Using Heat to Kill Bed Bugs

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Introduction

Bed bugs are an incredibly difficult pest to control because they are so good at hiding in tiny cracks and crevices. Also, modern bed bug populations are highly resistant to the insecticides used for their control. Because bed bugs are difficult to access, and our insecticides do not work as well as we would like, home owners and pest management professionals have been searching for novel ways to kill bed bugs inside a structure.

Heat is known to be a very effective bed bug killer and it can be used in many different ways to treat infestations. For instance, heat in the form of steam can be used to treat bed bugs in carpets, behind base boards and on upholstered furniture. Hot dryers and portable heat chambers can be used to kill bed bugs in infested household items. Larger heat chambers can be used to treat furniture, while professional heating systems can be used to treat entire rooms and structures.

Heat treatment offers certain advantages when it comes to bed bug management. Heat is non-toxic, and can kill all bed bug life stages including bed bug eggs. However, heat treatment of any kind (except your home clothes dryer) is still relatively expensive and has no residual (long lasting) activity. The lack of residual activity means that bed bugs can re-infest again the day after treatment. Still, heat treatment is one of the more effective tools that we have in the fight against bed bugs.

The following information is provided as an introduction to the various types of heat treatments available. The advantages and disadvantages of each type of treatment are discussed in addition to their approximate costs. Keep in mind that while the whole room heating systems are sold as stand-alone treatments, most heat treatments need to be used in combination with other non-chemical and/or chemical methods to control an infestation.

Recent research has determined the thermal death points (the temperature at which a bed bug dies) for bed bugs and their eggs. The thermal death point is determined by two things; temperature, and exposure time. Bed bugs exposed to 113°F will die if they receive constant exposure to that temperature for 90 minutes or more. However, they will die within 20 minutes if exposed to 118°F. Interestingly, bed bug eggs must be exposed to 118°F for 90 minutes to reach 100% mortality. Note that whole room heat treatments (see below) are based on a thermal death point of 113°F, yet these treatments have been very successful. This is due to the use of powerful fans to create convection currents within the heated room. These currents heat the bed bugs very rapidly, thus increasing their mortality.

Treating Infested Items:

The Clothes Dryer. One of the difficulties we face eliminating infestations is treating all of the household items that bed bugs are able to infest. Insecticides cannot be applied on household items like toys, clothes, shoes, or bedding. Fortunately, a household dryer is excellent for killing bed bugs on these items. A loosely filled dryer set on "high" is capable of killing all bed bug life-stages and their eggs in 30 minutes. A dryer with a removable shelf is excellent for killing bed bugs on items that cannot be tumbled, like leather shoes, handbags, knick-knacks, even books. However, the drying time may need to increase to make sure all items reach the bed bug thermal death point.

Portable Heating Devices. Currently, there is one portable electric heating device on the market designed for killing bed bugs. This is the PackTite® portable bed bug heater. The PackTite® was originally intended for heat treating suitcases. However, this portable heat chamber is also effective for treating other items such as backpacks, clothing, sleeping bags, tools, books, CDs, shoes, purses, and pillows. The PackTite® is basically a collapsible duffle bag that contains a

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support rack on which you place your infested items. The PackTite® has an interior heater and an exterior heat monitor so that you can see the temperature inside the bag. The bag is heated to a temperature above 120°F killing all bed bugs life stages, including eggs. The timer on the electrical cord automatically turns the heater off after the treatment is over. The PackTite® takes much longer to treat infested items (several hours) than a hot dryer but it is completely portable and is able to treat items (like packed suitcases) that a dryer cannot. Be sure to check the owner's manual regarding heat tolerance of any electronic devices before putting it in the PackTite®. The PackTite® sells for around $310 and when assembled is 36" long by 19" wide by 24" high.

Treating Infested Rooms

Steam. Pest management companies that specialize in bed bug control typically use steam as part of their treatment process. A professional steamer with a large steamer head is used to treat bed bugs on mattresses, inside boxsprings, on upholstered furniture, along the tacking strips of the carpet, behind baseboards and other locations where insecticide applications may be undesirable.

Steaming is slow, methodical work that takes patience. The technician must move slowly enough so that the heat concentration (target temperatures 160-180°F) is maintained over every inch of surface (the pace should be about 12 inches every 30 seconds). Care must be taken not to exhaust the technician so that he or she is just as good at treating the last home of the day, as they were the first. Also the head on the steamer needs to be large to avoid the steam coming out at such velocity that it blows bed bugs and their eggs across the room. Steam cleaning is an effective way of reducing a bed bug infestation quickly. However, steam alone will not eliminate an infestation. Professional steamers range in price from $300-$1,200.

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Do-it Yourself Heat Chamber. At the University of Florida, Drs. Philip Koehler and Roberto Pereira developed a chamber made of Polystyrene foam that could be used to treat household items and furniture (see illustration). Essentially all of the items in the infested room can be placed in the chamber and heat treated while the perimeter of the room, baseboards, cracks and crevices, are treated with conventional insecticides. Rooms with wood or tile floors require some extra preparation by placing an insulating foam mat under the chamber. This heat chamber is easily put together, and can be re-used in different locations. The heat chamber is also economical in that all components (see list below) can be purchased for < $350. Professional pest management companies are now using these chambers for treating hotel rooms because the chamber is effective, and easy to transport and assemble. An instructional video is available at the website listed below. The 30 minute video is a little long, but it contains some very valuable tips regarding the chamber construction. (http://entnemdept.ifas.ufl.edu/sepmc/bedbug_heat_treatment/Bed_Bug_Heat_Treatment.html).

Two very important points need to be made regarding the use of this heat chamber:

1. The room itself will still need to be treated with conventional insecticides by a certified applicator.
2. Successful heat treatment in the chamber is not dependent on the length of the treatment (time) but on all items reaching the bed bugs' lethal temperature. All monitors should read 120°F before the chamber is disassembled. Treatment usually takes several hours to complete.

Heat Chamber Components:

- **2 Space heaters (oil filled heaters to eliminate fire potential; see illustration)**
- **6 Polystyrene sheets of foam 2" thick**
- **2 Box fans**
- **1 Oscillating fan**
- **4 Thermometers with exterior monitors**
- **2 Extension cords; power strip**
- **Masking or Duct tape**

Whole Room Heating Systems (ThermaPureHeat® and Temp-Air Heat Remediation System®)

One of the most effective new technologies for bed bug control has been the development of heating systems capable of superheating infested rooms to kill all bed bugs. There are currently two heating systems being used for bed bug elimination. These are the ThermaPureHeat® and the Temp-Air Heat Remediation System®. The principles behind these two methods are essentially the same. Either electric heaters or propane generated heat is used to heat the air inside the room to a temperature of ~135°F (this temperature will not typically damage electronic equipment). The heat is blown into the room for several hours. The temperatures in cracks, crevices, and hard-to-reach places are monitored remotely from numerous sensors placed throughout the room. Once the bed bug thermal death point is reached at all of the sensors (~113°F), the heating process is continued for 60 minutes (or more) to kill all of the bed bugs and their eggs. The advantages of these heat systems are that the resident does not have to remove or bag their belongings, and most infestations can be cured in a single treatment. The disadvantages of heat treatment are that the technology is still so new that it may be difficult to find a pest management company who has purchased the system. The process is also time consuming (taking 6-8 hours from setup to take down), and therefore expensive ($1,200 or more depending on the size of the area to be treated and the time to reach temperature).

Heat treatment is one of the few methods that can be used alone for bed bug control. However, some buildings (usually older remodeled buildings) may have construction features that create heat sinks. In cases where construction issues are a concern, it is wise to supplement the heat treatment with a conventional insecticide application in cold spots where bed bugs might find refuge.

The Temp-Air Heat Remediation System® uses large electric heaters (120 - 220 pounds each) to generate the heat needed to treat a room or apartment (typically a 4-heater system will treat 900-1100 sq. ft.). The heaters are placed in the infested room and powered by a generator located outside. High velocity fans are used to blow the heated air into all corners of the room. The temperature of the room will increase to between 120-135°F. Strategically placed heat sensors are monitored until each has

reached 115°F. This temperature is adequate for killing bed bugs but not high enough to damage belongings. This treatment will take 4 hours or longer.

The ThermaPureHeat® system uses a large propane fueled heater to generate the heat needed to treat an infested home or apartment unit. The propane heater is located outside the building and the heat is funneled into the apartment through mylar duct work. The ducts extend into various areas of the home creating positive pressure as the propane heat is continuously blasted into the unit. The temperature of the room will increase to 135°F, heating bed bugs harborages to the thermal death point, but not damaging items inside the home. This treatment will also take 4 hours or longer.

Both the Temp-Air and ThermaPure Heat systems can be used inside portable storage containers or truck beds to create a heat chamber. The temperature of infested items inside the chambers need to be monitored closely to make sure that heat leakage from these non-insulated containers does not compromise the treatment effectiveness.

Summary

Heat is an excellent bed bug killer. A hot dryer is good for treating infested clothes and bedding. The PackTite portable heat chamber can treat suitcases, and other household items without damage. A Do-it-Yourself heat chamber can be built for treating furniture and large household items. For whole room treatment you can hire a pest management company that uses a professional heating system.