

Reduction of microorganisms by ironing

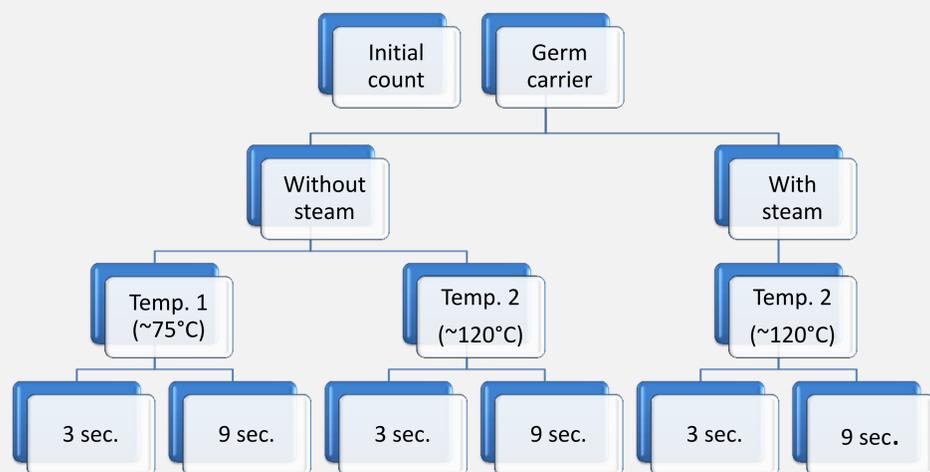
Abstract

The treatment of textiles after use has a great relevance from a hygienic point of view, because clothes can be potential vectors for transmission of infectious diseases. Although ironing is used regularly for treating garments after laundry, little is known about its germ-reducing effect.

To constitute a realistic situation of ironing in a laboratory experiment, textile germ carriers were contaminated with representative microorganisms before ironed under a larger and thicker piece of cloth by using different temperatures with and without steam. By this process it should be determined whether the cloth reaches a sufficient internal temperature to efficiently reduce microorganisms.

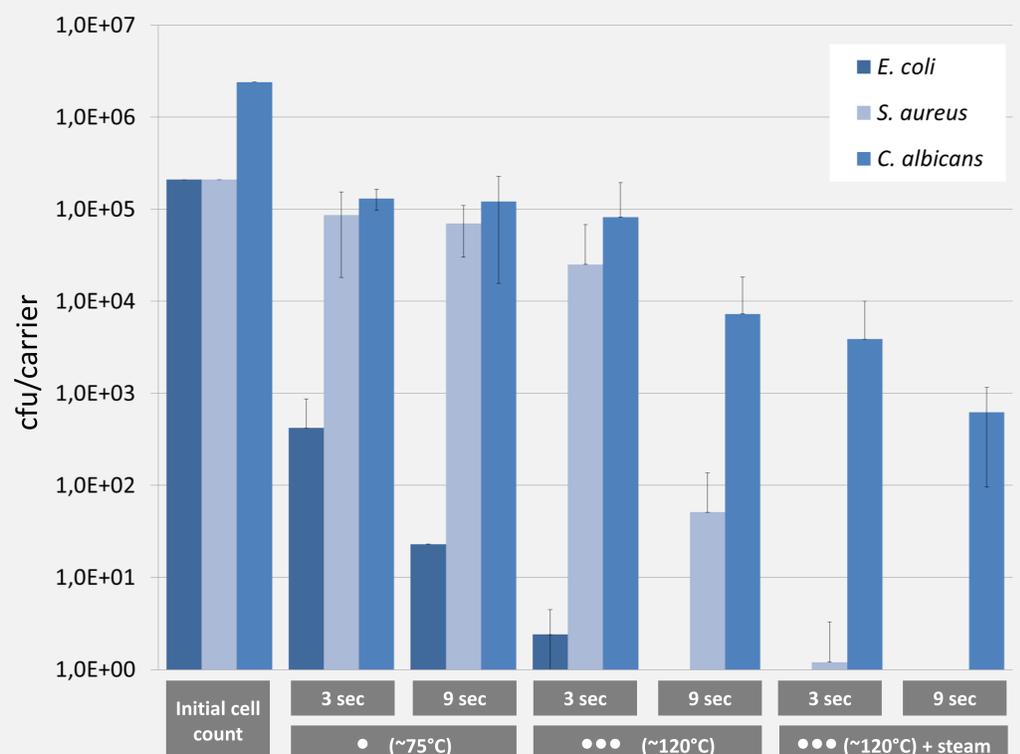
Materials & Methods

Overnight cultures were grown in CASO-broth (*Escherichia coli* DSM 682, *Staphylococcus aureus* DSM 799) or Malt-broth (*Candida albicans* DSM 1386). Germ carriers were prepared by immersing cotton pieces (2x2cm) in the culture vessels followed by drying for 30 minutes at 37°C. The dried carriers were placed under a thicker cotton cloth (wfk 10A) and ironed with an electric iron (Rowenta DZ 5020) for domestic purposes according the following scheme:



Directly after ironing the precise temperature was determined on the surface of the germ carriers using an infrared thermometer (Pioneer EM-A350). The germ carriers were then shaken in 10 ml of the appropriate medium in an Erlenmeyer flask for 15 min at 450 rpm to remove all remaining microbial cells and were analyzed by a 6-step MPN method. All experiments were performed in triplicates. One germ carrier of each tested microorganism was handled accordingly but without prior ironing to determine the initial cell count.

Results



The diagram shows the average number of remaining microbial cells on three germ carriers after ironing. While *E. coli* was inactivated at high temperature conditions even without steam, a complete inactivation for *S. aureus* could only be obtained when additional steam was applied at high temperature. *C. albicans* cells were not inactivated completely under the tested conditions. Interestingly, when using low temperature conditions or even high temperature with short contact times, virtually no inactivation of *S. aureus* and *C. albicans* could be observed.

Discussion

Although ironing must be considered as a common procedure within the treatment of textiles, studies on the antimicrobial effects of ironing are lacking almost completely. Back in the 1960s, Reploh came to the conclusion that ironing might contribute to the hygienic processing of textiles but must be considered insufficient alone (Reploh, 1965). This study tried to mimick the realistic conditions that are used in the domestic environment for the ironing of textiles, although the amount of bacterial cells applied to the germ carriers must be considered quite high with regards to “normal” contamination levels, especially on freshly laundered textiles (Blümke *et al.*, 2011). Nevertheless, the findings that ironing might not be an efficient means for the decontamination of textiles could be confirmed in general, although the use of steam and high temperature conditions when ironing might contribute to the inactivation of microbial cells remaining on garments after laundering. However, the high tolerance of fungi like *C. albicans* to ironing suggest for a safe elimination during the prior laundry process by using high washing temperatures and bleach-containing detergents (Hammer *et al.*, 2011).

Literature

- Blümke *et al.* (2011) The washing machine as a major source for microbial contaminations of domestic laundry. 7th European Detergents Conference; Fulda, October 2011
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Reploh *et al.* (1964) Untersuchungen über die Keimabtötung beim Bügeln und Dämpfen der Kleidung. *Arch Hyg Bakteriol.* 149(7):610

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