Chemical Free Cleaning, Microfiber cloths and Cleanability

Leila Kakko[1, *], Kiti Suomalainen[2], Saara Vossi[1]

[1] Tampere University of Applied Sciences, Finland
[2] Lassila & Tikanoja Oyj, Finland

[*]*Corresponding email: leila.kakko@tuni.fi*

SUMMARY
This paper describes two studies, one in laboratory and another in hospital entranc area. The aim of laboratory research was not to clean surfaces completely but obtain results with a standardized method and compare cleanability. This research was conducted in laboratory to study cleanability of two different kind of laminate surface. In the hospital study the aim was to compare different kind of cleaning clothes and theirs cleaning results in different contact areas. There was a small difference in cleanability measurement between different waters but overall, the results did not differ much. Used microfiber cleaning cloths cleaned surfaces poorly compared to the new ones as expected. Depending on the dirt one must make choices what kind of microfiber cleaning cloth is best for different types of dirt. The hospital study results will be ready in spring 2022.

KEYWORDS
Pre-moist Cleaning, Hygiene, Surfaces, ATP-measurements

1 INTRODUCTION

In the 21st century, several studies have been published showing that microfibers are more effective to reduce dirt and dust than other cleaning textile materials, regardless of whether tap water or detergent solution has been used for moistening.

According to Bergen et al. (2008) study and Dancer & Kramer (2018) the microfiber cloth collects microbial dirt well from surfaces, but cleaner must turn the clean surface from the cloth when moving to a new surface. This is the best way to prevent microbes in the cloth from moving to a new surface. Not all microfiber cloths are comparable, and the word microfiber cannot be considered as a superior cleaning textiles. Moore and Griffith (2006) compared six different microfiber cloths. The study did not find any clear differences between cloths cleaning efficiency, but some small differences in characteristics were observed between those microfiber cloths. Based on these findings, it was found out that the material and the manufacturing process of the microfiber towel are relevant to its effectiveness as a cleaning tool. (Moore & Griffith 2006.)

Soubieux, et al. (2020) studied the ability of microfiber cleaning cloths to clean pharmaceutical residues from surfaces. The study examined the products alone and added disinfectant to them and increased mechanical pressure. The results showed that when cleaning with microfiber cloths, pharmaceutical residues decreased by more than 96% from surfaces.

Boyce's (2021) study tested microfiber cloths and standard cotton cloths with three different quaternary ammonium compound disinfectants. According to the test, cotton cloths did not

have sufficient disinfection effectiveness. Microfiber passed the tests by being effective with all three substances. (Boyce 2021.)

Moccia et al. (2020) investigated the difference between the traditional cleaning method, the mop and the dictation combination, and the difference in purity of the new cleaning method, the disposable pre-treated microfiber towel. Both methods used a disinfectant solution containing 70 % ethanol. The purpose of the study was to investigate the benefits of the new cleaning method. When analysing the results, it was immediately found out that the new pre-treated method of cleaning different surfaces reduced the number of bacteria by up to 90%, compared the traditional method when the reduction of bacteria was only 10%. In the study, the microbial load of the floor decreased by 76% with the new method, while the traditional method reduced the microbial load by only 33%. The study also found that the new cleaning method was able to reduce the risk of falling and slipping on floors due to the lower amount of water on the floors and faster drying of the floor. The study found that the new method will make work safer, more ergonomic, and lighter for staff. The study suggested that the method should be added to the guidelines for infection control.

Gillespie et al. (2019) conducted a study in Australia at health care sites in the state of Victoria, monitoring norovirus infections over an 11-year period between 2006 and 2016. The aim of the study was to improve infection control practices in Monash Health Hospital in the state of Victoria. The hospital wanted to switch to chemical-free cleaning. Since 2015, Monash Health Hospital have been cleaned using ultra-microfiber cloth and tap water alone. Steam was also used in the final cleanings. Norovirus infections recorded at Monash Health Hospital were compared between 2006 and 2016. Even though disinfectants had been completely excluded from daily cleaning, the number of norovirus infections in 2016 was 95% lower than in 2006. With the results, the simpler cleaning method, just using microfiber, and water, continued.

An international survey on cleaning practices for health care conducted in 2018 revealed that 65% of the respondents had microfiber cleaning textiles in use. However, microfiber studies are often contradictory. Microfibers are shown to effectively remove microbial loads from surfaces, but they may transfer microbes to others on surfaces while wiping several different surfaces with the same towel. In addition, microfiber cloths are several different and their effectiveness and results vary. (Kenters, et al. 2018.)

2 MATERIALS/METHODS

2.1 Laboratory study

The aim of laboratory research was not to clean surfaces completely but obtain results with a standardized method and compare cleanability. This research was conducted in TAMK (Tampere University of Applied Sciences) laboratory.

Two different types of laminate were used as a surface material to be cleaned, one basic laminate worktop and another with antibacterial finish. Laminated tabletops samples were ready cut-from the factory. Samples were wiped clean with microfiber cloths moistened with tap water before starting the tests.

Selected microfiber cloths were Vileda Professional's Micron Quick and Microtuff. Those were the most popular used microfiber cloths in Finland. Also used MicronQuick cloths were tested. New cloths were prewashed using manufactures instructions.

Used chemicals were: Ultra H_2O water, Tersano SAO ozone water, tap water and a cleaning solution with low alkaline concentration.

There were two different soils in the study. One with protein to be measured with ATP-method and the other one to be measured with spectrophotometer, very dark soil, called "Liesimusta".

The laminate tiles were soiled with the Erichsen washability and scrubbing resistance tester. Luminometer and spectrophotometer were used to measure the cleanability.

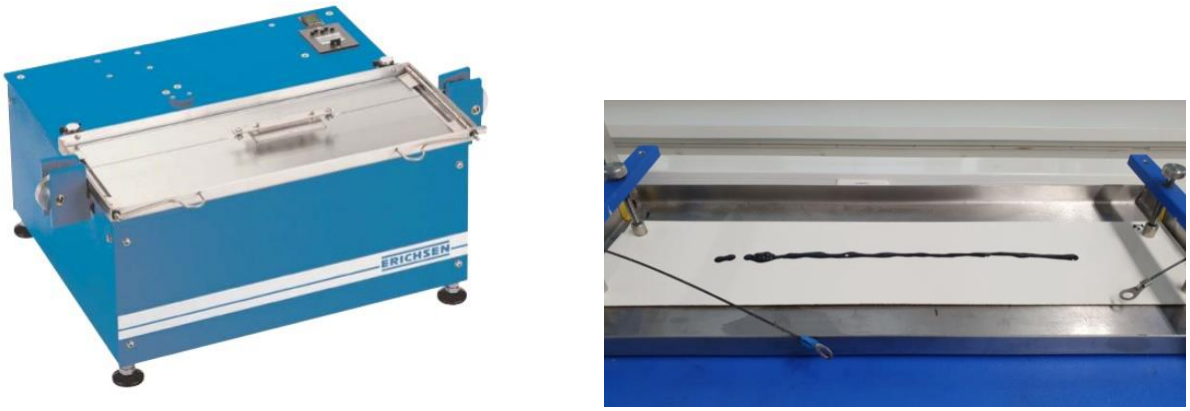

Figure 1. Erichsen washability and scrubbing resistance tester (Erichsen 2002) and soiled laminate surface.

2.2 Hospital study

The aim of the study was to compare different kind of cleaning cloths and theirs cleaning results in different contact areas. The study was performed in the entrance hall of Turku City Hospital.

There were three different cleaning cloths, two cloths made of microfiber (Taski Jonmaster Ultra Cloth and TaskiSum) the third (Taski Allegro Light) made of no-woven fibres.

The targets to be studied were the customer chair in the hospital entrance hall, the invitation button on the elevator and the door handle of the toilet. The surface materials of the study were the varnished wood, plastic, and metal surface.

In the study, surface cleaning samples were taken from surface materials in triplicate, three customer chairs, three lift call buttons and three toilet door handles.

The surfaces were cleaned more than 12 hours earlier. Samples of each surface were taken before and after wiping. The study was conducted with each cloth for two weeks. In the first week of research, the cloth was moistured with just tap water alone. In the second week of the study, the cloth was moistured with Jontec Profi detergent solution. The detergent solution was made in proportion to one milliliter of detergent to one litre of water. All cloths were pre-treated according to the manufacturer's recommendations.

Surface cleanliness was measured with a 3M CleanTrace luminometer.

3 RESULTS AND DISCUSSIONS

3.1 Laboratory study

Three parallel tests were conducted on the materials except with all-purpose cleaner only two tests were carried out because of lack of surface material. Total amount of tests was 138, so 66 tests were made for normal laminate surface and for antimicrobial laminate surfaces 72 pieces. Cleanability average values were calculated to assess the difference.

3.1.1 Cleanability from protein soil

The ATP measurements were done with Hygiena Plus luminometer before and after cleaning, each patch at two different points. Those results were tabulated, and the average of all values was calculated. Using ATP measurements, the value is better when it is near zero point.

The new MicronQuick cloth was the best when using Ultra H_2O water, both the basic laminate surface and the antimicrobial laminate. The averages were close together. Averages of other waters varied more.

In the mean values of cleanability, the difference between normal laminate surface and antimicrobial surface can be seen. Antimicrobial nano-coating prevents dirt from attaching to the surface more efficiently and the results are more evident with other solutions than Ultra H_2O. Example of results can be seen in Figure 2.

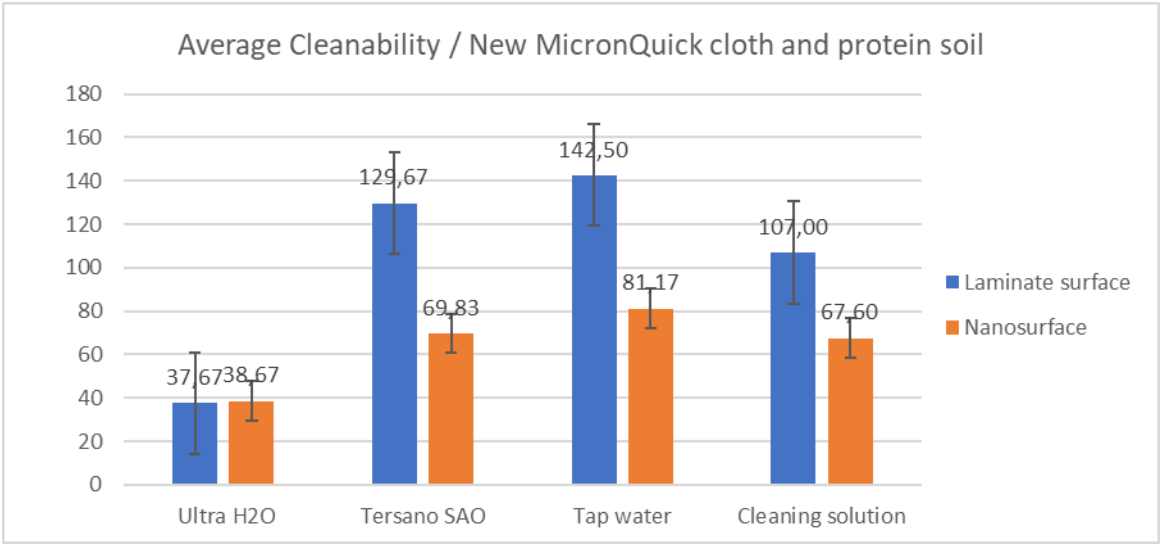

Figure 2. Average cleanability using new MicronQuick cloth and protein soil

3.1.2 Dark soil

Dark soil was measured using a spectrophotometer with the lightness value, L*, also referred to as "Lstar," defines **black at 0 and white at 100**. The surface cleanability can be calculated just L* value after cleaning – L* value after soilingcompared to the soaked starting point.

The best remover of dark soil was new MicronQuick microfiber cloth with cleaning solution and the worst was Tersano SAO. Nano-coated laminates the best cleanability was with Ultra H_2O water wiped and worst tap water. Nanocoating helped the cleanability altogether.
The smallest difference in readings between the laminate and nano-coated laminate was in tap water, the difference was only 5.12. Example of results can be seen in Figure 3.

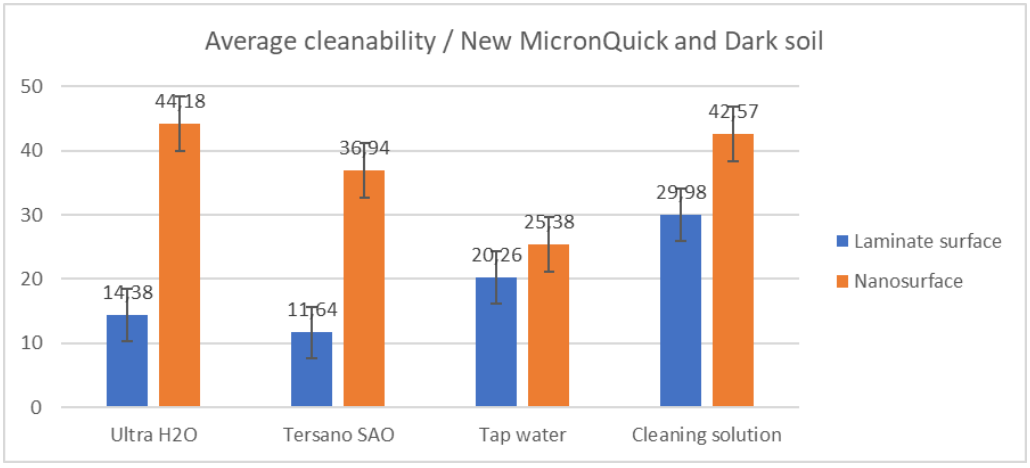

Figure 3. Average cleanability using new MicronQuick cloth and dark soil

3.2 Hospital study

Totally 358 surface samples were taken with the 3M CleanTrace luminometer. Before cleaning, 88 samples and 270 samples after cleaning.

The average result of all cleaning equipment was acceptable when the manufacturer's limit of 250 RLU for healthcare was used for the results obtained. There were no major differences in the surface cleanliness results of the different cloths, but the superiority of the multiple use microfiber cloth was clearly noticeable. Figure 4 describes the mean results of surface cleanliness after cleaning. The disposable microfiber cloth and nonwovens cloth were quite equal, with the disposable cloth working better moistured with water and the nonwovens cloth better treated with detergent. More results of the hospital study will be released before summer.

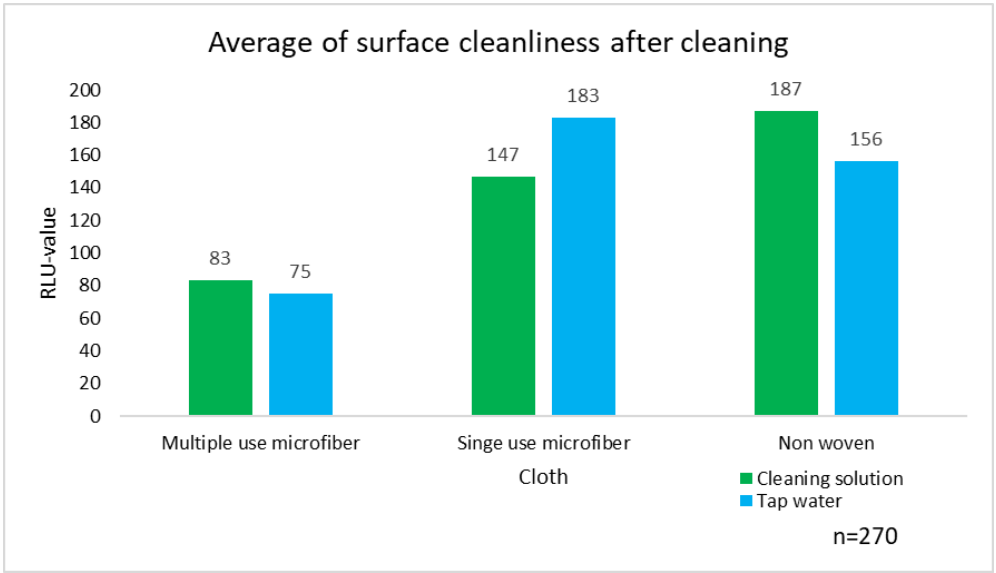

Figure 4. Average surface cleanliness

4 CONCLUSIONS

4.1 Laboratory study

Overall, there were no major differences in the purity of the different waters. All the waters cleaned the surface from the starting point both visually and based on measurements. However, it was surprising how well, after all, tap water alone cleaned surfaces with different microfiber cloths. The question arose could the microfiber cloth alone make surfaces clean enough? There should be more comprehensive studies in longer term.

The new MicronQuick cloth, as a rule, cleaned the surfaces better than the used one. The cleansing of the microfiber cloth depends on how worn it is and how it has been maintained and how clean the microfiber cloth has been obtained after washing. If the dirt is not cleaned properly from the microfiber cloth during washing process, it will no longer be able to catch t dirt and then it will not work as it should. For this reason, it is advisable to invest in the maintenance of microfiber cleaning equipment to maintain the cleaning efficiency of microfiber cloths for as long as possible, thus sparing costs and cleaning ecologically.

4.2 Hospital study

The multiple use microfiber cloth was the only one to achieve approved of all surface purity samples. The best results were obtained with a multiple use microfiber cloth pre-moist with a detergent solution. Nonwoven's cloth, the cleanest results came after it was pre-moist with a detergent solution but when using only water to pre-moist the results were the worst of surface purity. Based on the results, the nonwovens cloths always need the detergent to make surface clean enough. According to this, it can be concluded that the detergent is relevant for the purity result. All the best results came with detergent pre-moist cloths. But the multiple use microfiber cloth works well enough just with tap water, so could it have used like that as well?

4.3 What to do next?

All together there is still need for new studies concerning using microfiber cloths with and without chemicals. In these two studies no costs were calculated, and no user experience was gathered. In these studies, can be seen the efficiency of microfiber cloths, even the used ones as well as those single use microfiber cloths. When using ATP-measurements the limits vary depending on the manufacturer of the device, so either the device should be mentioned or should researchers use femtomoles instead of RLU-values?

ACKNOWLEDGEMENT

We would like to thank Diversey Finland, ISKU Ltd, OrboTech Finland and Vileda Professional Finland as well as Turku City Hospital to help us to make these studies.

6 REFERENCES

Bergen, L.K., Meyer, M., Høg, M., Rubenhagen, B. & Andersen, L.P., 2009. Spread of bacteria on surfaces when cleaning with microfibre cloths. Journal of Hospital Infection, 71 (2), s.132-137.

Boyce, J.M. 2021. A review of wipes used to disinfect hard surfaces in health care facilities. American Journal of Infection Control, 49 (1), s.104-114.

Dancer, S.J. & Kramer, A. 2018. Four steps to clean hospitals: Look, Plan, Clean and Dry. Journal of Hospital Infection 103 (1) e1-e8.

Erichsen. Washability and scrubbing resistance tester model 494. 2002. Read 22.11.2020. https://www.yumpu.com/en/document/read/15352293/washability-and-scrubbing-resistance-tester-model-494-labex

Gillespie, E., Lovegrove, A. & Kotsanas, D. 2015. Health care workers use disposable microfiber cloths for cleaning clinical equipment. American Journal of Infection Control. 43 (3), s.308–309.

Kenters, N., Gottlieb, T., Hopman, J., Mehtar, S., Schweizer, M.L., Tartari, E., Huijskens, E.G.W. and Voss, A., 2018. An international survey of cleaning and disinfection practices in the healthcare environment. Journal of Hospital Infec-tion, 100 (2), 236–241.

Moccia, G., Motta, O., Pironti, C., Proto, A., Capunzo, M. & De Caro, F. 2020. An alternative approach for the decontamination of hospital settings. Journal of Infection and Public Health, 13 (12), s. 2038-2044.

Moore, G. & Griffith, C., 2006. A laboratory evaluation of the decontamination properties of microfibre cloths. The Journal of Hospital Infection; J Hosp In-fect, 64 (4), s.379-385.

Soubieux, A., Palamini, M., Tanguay, C. & Bussières, J-F. 2020 Evaluation of decontamination strategies for cyclophosphamide. Journal of Oncology Pharmacy Practice. 26 (2), 413–422.