Reduction of Domestic Allergen Levels in Carpets and Soft Furnishings in US Homes Using a Proprietary Hot Water Extraction Cleaning Process (#278)

Máire Fox, Claire Mernagh, John Fallon, Vivienne Mahon & Bruce Mitchell

1. Abstract

Rationale: Allergen avoidance in the home should address contaminant reservoirs e.g. carpets and soft furnishings. The impact of a proprietary hot water extraction cleaning process on surface and airborne allergens and microorganisms was evaluated.

Methods: 20 US homes were studied. Air and surface samples taken before and after hot water extraction were analyzed for airborne and microorganism levels by ELISA and total viable counts. Airborne particle counts were monitored during room disturbances before and after cleaning. Carpet layers were analysed for particulate and allergen content by scanning electron microscopy and ELISA, respectively. Three carpets were similarly sampled in an environmental test chamber.

Results: Post-hot water extraction cleaning, surface levels of Derp1/Derf1, Felid1 and Canf1 were reduced by 83%, 96% and 90% on soft furnishings (p = 0.04) and 91%, 95% and 97% on carpets (p = 0.01), respectively. Reductions were also seen for airborne mite (55%, p = 0.01) and surface bacteria (90%, p = 0.05). Test chamber airborne particle counts during room disturbances in the presence of three different carpets were reduced hot water extraction cleaning by 78%, 37% and 65%. Airborne Felid1 was reduced by 67% (p = 0.01). Reductions were also seen for airborne mold (55%, p = 0.01) and surface bacteria (90%, p = 0.05). Test chamber airborne particle counts during room disturbances in the presence of three different carpets were reduced hot water extraction cleaning by 78%, 37% and 65%. Allergen was predominantly found in the carpet base (71% of Felid1/Canf1). Hot water extraction cleaning had a greater effect on allergen levels in the upper layers (74 - 100% reduction), than on base layer levels (15 - 91% reduction).

Conclusion: Incorporation of a hot water extraction cleaning procedure in a home allergen avoidance strategy, at yet to be determined intervals, significantly reduces the levels of bio-contaminants to which occupants are exposed.

2. Field Study Method

A proprietary hot water extraction cleaning process was conducted on the homes.

Sampling occurred 1 hour prior to hot water extraction and 24 hours post water extraction, surface and airborne samples were performed.

Hot water extraction was performed on two out of four quadrants of three different carpets, i.e. two quadrants remained un-cleaned. Airborne samples were taken for allergen, bacteria and mold.

Further sampling occurred 1 hour post hot water extraction to take surface sampling and room disturbance were performed.

3. Test Chamber Method

Airborne and surface sampling was performed before and after cleaning.

Hot water extraction cleaning was performed on two out of four quadrants of three different carpets, i.e. two quadrants remained un-cleaned. All quadrants were then removed from the homes and transported to a modified AC-1/ASTM Test Chamber for testing as outlined above.

4. Field Study Results: Airborne Allergen

Airborne cat allergen levels were assessed during each testing stage. Pre and post-hot water extraction, a room disturbance (5 mins walking, then 5 mins bouncing a ball) was performed to disturb allergen into the air.

24 hours after hot water extraction, the levels of airborne cat allergen were 67% less than the levels detected prior to the cleaning process.

5. Field Study Results: Surface Allergen

Detectable levels of dust mite, cat and dog allergens were found in 4/20, 11/20 and 15/20 homes respectively. 24 hours post-hot water extraction, surface levels of all allergens were significantly less than those detected prior to the cleaning process (p ≤ 0.04)

6. Field Study Results: Airborne and Surface Microorganisms

While the concentration of airborne mold increased during the cleaning process, 24 hours post-hot water extraction, airborne mold levels had more than halved (p = 0.01).

Analysis of the concentration of bacteria present on the carpet surface demonstrated that 24 hours after hot water extraction, bacteria levels were 90% less than those detected prior to the cleaning process.

7. Test Chamber Results: Airborne Particles

Cleared (hot water extracted) and un-cleaned samples of three different used carpets were individually laid in the chamber. The air in the test chamber was monitored while disturbance activities were performed on the carpet samples. Reduced levels of particles were detected in the air in the presence of carpet samples that had undergone the hot water extraction cleaning process.

8. Test Chamber Results: Carpet Layers

Lateral slices (top, middle & base layers) of the used carpet samples were assessed for their allergen content. Lower allergen levels were detected in the base layers of the carpet samples that had undergone the hot water extraction cleaning process.

9. Conclusion

Hot water extraction cleaning had a significant impact on bio-contaminants in the home, reducing the levels of allergen and microorganisms on carpet and soft furnishings and in the air. Therefore the proprietary hot water extraction cleaning process investigated in this study was found to reduce the level of bio-contaminant exposure to home occupants. Based on the results of this study, hot water extraction cleaning would be a valuable addition to a comprehensive home allergen reduction plan. Regular vacuuming with a proven effective vacuum cleaner by the home owner, periodically supplemented at yet to be determined intervals by hot water extraction cleaning, can have a significant beneficial impact on allergen reservoirs in the home, even where carpets and soft furnishings remain.

Funding Source: Stanley Steemer International, Inc.