Smart indicator textiles and nonwovens for detection of pH on skin and in wounds
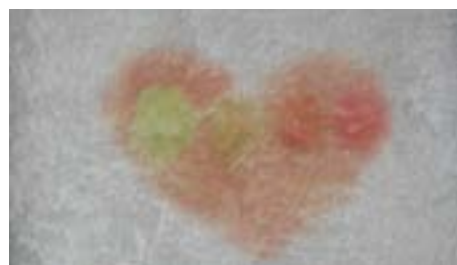
Gerhard J Mohr
Joanneum Research, Austria

Statement of the Problem: The acid mantle of the skin has a pH of about 5.5, which is slightly acidic. This protects the skin against bacteria, fungi and dryness. Therefore, skin-friendly (so-called pH skin-neutral) detergents, shampoos and shower gels have a slightly acidic pH. Soaps and low-cost cleaning products however, are often alkaline (pH above 8), which can lead to skin irritation in both infants and dermatitis patients. Alkaline washing agents used for laundry with pH values above 10.0 can also cause skin irritation if clothes are not rinsed properly or if too much washing agent is used. Furthermore, wound pH is a relevant parameter for monitoring progress of wound healing. The purpose of this work was to develop a simple method to detect undesirable changes in pH via color changes from green to red.

Methodology & Theoretical Orientation: Textiles and nonwovens were covalently functionalized with indicator dyes that change color when pH causes skin irritation or is too high for proper wound healing. The colored nonwoven is not cytotoxic and all textiles were certified by OEKO-TEX® Standard 100, class I.

Findings: Indicator washcloths show a visible and fully reversible color change from green (ideal pH) to red (irritating washing solution). Indicator labels show a color change when clothes contain residual amounts of alkaline washing agents. Indicator cotton swabs show a color change to red when wound treatment may be necessary. The color changes can be interpreted by the naked eye as well as by an optical color measurement device.

Conclusion & Significance: Smart indicator textiles enable the determination of pH in washing agents, on the skin, and in wounds. The convenient format and easy interpretation make indicator textiles and nonwovens helpful for assisted living, consumer care and medical diagnostics.

Biography

Gerhard J Mohr received his PhD in Chemistry (1996) at Karl-Franzens University Graz in the field of optical sensors for anions. Then, he moved to the Centre for Chemical Sensors at ETH Zurich where he was engaged in the synthesis and characterization of new chemo-sensor dyes and functional polymers. From 2001 until 2008, he was Marie Curie and Heisenberg fellow at Friedrich-Schiller University Jena and from 2009 to 2011. He established and led the Fraunhofer workgroup Sensor Materials in Regensburg, focusing on new functional dyes, fluorescent nano-sensors and their combination with polytronic systems. Currently, he is Senior Researcher at Joanneum Research developing new indicator dyes for textiles and nonwovens and combining them with information and communication technology.

gerhard.mohr@joanneum.at

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