PURDUE INNOVATES | Office of Technology Commercialization

Materials to Contain the Norovirus from Emesis

Face-fitting emesis bag with absorbents, surfactants, filters, and viral test strips contains norovirus safely.

Researchers at Purdue have designed a specialized emesis (vomit) capture system that is capable of inactivating and containing norovirus exposure to unaffected persons as well as reducing exposure of unpleasant smells and other emesis-borne diseases. Norovirus is the leading cause of emesis and diarrhea in the United States, causing 58% of the foodborne illness and around $2 billion USD in lost productivity and healthcare expenses, and is particularly prevalent on Cruise ship environments. Existing solutions for emesis containment amount to a simple plastic bag with a plastic collar at the opening to seal the emesis within, with some products containing superabsorbent beads to contain the liquid emesis. However, these solutions are limited due to their inability to prevent splash-back, spillage, emission of gases, and cannot test for virial or bacterial agents within the emesis.

The researchers designed an improved emesis capture and containment system that incorporates several simple, low-cost improvements to the plastic bag design. At the opening, instead of an oval, the researchers designed a more form-fitting plastic attachment that fits a human face to better direct the emesis flow into the container. Next, a flexible, duck-bill style 1-way valve helps to prevent splash-back. An N95-type filter is incorporated to prevent viral escape from emitted gases. Inside the bag, the researchers formulated a composition for a compressed pellet that, upon contact with emesis, can absorb the liquid fraction, trap the solids, and inactivate/trap any noroviruses within a surfactant layer. Finally, an optional test strip for viral-associated particles can be incorporated on the inside wall of the transparent plastic bag to test for different pathogens within the emesis, without having to take a sample.

Technology Validation:

Technology ID
2023-GOLD-69930

Category
Pharmaceuticals/Pharmaceutical Packaging & Delivery Systems
Digital Health & Medtech/Analytical & Diagnostic Instrumentation

Authors
Kendra Ann Erk
Ethan Francoeur
Robert S Gold
Subin Han
Parth Kelkar
Logan Mick
Jae Hong Park
Akul Nimish Seshadri

Further information
Clayton Houck
CJHouck@prf.org

View online

Different components of the emesis capture system were tested and validated. The ability of the absorbent particles to absorb liquid at pH 4 was evaluated by massing the dry absorbent particles and massing the absorbent particles at different time points post-immersion in water to find the "swelling ratio". The anionic absorbent particles in particular were successful, with a swelling ratio of ~100 at around 10 minutes of soaking. The researchers found a formulation that had a maximum foam height of ~13 mm, and a staying power of 80%. Finally, the researchers validated the ability of their compressed pellet formulation to fully dissolve and contain liquid at low pH. They found that their optimal formulation was able to easily fully dissolve in pH 4 water in under 30 seconds, without any added mechanical mixing that would likely happen during an actual emesis event.

Advantages:

-Absorbs and contains liquid and solid emesis components

-Surfactants to trap and inactivate noroviruses

-Includes non-powered test strip to show presence of viral agents

-N95 filter to block norovirus exposure from possible emitted gases

-Low-cost

-Simple

Applications:

-Emesis control on ships, planes, and hospital environments

TRL: Medical/Health

Intellectual Property:

Provisional-Patent, 2024-03-11, United States

Utility Patent, 2025-03-10, United States

Keywords: Emesis, Medical/Health, Norovirus, Vomit