

Investigating the use of nanofibers for skin decontamination

L. Frazier and J. Lademann

Abstract:

Stimulation of the penetration of topically applied substances into the skin is a topic of intensive dermatological and pharmacological research. Next to intercellular penetration, i.e. a penetration inside the lipid layers around the corneocytes, follicular penetration also represents an efficient penetration pathway. The hair follicles act as a long-term reservoir for topically applied substances. They are surrounded by or contain several important target structures, such as blood capillaries, stem cells and dendritic cells. Therefore, the hair follicles have to be well protected from hazardous substances coming into contact with the skin. The traditional method of decontamination of the skin involves an intensive washing procedure. However, this process represents a massage, which pushes the hazardous substances even deeper into the hair follicles.

In the present study, the application of absorbing materials for decontamination of the skin was investigated after the application of a model substance utilizing the tape-stripping procedure as well as *in vivo* laser scanning microscopy (LSM). It was found that absorbing materials are better suited than the washing process for decontamination of the skin.

Methods used to decontaminate skin^{1,2}

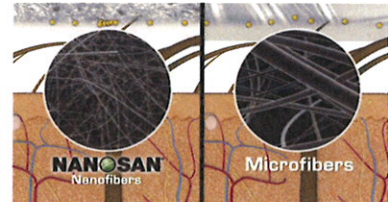
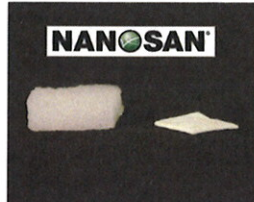


Pressing absorbent material on skin for 30 seconds



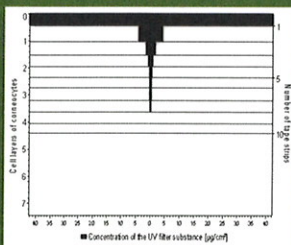
Hand-washing with soap and water for 5 minutes

Materials- Hydrophilic polyurethane nanofibers

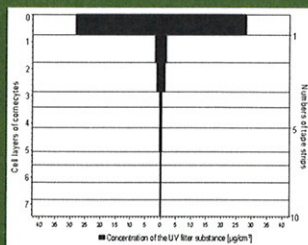


Results using tape-stripping method¹

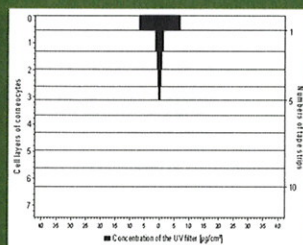
Penetration profile of the model substance into the skin



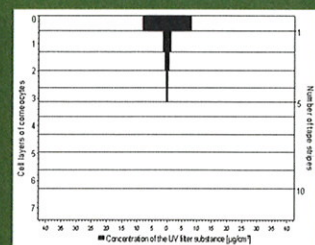
Distribution of the model substance in the stratum corneum after washing



Distribution of the model substance in the stratum corneum after decontamination with absorbent material A



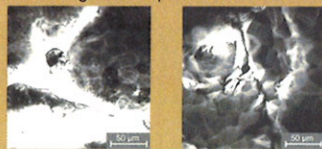
Distribution of the model substance in the stratum corneum after decontamination with absorbent material B



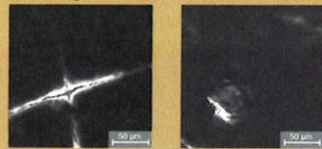
Results using *in vivo* laser scanning microscopy (LSM)²

After washing with soap and water for 5 minutes

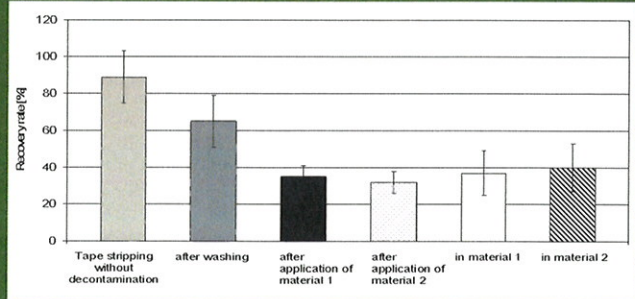
No decontamination



After pressing with absorbent material for 30 seconds



Amounts of the topically applied model substance in the stratum corneum without decontamination and after decontamination by different treatments (washing, application of the absorbent materials A and B)



Conclusion:

Absorbent materials are well suited to decontaminate the skin surface from hazardous substances. In contrast to washing of the skin, the application of absorbent materials prevents further penetration of the substances into the hair follicles. This is of high importance, because the hair follicles represent an efficient long-term reservoir for topically applied substances, where the sensitive skin targets are located and require protection. Furthermore, the results of the study demonstrate that *in vivo* laser scanning microscopy is an efficient tool for the evaluation and optimization of decontamination procedures of the skin.

References

1. Decontamination of the Skin with Absorbent Materials
J. Lademann, A. Patzelt, S. Schanzer, H. Richter, I. Gross, K. H. Menting, L. Frazier, W. Sterry, C. Antoniou
2. *In vivo* laser scanning microscopic investigation of the decontamination of hazardous substances from the human skin
J. Lademann, A. Patzelt, S. Schanzer, H. Richter, I. Gross, K. H. Menting, L. Frazier, W. Sterry, C. Antoniou



Skin without decontamination at different depths

