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TEXTILE HYGIENE - Home washing vs professional industrial washing - Risks of washing at home

1. Why this initiative?

Washing professional clothing and textiles at home may seem like a simple and obvious solution. Whether for workwear, chefswear, elderly care facilities, linen, bedding or towels…

However, this comes with an undefinable level of risk. The difference between “clean”, “hygienically clean” and “disinfected” are often overlooked.

Research shows that consumers’ knowledge of hygiene when washing textiles at home is limited. 34% of people “sometimes doubt if they are washing their clothes in the right way”[1].

Most people admit to not being “experts” in washing their clothes. Particularly for workwear, towels, table and bed linen…

As long as nothing serious happens, everybody seems to be on the safe side.

In reality, however, scientific publications indicate that textiles can be a vector for infective agents. Ignoring this could lead to severe problems and even death in certain vulnerable cases [See references 1-7].

In reality, hand hygiene, surface and textile disinfection as well as hygiene monitoring and quality control systems are key factors for hygiene.

In fact, even when special efforts are made to monitor and control hygiene for hygiene-sensitive environments, textiles are often neglected and left out of the picture.

This paper addresses the important questions concerning textile hygiene in order to help involved parties (employers and employees) to be on the safe side – every time.

[1] Source: Consumer Behavior while washing workwear at home, GFK, 2012, P107.

2. Legal requirements. Who decides on hygiene levels?

In European countries, hygiene levels for hospital linen are regulated by law.

According to the Regulation for personal protective equipment, instructions for storage, use, cleaning, maintenance, servicing and disinfection have to be given by the manufacturer. "Cleaning, maintenance or disinfectant products recommended by manufacturers must have no adverse effect on the PPE or the user when applied in accordance with the relevant instructions;" [8]

According to the Regulation on foodstuffs hygiene, "Surfaces in contact with food are to be in a sound condition and be easy to clean and, where necessary, to disinfect. This will require the use of smooth, washable, corrosion-resistant and non-toxic materials…" [9].

According to the Regulation of medical products, "information on the appropriate processes for allowing reuse, including cleaning, disinfection, packaging and, where appropriate, the validated method of re-sterilisation appropriate to the Member State or Member States in which the device has been placed on the market" have to be given. "Information shall be provided to identify when the device should no longer be reused, e.g. signs of material degradation or the maximum number of allowable reuses;" [10].

No private household is capable of fulfilling these requirements.

Furthermore national regulations of authorities like the recommendations of Robert Koch Institute need to be taken into account, where a certain level of hygiene and disinfecting washing procedures are defined as "the state of the art" [11,12].

3. Proper textile care for textiles used in hygiene-sensitive environments

By “hygiene-sensitive” environments we mean:

- Kitchens and food-processing
- Healthcare
- Elderly care
- Pharmaceutical area
- Cleanrooms

Can we be confident our textiles are sufficiently “clean” and “hygienic”?

The key requirement is to have a **validated disinfecting washing procedure** [See 1,4,5,13,14].

This can be achieved **chemically** (for temperatures up to 40°C), **chemically and thermally** (for temperatures usually between 40°C and 70°C), or **thermally** (temperatures above 80°C).

After cleaning and disinfection, the textiles need to **avoid re-contamination** during handling, drying, folding, transport and storage [13].

4. Is it possible to "disinfect" textiles in household washing machines?

Theoretically yes. In practice, this is difficult.

Theoretically, the following conditions could indeed be met to kill or inactivate bacteria, yeasts, fungi and viruses [6]:

- setting the announced temperature at 90°C in order to achieve a real temperature of about 80°C inside the washing drum
- achieving a sufficiently long holding time at high temperature (without falling below the holding temperature)
- correct concentration of detergents
- correct amount of textiles (kg) and water (l) in the washing machine and
- a proper handling of the textiles after washing and drying,

In practice, one or more of these conditions are often not fulfilled.

Moreover, there is a high degree of variations of parameters among different household washing machines, and indeed from washing load to washing load (even with the same machine).

Tolerance thresholds cannot be determined or are within such a broad range that processes are not reproducible or even repeatable anymore. It is therefore impossible to validate a washing procedure in a household washing machine in practice [6,13].

5. How reliable are the washing programs of household washing machines in terms of temperature?

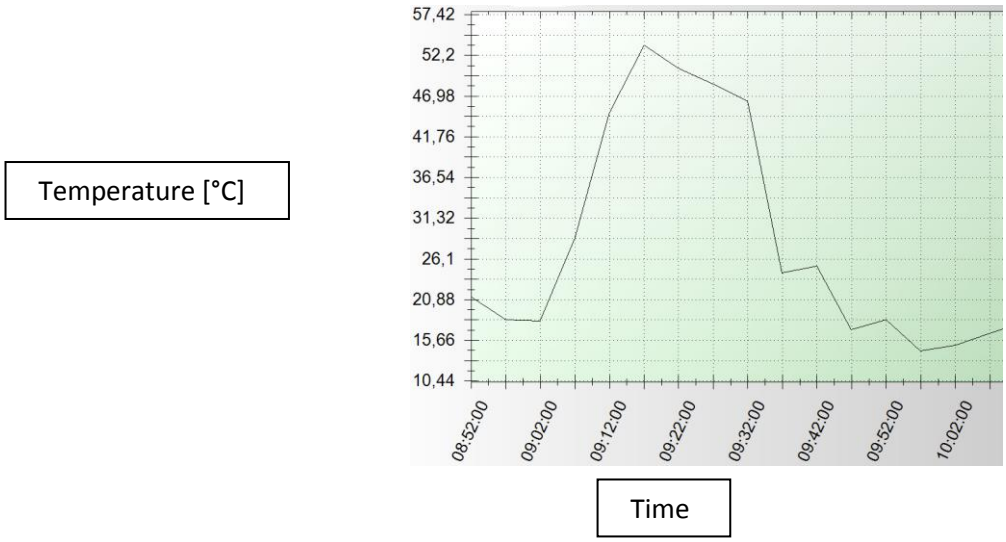
Domestic washing machines offer a pre-programmed choice of washing programs, often based on temperature and time.

Energy saving measures in modern washing machines mean that, the required 60°C are often not reached, nor maintained sufficiently long enough [6].

If a temperature of 60°C is not actually reached inside the washing drum or varies, a safe disinfection is not possible.

The figures below show the temperature of two different 60°C programs of two regular household washing machines as examples.

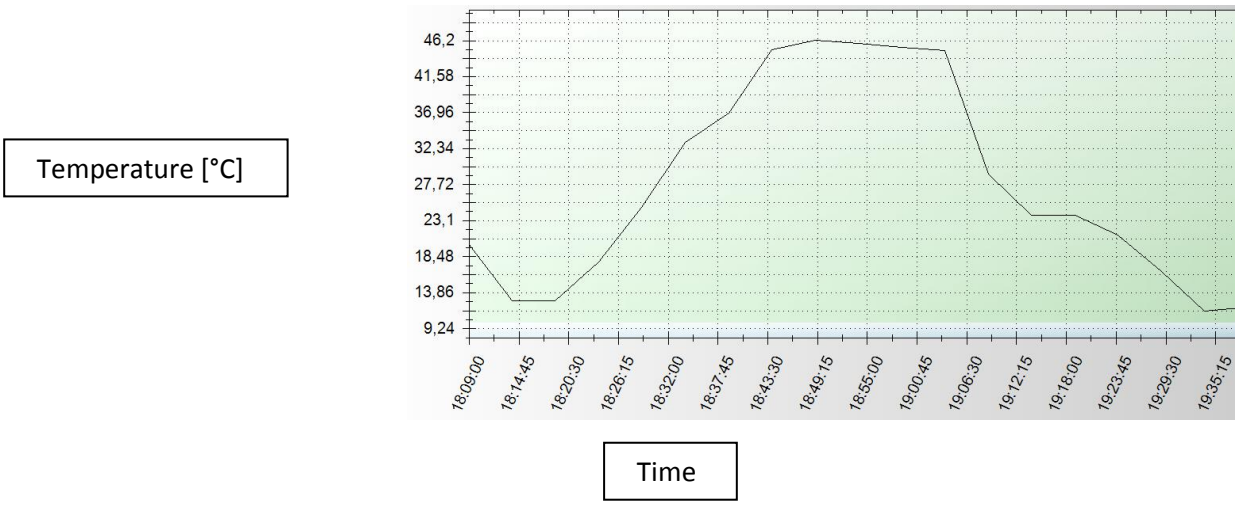
Example 1 - Washing temperatures of 60°C programs in a horizontal axis household washing machine



[Source: own investigations]

In example 1, the temperature rises to a short peak of nearly 55°C, and, over the next 15 minutes, falls to 47°C.

Example 2 - Washing temperatures of 60°C programs in a horizontal axis household washing machine



[Source: own investigations]

In example 2, the temperature reaches only 45°C for approximately 20 minutes.

In practice, domestic washing machines offer a variety of temperature and time profiles.

Moreover, there is also a wide degree of variation in terms of detergents and drying procedures.

This makes it difficult to follow strict washing and care instructions received from employers [7].

6. In conclusion - Can we be confident our textiles are sufficiently “clean” and “hygienic”?

Washing at home is not always as easy and efficient as we think in order to achieve hygienically clean results.

Soiled textiles can be a vector for infective agents.

Ignoring this could lead to problems, particularly in hygiene-sensitive environments.

The differences between “clean”, “hygienically clean” and “disinfected” are often overlooked.

Proper textile care for textiles is necessary for hygiene-sensitive environments and the workplace.

Despite the existence of European legislation for hygiene-sensitive environments, consumers are often left to decide on hygiene levels by themselves…

In comparison to professional laundry services household washing does not guarantee reproducible results.

Temperatures reached in household washing machines do not necessarily reach those announced in the pre-set programs.

Holding times differ from program to program and have a broad range of variation.

After a disinfecting treatment, the textiles need to be handled with caution to avoid re-contamination during handling, drying, folding, transport and storage.

Household washing machines are not manufactured to be compatible with professional quality management systems.

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Appendix 1 - Why is textile hygiene important?

Germs and bacteria in textiles, usually invisible, can lead to serious illnesses unless sufficient hygiene and disinfecting measures are taken when textiles are regularly cleaned.

The survival of microorganisms on textiles is well evidenced: bacteria can survive an inadequate laundry process:

- Food-borne; *Salmonella* sp. *Listeria* sp.
- Spore-bearing species associated with the food and healthcare environments; *Bacillus cereus* & *Clostridium difficile*
- Hospital-acquired infections (HAIs) associated bacteria both antibiotic and resistant strains: *Staphylococcus aureus*, MRSA, *E. coli & Pseudomonas* sp.

It has been shown that both *E. coli* and *S. aureus* can survive on cotton fibres for up to 21 days and seven days on polyester fibres. This leaves the **potential for cross-contamination to the home environment** and individuals pre-laundering, should highly contaminated textiles then be washed at lower than recommended temperatures (60°C) in the domestic setting bacteria are not only able to survive but also go on to cross contaminate other items in the wash (Riley *et al* 2017). Raising questions about the potential of these textiles to be the source of infectious disease in susceptible individuals.