SERQET™ TECHNOLOGY FOR GLOBAL HUMAN HEALTH

Joe Schneider, President & CEO

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Introduction to SERQET Technology

Applications for Fecal Sludge Management

Applications for Feminine Hygiene

Applications for Drinking Water Purification

Current Products and Validation Testing
WHAT IS SERQET™ TECHNOLOGY?

- SERQET™ is a light activated, antimicrobial technology
  - Kills viruses and bacteria within 15 minutes

- Serqet TM technology has 3 components of photodynamic inactivation
  - Light
  - Oxygen
  - Photosensitizer

• Effective against most common bacteria and viruses such as:
  - S. aureus
  - MRSA
  - E. coli
  - Influenza B
  - Influenza A

SERQET TM by LAAMScience, Inc.
A light photon is absorbed by the photosensitizer (SERQET™). This promotes an electron to an excited energy state.

1. Activation

2. Production

- Oxygen interacts with the excited state electron forming a reactive oxygen species, $^1\text{O}_2$ (singlet oxygen).

3. Termination

- $^1\text{O}_2$ induces cytotoxicity by damaging lipids and proteins of microbes.
- This damage causes cell death of virus and bacteria (necrosis or apoptosis).

**HOW DOES SERQET™ WORK?**

SERQET™ by LAAMScience, Inc.
Serqet TM technology has 3 components of photodynamic inactivation

- Light
- Oxygen
- Photosensitizer

Kills bacteria and viruses
Current products:
- Protective face masks
- Odor-free kitchen cloths

Our chemistry is permanently bonded to the fabric. It is effective wet or dry, compared to other products, which are using silver, copper, zinc, bleach, alcohol etc., and need moisture present, to work.

Under development:
- Multi-use fecal collection bags
- Reusable self-decontaminating menstrual napkin
- Water filtration to remove cholera for safe drinking water
Some of the pressing needs for human waste decontamination in the environment:

- Fecal Waste removal and decontamination
- Feminine sanitary napkin availability and disposal
- Removal of Cholera, and typhoid from drinking water
Integration of the SERQET technology into fecal sludge management – feces collection bag
Samples of bags are available-handout

- Cost effective
  - Cost is offset by cost of emptying Pit’s

- Bags can and should be made locally, by independently owned Businesses. Treated high strength Nonwoven is supplied by Laam.

- Bag separates Liquid from Solids, and can be used multiple times, up to about 5 lbs.

- Solids can dried and used for fuel. Liquid can be collected separately

SERQET TM by LAAMScience, Inc.
- Take a bag
- When bag is full
- About 5 lbs
- Hang it outside to dry – Voila.
Integration of the LAAM technology into sanitary pad

Working with women’s groups in Nairobi for further development of style and fitting.

REUSABLE SELF-DECONTAMINATING MENSTRUAL NAPKIN
LAAMScience will provide fabric material to small local, and independently owned businesses at a very low cost (initially by donation)

Small local businesses will sew fabrics to make bags and sell them

Provides new revenue stream, jobs, and most important improves health

The price of multiple usable bags will be equivalent to, or less than the price to pay someone to empty out latrines, or build new ones.
• LAAMScience is developing a reusable, antimicrobial menstrual napkin for women in developing countries.
- Mathare and Kabiria slums in Nairobi, Kenya
- The organization in Kenya worked with women age 15-41 to solicit feedback on Serqet’s washable anti-microbial sanitary pad.
- 40 women tested the product and completed a questionnaire, limited due to literacy as well as availability of Translators.
- Pending is still a survey with High school students (80 -100), those studies will be available in 4 – 6 weeks.
RIGHT 2 THRIVE FOCUS GROUP
Economic:
- 90% questioned “would like disposable napkins”, however cannot afford it. (cost est. US $ 5-6/Period) verses US $.70 -.90/ period, assuming our reusable Pads which are usable for 3 periods, - made in Kenya using treated LAAM- material.
- Local Income is reported less than $5/week. “A large percentage of the girls/women reported having sex for money in order to buy sanitary napkins”

Design:
- Only 15% felt comfortable drying the washed napkins outside. (cultural/private issue). We offered a design which is not at all obvious, that it is a napkin, looks like a towel.
- We had supplied pads with straps, but all reported they do have at-least 1 pair of underwear. Other report: Majority of High school girls, do not have underwear. All reported, they would never wear a pad with straps.
- Half reported, they do not want to touch their own blood.

Longevity:
- All ask to make the Pad last longer than the disposable: 2-3hours, would like 8 hours. The samples we supplied had a average holding capacity of 6 hours, based on flow info available in literature.
- All do not want to carry a used pad in their bag all day
DEVELOPMENT GOALS

- Last up to 8 hours - absorbency = development Task
- Not being obvious looking as a feminine pad
- Easily changeable
Treated nylon is the outer layer of the SERQET™ N95 respirators and flat masks. Nylon fabric was treated with SERQET™ technology and exposed to light after inoculated with virus or bacteria.

- Achieved >99.9% reduction against pertinent respiratory pathogens.
WHAT THE NUMBERS MEAN

- **1-log = 10 fold reduction (90%)**
- **4-log = 10,000 fold reduction (99.99%)**

For instance, 4-log killing is taking 100,000 organisms (harmful amount) to 10 (not harmful)
INDEPENDENT TESTING VALIDATED PATHOGEN KILLING SERQET™ TREATED FABRIC FOR RESPIRATOR MASKS

Achieved >99.9% reduction against pertinent respiratory pathogens

* Not tested by LAAMScience
SHELF LIFE IS 5 MONTHS OR MORE (STABILITY OF MASK FABRIC)

- Treated fabric is stable in packaging for >3 years after production (dark storage)
- Microbial efficacy is maintained during storage
- Achieve >99.9% efficacy in 15 minutes against most viruses and bacteria
SERQET™ ANTIBACTERIAL KITCHEN WIPES REDUCE SALMONELLA GROWTH

• Fabric samples were inoculated with *Salmonella* and 10% milk and placed in light (500 lux) or dark conditions for up to 10 days.

• After Day 3, *Salmonella* was present >10⁸ cells/ml on untreated fabric and <10² cells/ml on treated fabric (6 log difference).
- Treated with LAAM Technology
  Light Activated Anti-Microbial
- Washable
- Reusable for 3 months
- Semi-Disposable
- 100% Biodegradable
- 100% Renewable fibers
- Environmentally friendly

**Graph:**

- **Strong Odor**
- **Odor Free**

**Legend:**
- Serqet (Room light)
- Untreated cloth

**Axes:**
- **Number of Days at Room Temperature**
- **Bacterial density**

**Limits:**
- Limit of detection

**Data Points:**
- 0, 2, 4, 6, 8, 10
- Bacterial density: 0, 1, 2, 3, 4, 5, 6, 7
ROSE BENGAL PROVIDES 3.6 LOG REDUCTION IN CANDIDA ALBICANS (YEAST) IN ONE HOUR UNDER NORMAL SUNLIGHT CONDITIONS

![Bar graph showing CFU/sample for different treatments: Untreated cotton, Azure A, Methylene Blue, Rose Bengal. The graph indicates a 99.9% reduction in CFU/sample under normal sunlight conditions.](image-url)
In 2010, a cholera outbreak in Haiti resulted in nearly 2000 deaths.
The CDC recognizes that one of the most important methods in preventing transmission of cholera is to drink safe, treated water or bottled water, which is costly.
• Inexpensive system that produces clean drinking water for an average family

• Components:
  1) Filtration system
  2) Decontamination basin

• Decontaminates/Inactivates
  ✓ V. cholerae
  ✓ E. coli
  ✓ typhoid

• Filters (1-4 micron particles)
  ✓ Giardia cysts
  ✓ Cryptosporidium
Step 1: Pour in contaminated water

Step 2: When water level is reached, filtered water will flow into the decontamination basin.

Step 3: Expose the fabric and water to sunlight for 30 minutes, killing harmful pathogens.

Step 4: Open valve and dispense water into a clean cup.

*Filters particle sizes 1-4 microns
Includes Giardia, Cryptosporidium
SERQET™ WATER FILTERS

☀ Filtration rate: 5 gallons in 4 hours filtration time in daylight

☀ Kills 1 millions cholera bacteria

☀ A SERQET treated filter maintained 89% efficacy after filtering 250 gallons of contaminated water.

☀ Extensive testing is required to collect more data to design filter area and capacity.

☀ TEST unit:
   
a pilot apparatus was designed and build to conduct long term testing.
- Other SERQET™ applications
  - Treated hospital gowns
  - Floor Wax for Antibacterial tiles
  - Odor eliminating PET-bed spray

- SERQET™ applications under development
  - Burn sheets
  - Wound dressings
  - Hospital linens/drapes
  - Latex/nitrile gloves
SUMMARY

LAAMScience strengths:

- Chemistry – SERQET treatment of fabrics
- Textile manufacture
- Commitment to global health
ACKNOWLEDGEMENTS

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