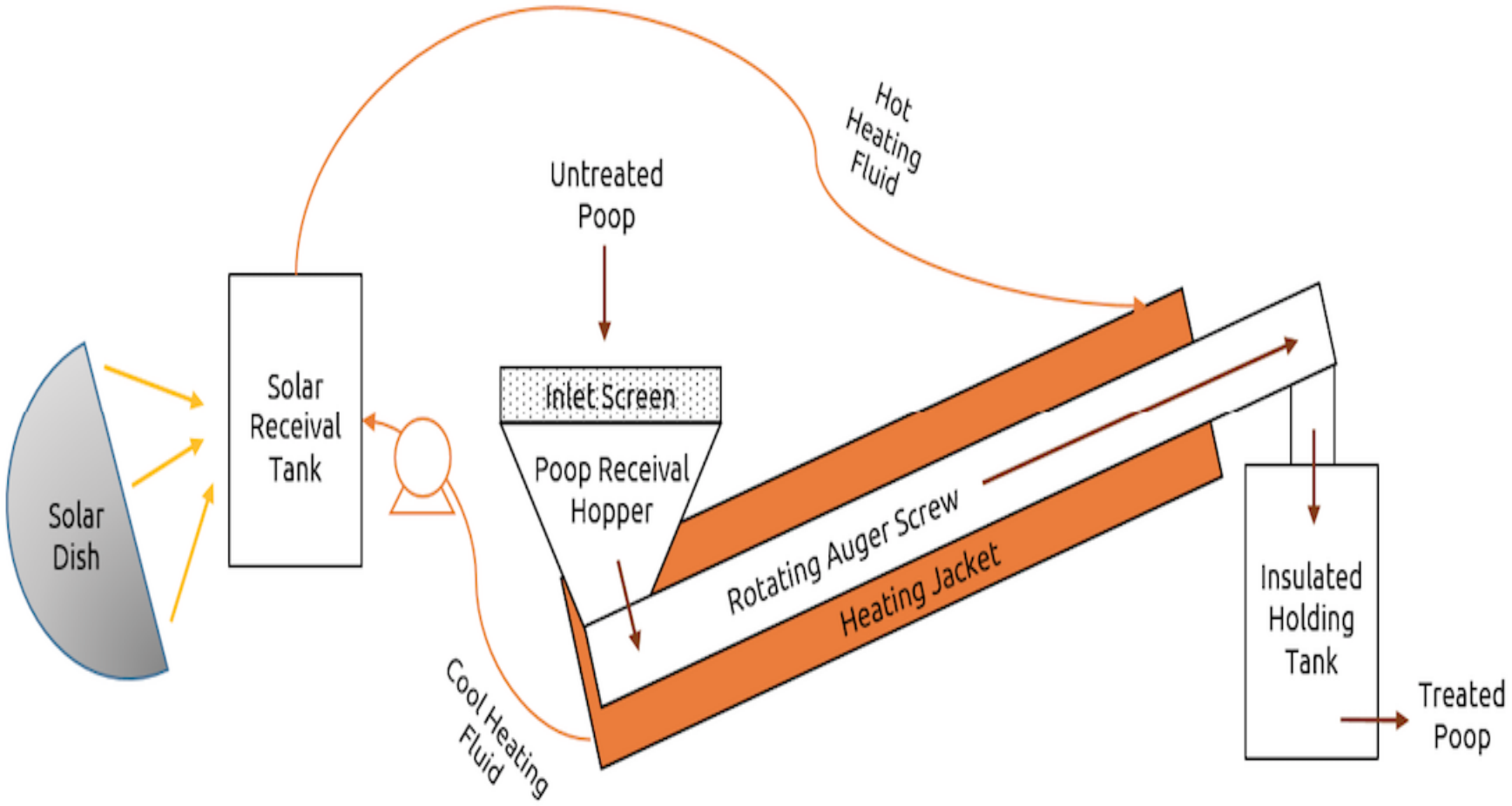
Schematic of Continual Flow Heat Exchanger

An approach to a scalable system



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Continual Flow Heat Exchanger in Naivasha

An approach to a scalable system

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Containerized Continual Flow Heat Exchanger

An approach to a replicable system

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Less than $0.25 per person for treatment

An approach to a cost-effective system

	Old system	New Naivasha system	Kakuma system	Traditional WWTP
CapEx	$0.60[2]	$39	$18	$~8[3]
OpEx	$0.10[2]	$0.25	$0.25	$7[3]
Lifespan	2-3 years	5 years	5-10 years	30 years

2. Foote, A. et al. Rendering fecal waste safe for reuse via a cost-effective solar concentrator. *J Wash Dev*. 2017.

3. Dodane, P.H et al. Capital and operating costs of full-scale fecal sludge management and wastewater treatment systems in Dakar, Senegal. *Environ. Sci. Technol*. 2012.

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Where Do We Go From Here?

Next steps and recommendations

- Ongoing testing of microeffectiveness with CDC
- OpEx costs to be refined in the next few months
- Modifying system to take in alternative waste streams

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The Power of Reuse Potential

Take-away message

- Waste treatment can be more cost and energy efficient when designed for reuse rather than disposal

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Kate Bohnert
kate@sanivation.com

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