

Prototype Testing:

Engineering Metric Being Tested: Corrosion due to Cleaning Materials

Purpose:

The purpose of this protocol is to examine the potential reactions between the cleaning materials used when cleaning the system and the type of plastic chosen to use to construct the urine diverter. This is necessary because to ensure the longevity of the design, the prototypes must be subjected to everyday use scenarios.

Goals:

The goal of this protocol is to determine which types of plastic could be used to construct the diverter while considering the interactions of possible cleaning solutions that might come in contact with it. An ideal material would be inert to any of the common cleaning materials used in an average Haitian household.

Conclusions:

The findings of this protocol showed that neither ABS nor polypropylene plastic degrade when in contact with household cleaning bleach. As of January 25, 2018, the acrylic in question will also not corrode when exposed to cleaning with bleach. From these findings, we are confident moving forward that a urine diverter can be constructed from either ABS or polypropylene or acrylic and maintain its integrity during periods of cleaning.

Amended as of 2/22/2018 Even after the surface abrasion tests, there was not significant evidence to prove that household bleach will degrade the materials over time.

Materials:

- 2" x 2" sample of each type of plastic being considered for the urine diverter
 - ABS
 - Acrylic
 - Polyethylene
 - Polypropylene
- Household Clorox bleach
- Tupperware containers to house each sample

Procedure:

1. Set up the correct number of tupperware containers to make sure each sample has its own container.
2. Slightly wet a paper towel using a few drops of the saline solution for each container
3. Place the squares of plastic in the tupperware containers.
4. Apply a small coat of cleaning solution to each plastic sample. Be sure to include all possible combinations of diverter materials with cleaning materials.
5. Ideally, place the containers in a somewhat warm environment to simulate the conditions of a Haitian household.

6. Seal the containers with the lids and let incubate for 24 hours.
7. At the 24 hour mark, open the containers and carefully examine the plastic samples for signs of corrosion or bacterial growth. Note any abnormalities.
8. Repeat the observation process every 24 hours until a week in total has passed.
9. *Amended as of 2/22/2018* Using an X-acto knife, score both faces of each type of material.
10. Using the scale, take an initial mass measurement and record in the below table.
11. Place each plastic in a separate tupperware container and cover completely with bleach.
12. Incubate for 24 hours.
13. Remove the plastic from the containers at the end of the incubation period and rinse thoroughly with water.
14. Take a final mass measurement and record in the below table.

Results:

Plastic Type	Initial Mass (g)	Final Mass (g)
ABS	9	9
Polypropylene	8	8
Acrylic	50	50

Abrasion Test Results:

Plastic Type	Initial Mass (g)	Final Mass (g)
ABS	9	9
Polypropylene	8	8
Acrylic	49	49

Analysis:

No amount of degradation of material was observed after the 24 hour incubation period. This corresponds with initial feasibility research completed on the material properties of the plastics at hand. By nature, plastics do not have adverse reactions to household cleaning bleach. Acrylic could not be obtained prior to this first round of testing, however, a swatch of acrylic has been ordered and the same testing protocol will be completed for the material. *Amended as of January 25, 2018* The acrylic swatch has been tested and no noticeable damage occurred. The initial mass was the same as the final mass, and a visual inspection showed that no surface corrosion happened. Polyethylene was also planned to be tested, however, after initial research

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was performed, it was discovered that the plastic used to form the bleach container is polyethylene. After this realization was made, it was decided that it would be wasteful to purchase additional polyethylene to perform the test.

Amended as of 2/22/2018 Even after scoring the faces of the materials to simulate abrasion over time, the bleach did not degrade the material; the final mass was equal to the initial mass in each case.