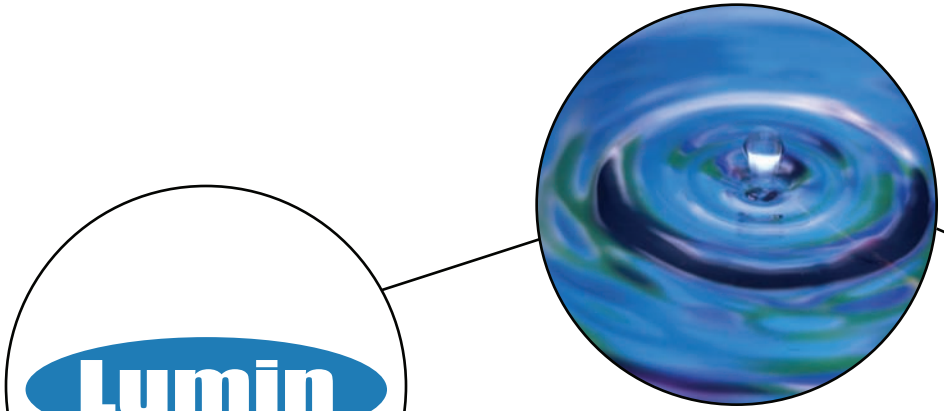


solar water disinfection device

A SOLUTION TO WATER TESTING IN BANGLADESH

TEAM C

colette bazirgan
gavin engel
justine jividen
megan yuen

ACCURACY AND STERILITY:

The device needs to be accurate. Each test needs to be reliable. The device must be able to sterilize the water sample before exposing it to the e coli GMO and needs to be able to keep the water sample sterile throughout the entire process.

COST:

The average household income in Bangladesh is $380 per year. This testing device needs to be manufactured, sold, and transported at the lowest possible cost.

SIMPLICITY AND EASE OF USE:

The person using the device should be able to use this device regardless of their knowledge or literacy. The device and testing process should be as simple and streamlined as possible.

TEAM C
colette bazirgan
gavin engel
justine jividen
megan yuen

CONCERNS AND CHALLENGES

SOLAR WATER DISINFECTION:

While researching various methods of disinfecting water, Team C discovered that ultra violet radiation is commonly used to disinfect water in city systems all over the world using expensive UV equipment. This has inspired a method called SODIS. SODIS skips the expensive equipment and simply uses the UV radiation from the sun to disinfect water inside plastic bottles and bags. SODIS is being used to purify water in 24 countries as an inexpensive and reliable way to provide clean and safe drinking water and prevent disease.

WHY SODIS CAN HELP:

In the existing water testing devices, the filter is the most expensive part. Using UV light to disinfect the water sample will reduce the overall cost of the device. SODIS kills bacteria, viruses, and parasites by using extended doses of ultra-violet radiation. Providing the proper conditions, SODIS takes effect after 6 hours.

WHAT CONDITIONS MUST EXIST FOR SODIS TO BE EFFECTIVE?

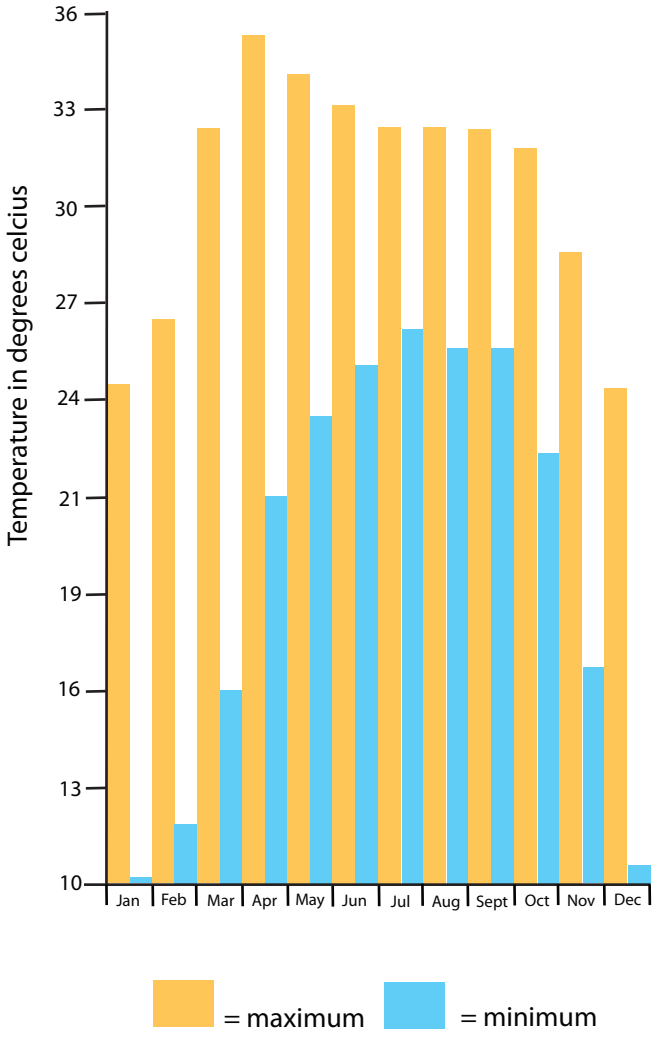
Water turbidity must not be below 30 NTU
Depth of 10 cm or less in order to UV to reach all matter suspended in water
50% clear sky is ideal

HOW EFFECTIVE IS SODIS?

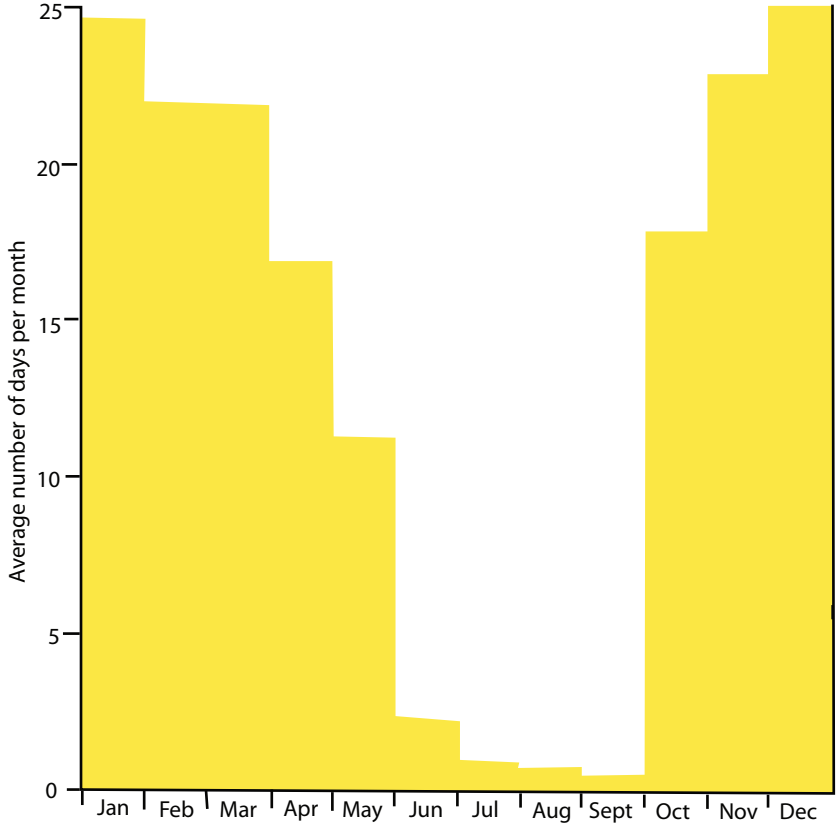
Removes 99.999% of Escherichia coli, Vibrio cholera, Salmonella species, Shigella flexneri, and other bacteria and viruses.
If water heats to over 50 degrees celsius during the process, the process speeds and amoebas are killed.

TEAM C
colette bazirgan
gavin engel
justine jividen
megan yuen

AVERAGE MINIMUM AND MAXIMUM TEMPERTATURES



CLOUD FREE DAYS



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colette bazirgan
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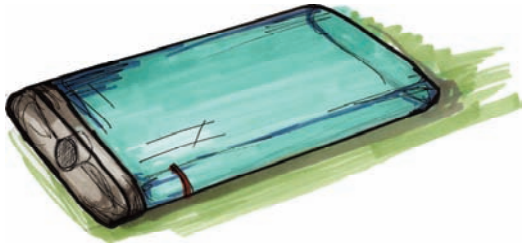
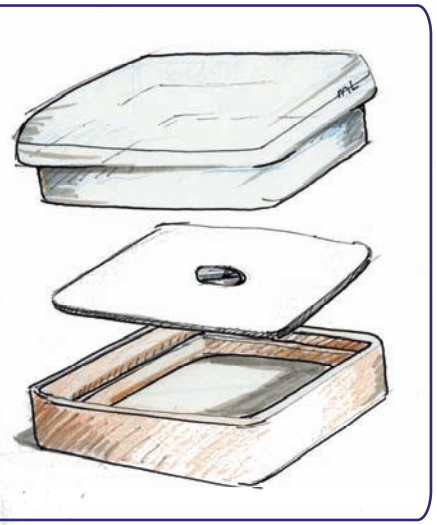
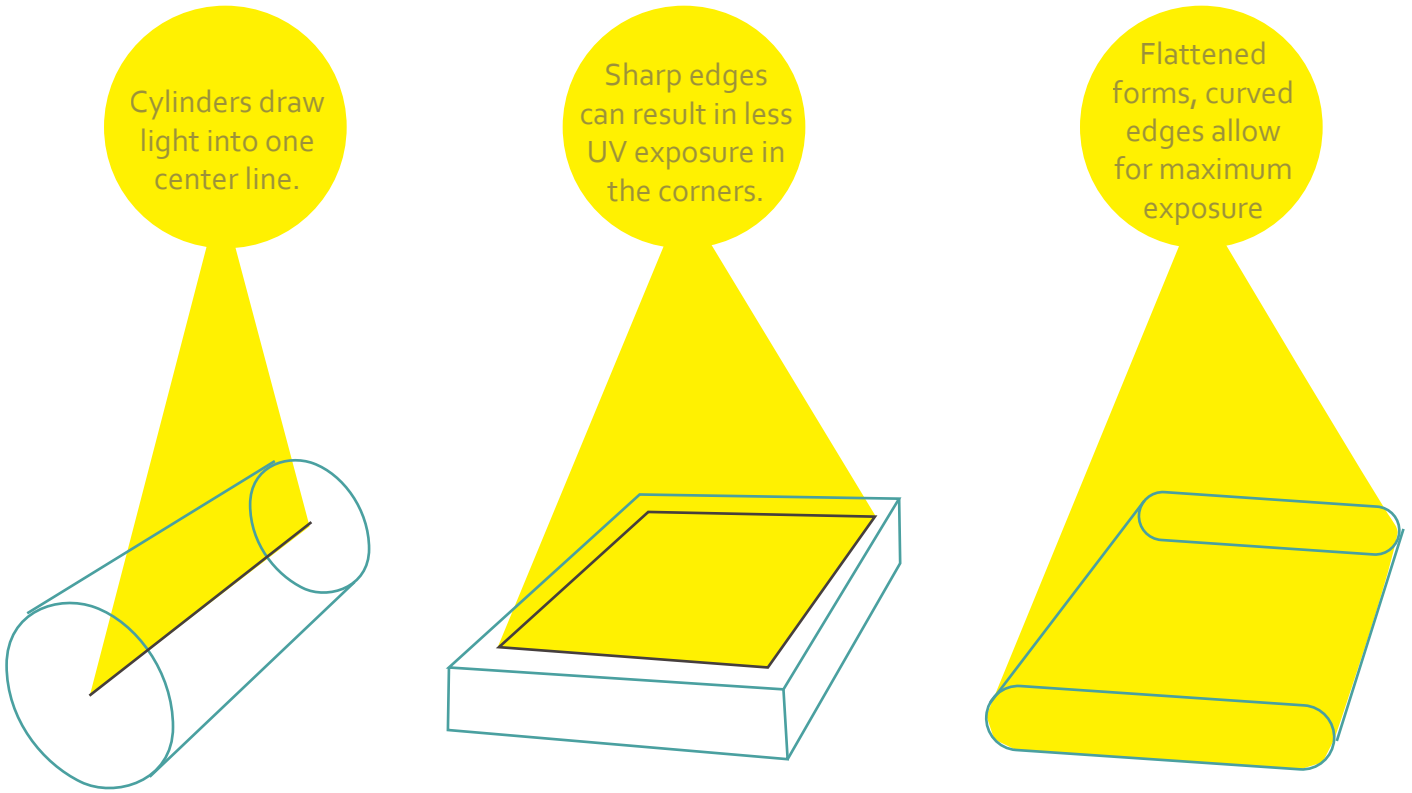
BANGLADESH CLIMATE INFORMATION



Since our design utilizes sunlight and UV as the disinfection mechanism in the testing device, it is crucial that the form of the object allows UV light to enter the device in the most effective way. After studying various forms, we realized rectangular forms with curved edges would allow the most even and consistent UV penetration.





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colette bazirgan
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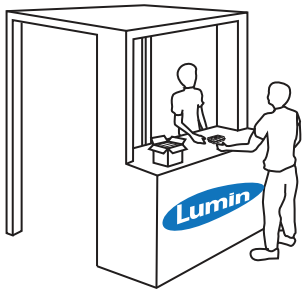
PRODUCT RENDERING

Pre-Reaction

1



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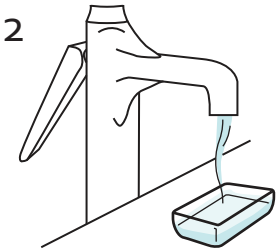

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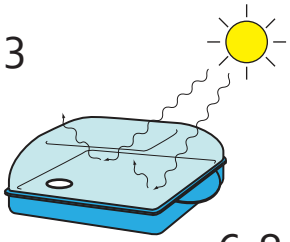
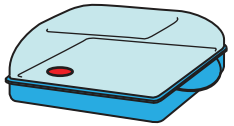


6-8 hrs

4

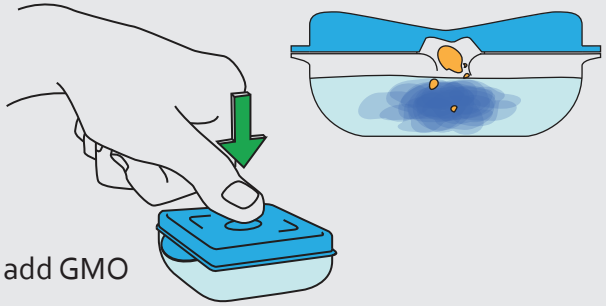


Temperature Indicator

- 42+°C (Not Ready)
- 42-°C (Ready for Activation)

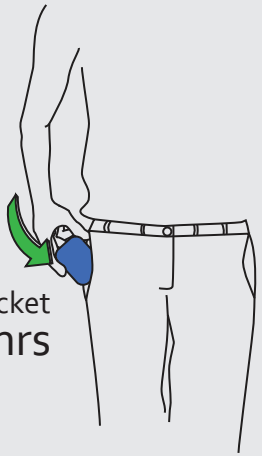
Reaction

5



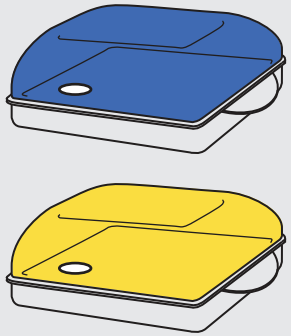
42-°C
Press to add GMO

6



Incubate in Pocket
10-12 hrs

7



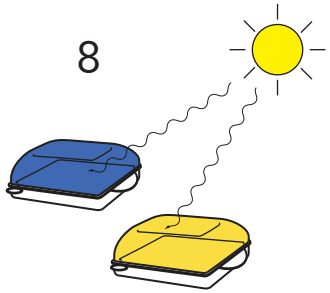
No Arsenic Present

Arsenic Present

Post-Reaction

Re-expose to UV to kill GMO

8



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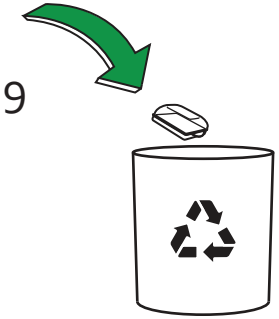


Recycle BioSensor

TEAM C

colette bazirgan
gavin engel
justine jividen
megan yuen

SEQUENCE OF USE

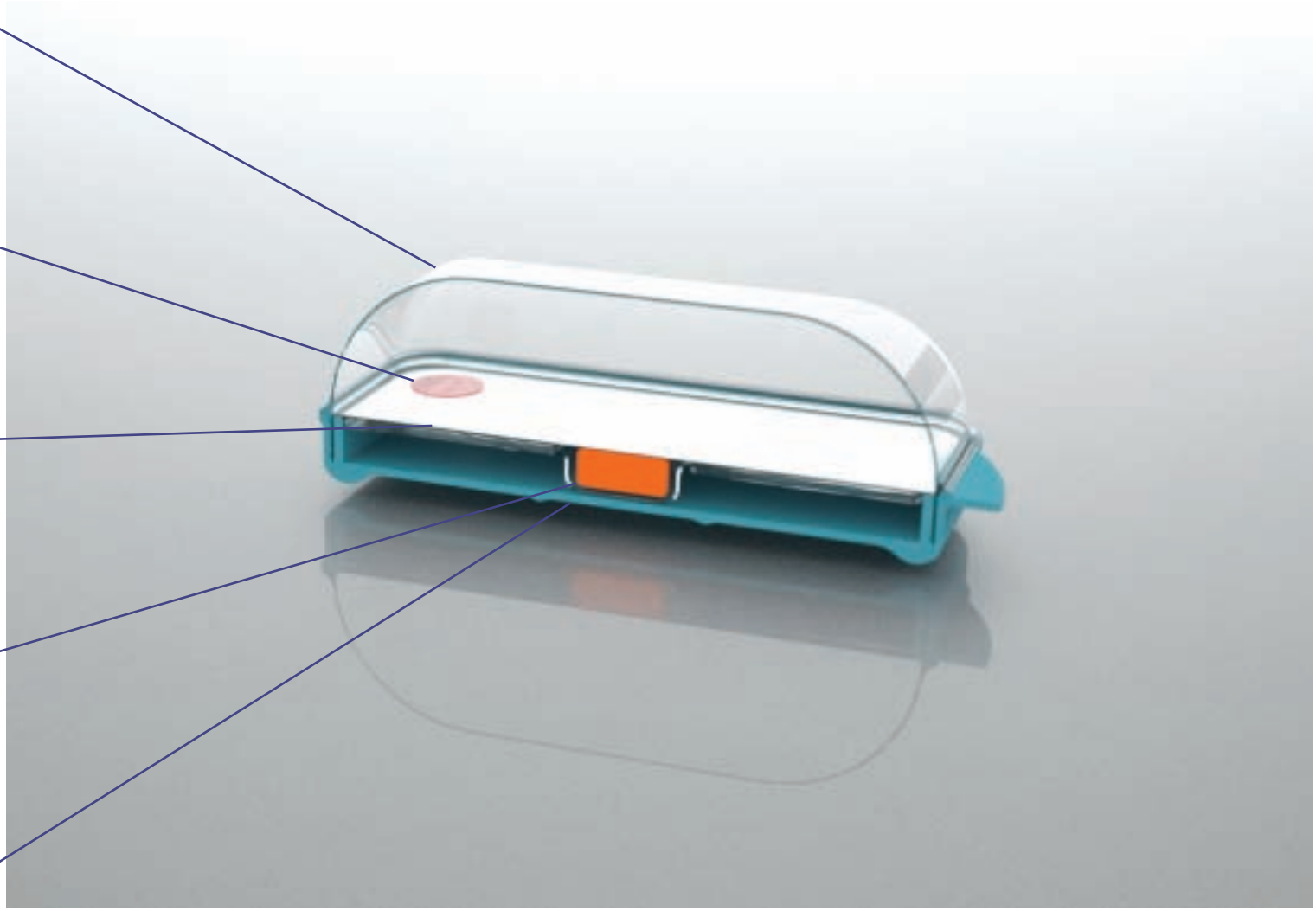
water receptacle

temperature indicator

blister packaging

GMO tablet

lid



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colette bazirgan
gavin engel
justine jividen
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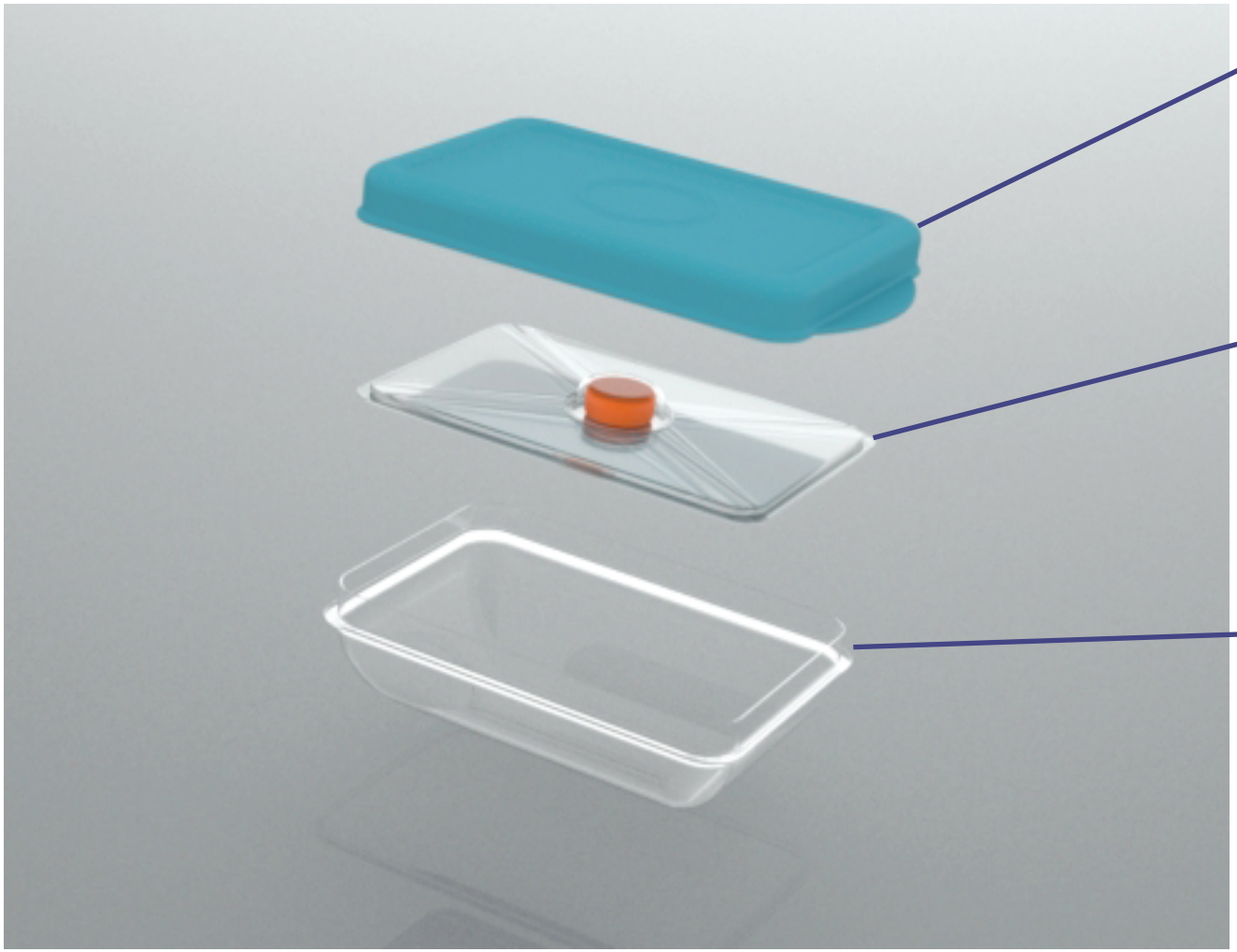
PRODUCT RENDERING



LDPE LID:
-inexpensive
-flexible
-can be opaque
-tolerates heat well

GMO BLISTER PACKAGING:
-encompassing the GMO in a blister pack is better in this situation than a capsule or film coating because the pack can be considered a layer of packaging

PET WATER RECEPTACLE:
-inexpensive
-impact resistant
-a rigid container is easier to fill with exact liquid measurement
-container can be carried in a pocket without bursting

MANUFACTURING:
-All components of our design will be injection molded or vacuum molded. The blister pack will be induction sealed to the lid.

TEAM C
colette bazirgan
gavin engel
justine jividen
megan yuen

EXPLODED VIEW + MATERIALS

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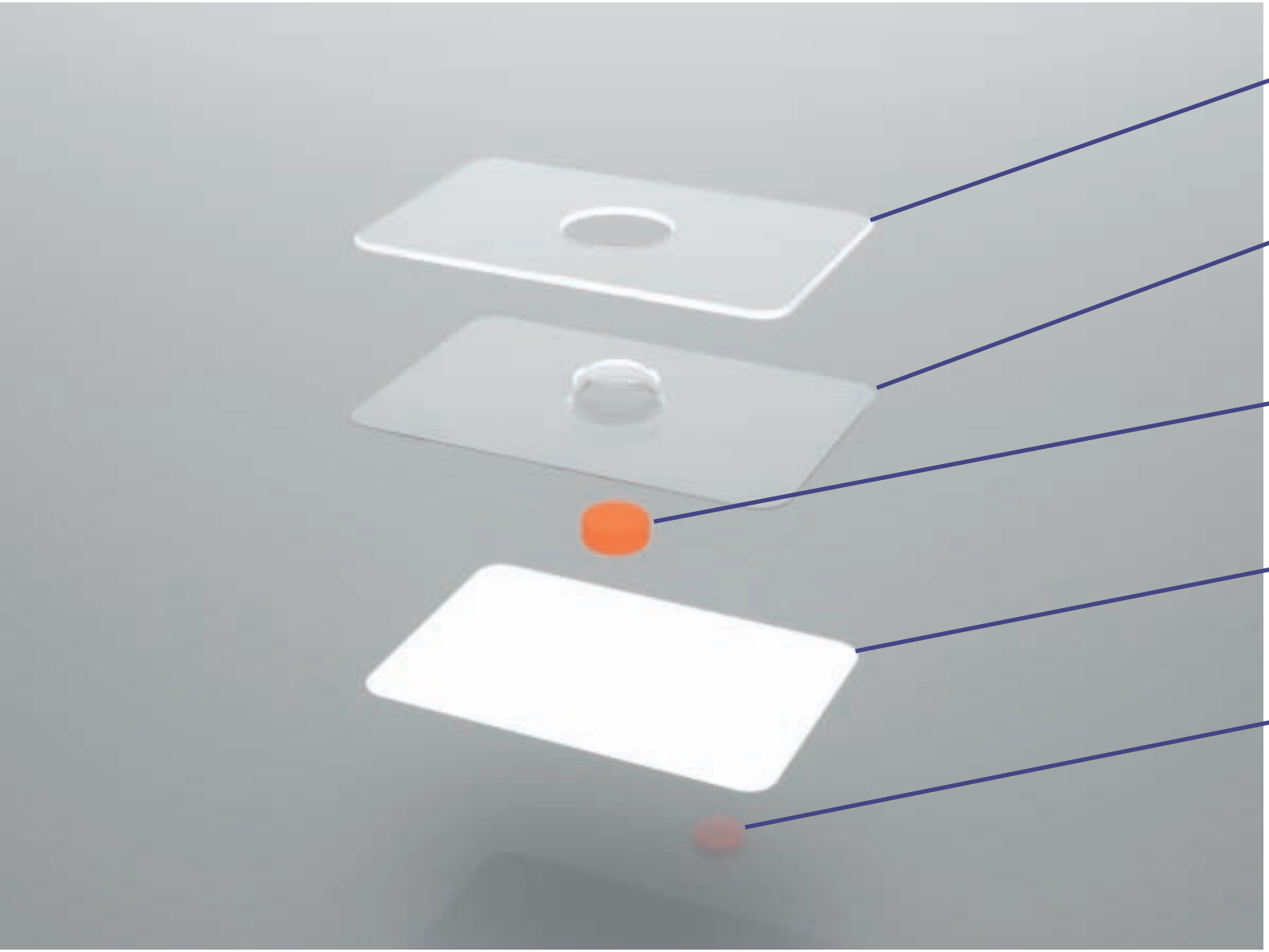
colette bazirgan
gavin engel
justine jividen
megan yuen

PRODUCT RENDERING



RIGID PLASTIC SUPPORT
-made of PET plastic
-supports blister pack

BLISTER CASE
-made of PET plastic
-contains GMO tablet

GMO TABLET
-organism culture is compressed into a tablet

FOIL SEAL
-contains GMO
-helps to reflect UV light

TEMPERATURE INDICATOR
-made of leuco dye & paper

TEAM C
colette bazirgan
gavin engel
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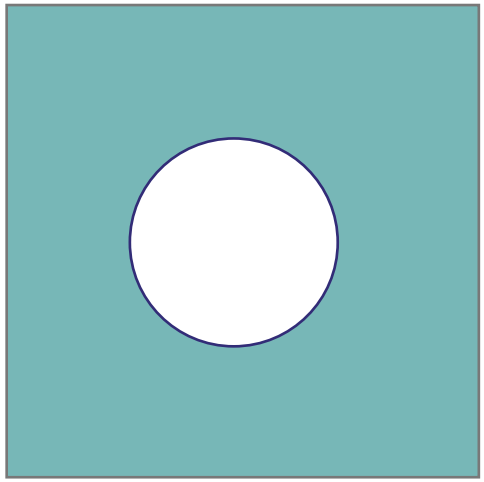
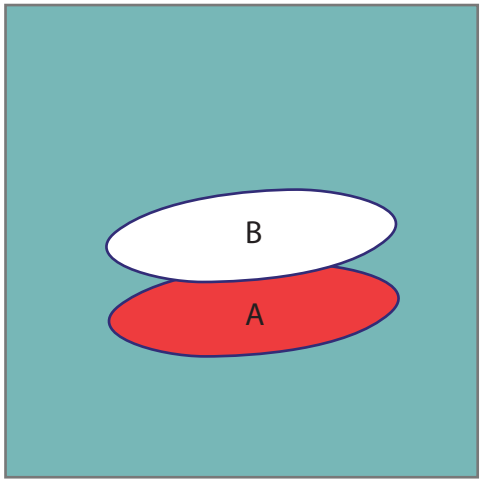
EXPLODED VIEW + MATERIALS

When water is placed in the sun, there is two forces working together to kill bacteria: Ultra violet exposure and heat. It is possible that during the time the device sits in the sun that the water can heat to more than 50˚C. While this is great for the disinfection process, it could potentially lead to problems in the next step of testing, adding the GMO. The GMO can be damaged or killed if it is exposed to 42˚C or above.

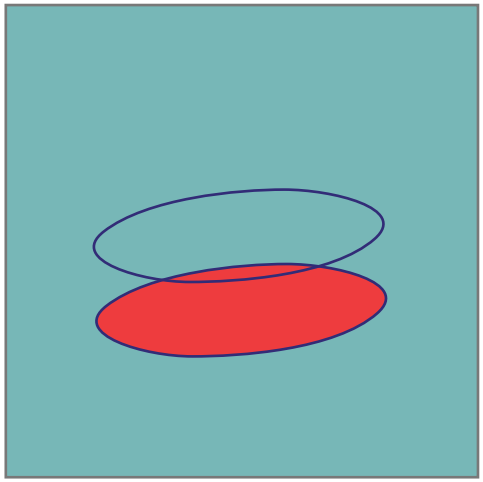
In order to eliminate this potential error, a temperature indicator has been added to the interior of the device. The indicator changes from white to red when the water heats to above 42˚C to show the user that it is unsafe to add the GMO. Once the water cools, and the indicator changes back to white, the GMO may be added.



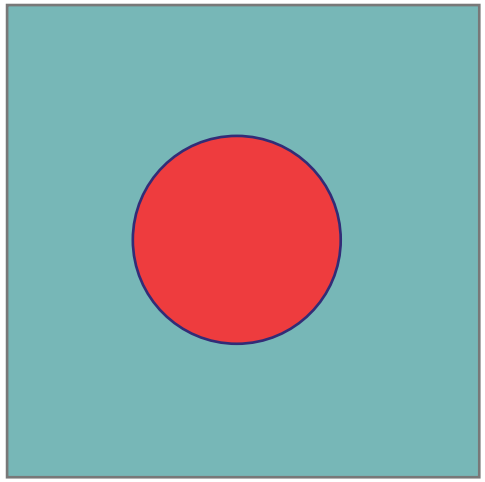
The indicator dot appears white when temperature is below 42˚C.



The dot is actually composed two layers: the (A) is actually a red paper circle. (B) is a layer of temperature-sensitive leuco dye. The leuco dye is white and opaque.



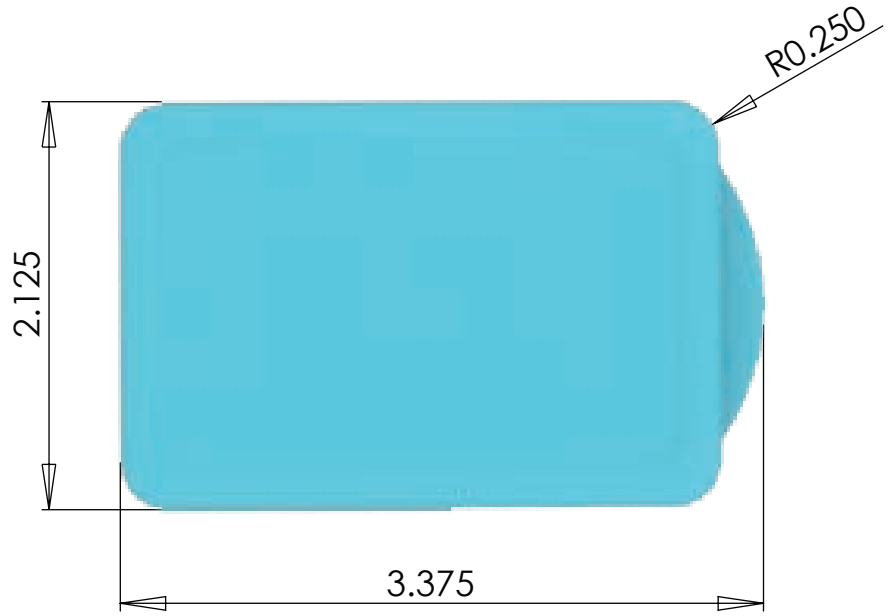
When the leuco dye is exposed to heat above 42˚C, it turns white to clear, exposing the red paper.

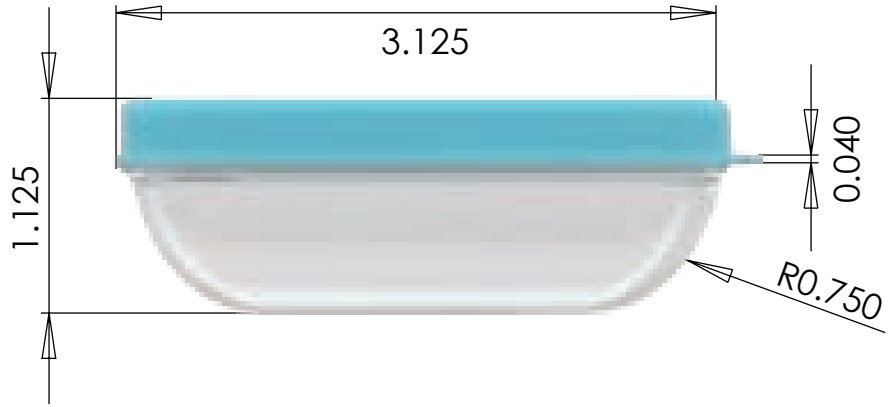


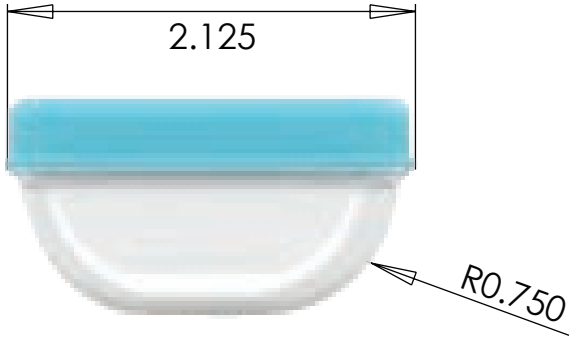
The indicator appears red when the temperature rises above 42˚C, so the user knows not to add the GMO.

TEAM C
colette bazirgan
gavin engel
justine jividen
megan yuen

TEMPERATURE INDICATOR







TEAM C

colette bazirgan
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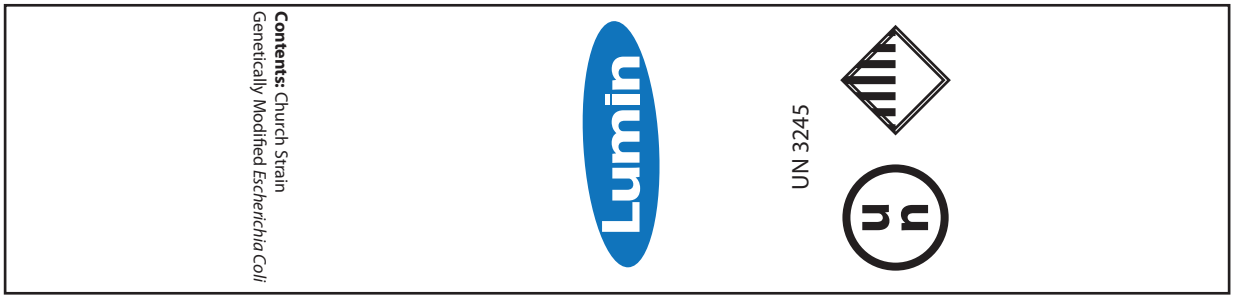
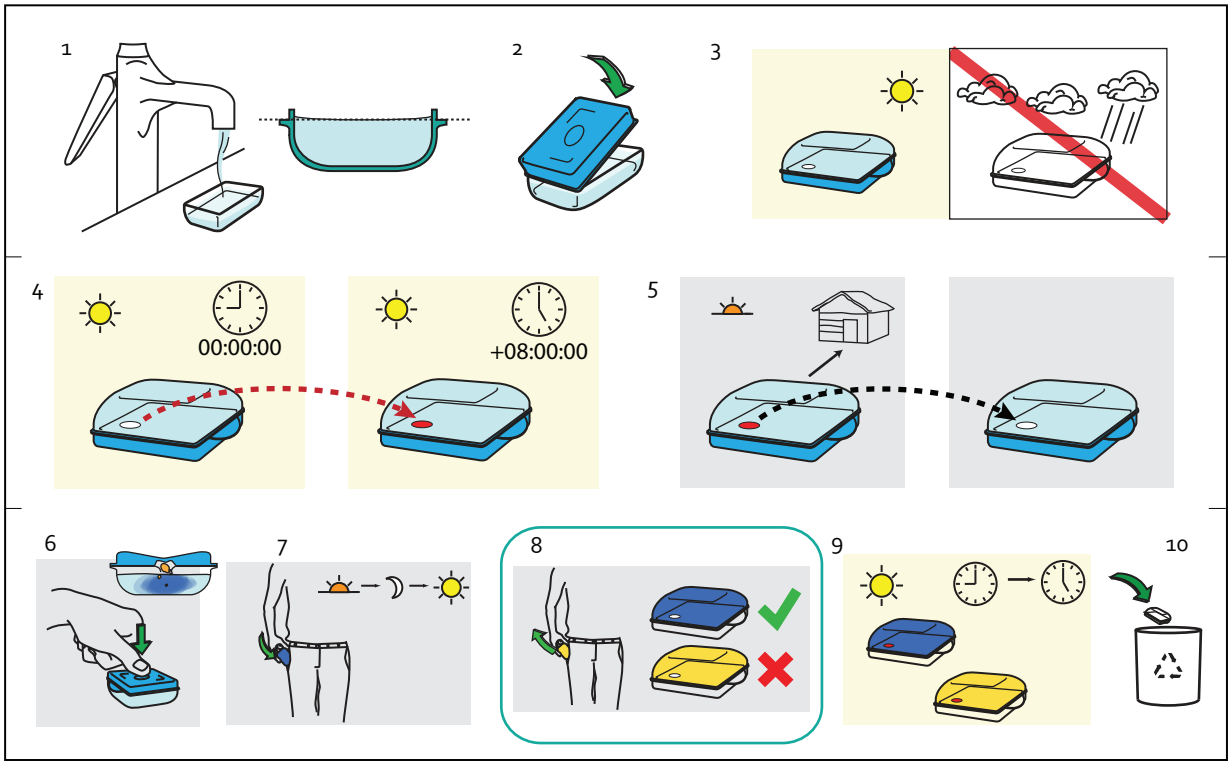
ORTHOGRAPHIC DRAWINGS


Lumin
UN 3245
Contents: Church Strain
Genetically Modified Escherichia Coli


1
2
3
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Lumin
UN 3245

IATA PACKING INSTRUCTION 602

- Packages must bear UN specification mark
- Triple packaging consisting of watertight primary receptacles, watertight secondary packaging and an outer packaging of sufficient strength to meet the design test types

SECONDARY PACKAGING
(Water Tight)

PRIMARY RECEPTACLE
(Water Tight)

OUTER PACKAGING

QUESTIONS?

solar water disinfection device

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colette bazirgan
gavin engel
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