

**Final Report Of Encasement
Tests
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A series of experiments were conducted to evaluate the effectiveness of SecureSleep™ mattress encasements in containing bed bugs and preventing their feeding. The experiment, conducted by T. J. Gibb, Ph.D., commenced on 11/12/09 and the final report was issued July 23/10.

Objective #1: To determine if SecureSleep™ bed bug encasements, when used according to manufacturers specifications, permanently contain bed bugs and prevent their escape.

Objective # 2: To ascertain the likelihood of bed bugs piercing through and feeding through SecureSleep™ encasement material.

General Methods: A colony of bed bugs was transported to the laboratory for use in testing these objectives. The colony consisted of adults as well as all 5 instar nymphs and eggs.

Eight SecureSleep™ encasements were obtained from (bedbug.com) for testing.

Objective 1 Test:

To determine if bed bugs can escape from sealed mattress encasements, bedbugs were enclosed in a container separated by an encasement from two known bed bug attractants. Prior research has shown that bed bugs are highly attracted to heat and Co2 (Wang, C., T. Gibb, G. W. Bennett, and S. McKnight. 2009. Bed bug attraction to pitfall traps baited with carbon dioxide, heat, and chemical lure. Journal of Economic Entomology 102: 1580-1585.).

Sections of SecureSleep™ encasements were cut in a manner that included part of the zipper as well as the end of the closed zipper area (approx. 32 cm x 32 cm) (Photo 1).

Treatments consisted of encasements sections with the zipper in the closed position and the Velcro sealed. A control consisted of an identical set up except that the zipper end was not properly closed nor sealed with Velcro.

The bioassay was set up by first stretching each encasement section across the top of a large (13.5 cm dia) Petri dish (Photo 2).

The bottom of each Petri dish was modified (Photo 3) so that there was an opening slightly smaller than the size of the top of a Solo collection cup (Solo®; Urbana, IL

P550 A 35) covered with mesh (104 x104 openings per sq. in.; 94 µm thread diameter; 150 µm opening size) across the opening in the bottom and hot glued into place (Photos 4a-d, & 6c).

This mesh size was chosen because it prevents bed bugs from passing through. The cup with mesh was then placed into a small plastic container (10.5 cm dia x 7.5 cm height) containing approx 5 g dry ice. A heat pack (Heat Factory™ disposable warm pack Vista, CA) was placed on the side of the container. Using this apparatus, any insects penetrating the encasement and zipper, would fall into the Solo collection cup and would remain separated from the source of heat and CO₂ due to the mesh to make detection simple.

Three bed bug nymphs and one adult were placed on the inside of each Petri dish and thus on top of the encasement (Photo 5). The lid was then put in place and hot-glued shut on both sides (Photos 6a- c) (lid to encasement and encasement to dish). Photos 7a-c shows the completed setup. Warm packs were changed every 24 h. for 5 d. Dry ice used on day one was replenished on day five. Bugs were held until they expired.

Results:

Within the first 24 h, two nymphs in the control (open zipper and

open Velcro) were found in the collection cup (Photo 8a, b). The three bioassays with correct zipper and Velcro closure had no bed bugs escape into the collection cup during the course of this experiment.

Objective 2 Test: To determine if bed bugs can feed through a SecureSleep™ bed bug encasement, two experiments were conducted. The first was to measure and photo document, using multilayered microscopy, proboscis penetration through the fabric.

Adult bed bugs were used in this study because they have the longest and most sturdy mouthparts (if any bed bug stage could push stylets through the fabric and pierce skin, it would be the adult stage).

Microscope slide bioassays were set up by hot gluing a well (approx. 3.0 x 1 ¾ cm) onto the slide (1.2 mm thick plain glass). A piece of encasement (oriented with the inside exposed to the bed bug in the manner in which they would encounter an encasement) (approx. 5 ½ x 2 ½ cm) was partially glued onto the well. An adult bed bug was placed under the encasement and the rest glued down (Photo 9a,b). A heat pack (Heat Factory disposable warm pack Vista, CA) was placed under the slides and

dry ice was placed to the side of the slides (Photo 10). A total of ten slides were set up and left until the bed bugs died (3-4 d). Slides were checked continuously under the microscope to see if mouthparts were protruding.

A second test was performed using bed bugs in a feeding chamber. Bed bugs are known to feed through some materials such as organza (a thin synthetic, sheer fabric that is loosely woven). In this experiment small holding containers were constructed using either organza or bed bug encasement material (Photo 11) cut and glued to the open end (Photo 12). The cups were then inverted and placed directly on a para-film covered source of blood, such that very close contact could occur. Starved (10 d) bed bug adults were added and observed (Photo 13).

After a sufficient period of time to allow for feeding, each bed bug from the encasement container was then placed in the containers lined with organza and exposed to the blood in the same manner.

Observations for feeding success were repeated.

Results:

No bedbugs penetrated (probed) their mouthparts through the SecureSleep™ encasements even when enticed to do so by the

addition of attractants. Further, bed bugs were unable to successfully feed through the encasement when provided with a blood meal on the other side. In all seven replications, the bedbugs almost immediately (within less than 60 seconds) inserted their mouthparts through the organza containers and fed to repletion.

Conclusions:

The above test concluded that when used according to manufacturers directions, SecureSleep™ encasements effectively seal in bed bugs and prevent them from escaping. Further, SecureSleep™ encasements effectively prevent sealed bed bugs from feeding through.



Photo 1



Photo 2

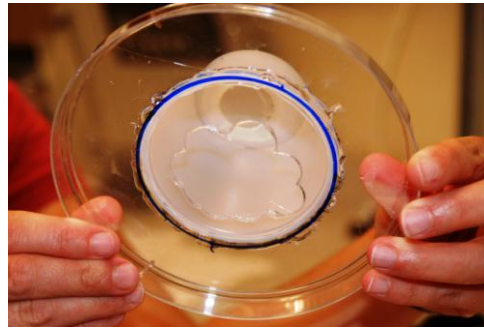


Photo 4c



Photo 3

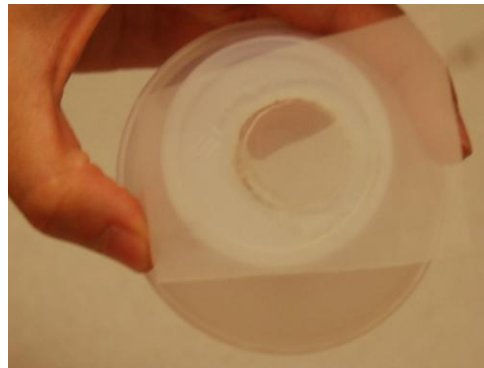


Photo 4d



Photo 4a



Photo 5



Photo 4b

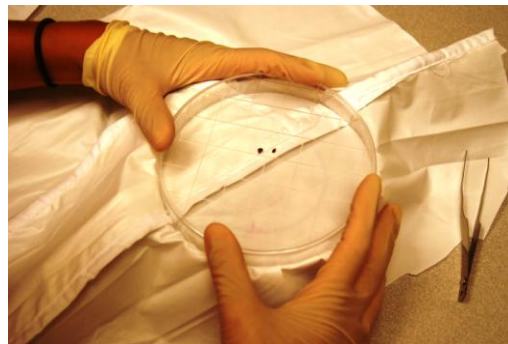


Photo 6a

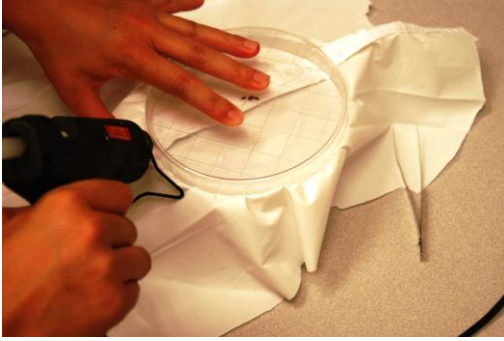


Photo 6b

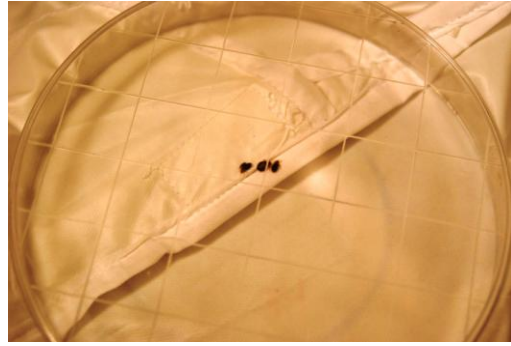


Photo 7c

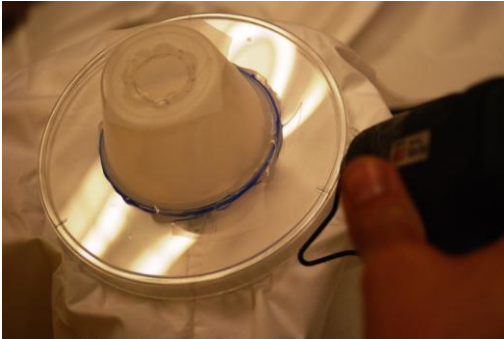


Photo 6c

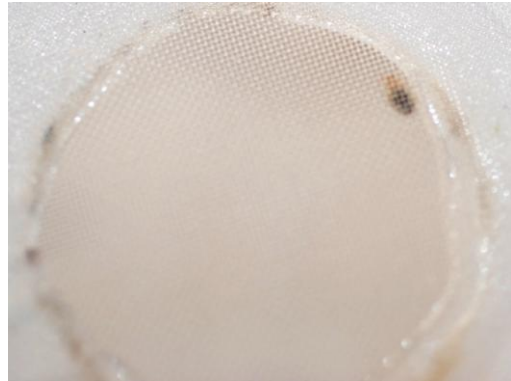


Photo 8a



Photo 7a



Photo 8b



Photo 7b



Photo 9a



Photo 9

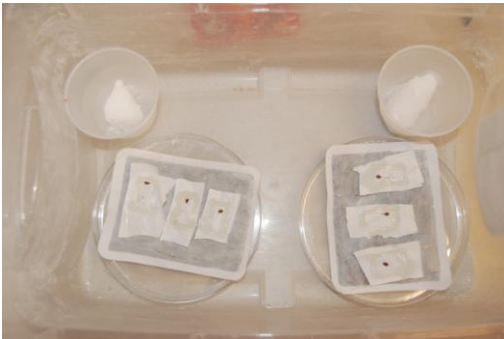


Photo 10



Photo 11 Encasement material on left – organza material on right

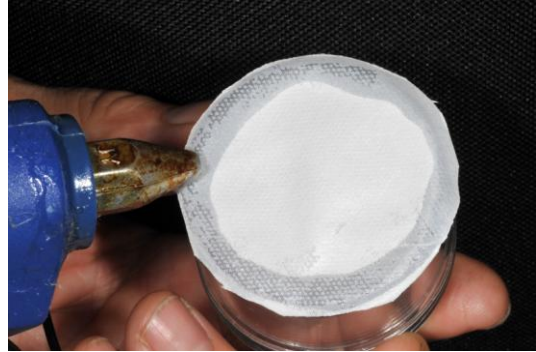


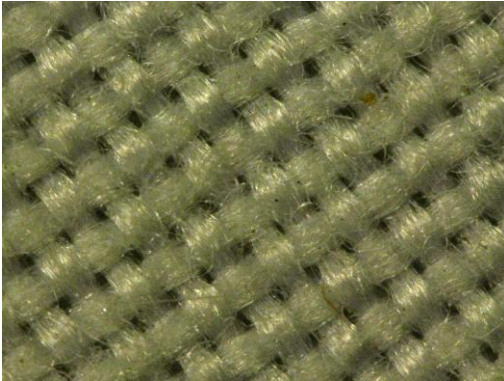
Photo 12 Constructing feeding containment chamber with encasement feed through material glued to bottom



Photo 13 Feeding containment chamber completed and supplied with 2 adult bedbugs

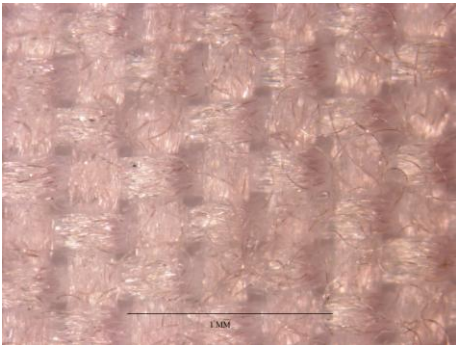
Extra photos

Outside of encasement (facing human)



Outside of encasement -facing human.
(artificially colored to accentuate
contrast)

Inside of encasement (facing bedbugs)



Inside of encasement - facing bedbugs



Bed bug on inside of encasement

