Shape-retaining organic nanoparticles for superhydrophobic coatings

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The self-cleaning effect and superhydrophobic surface of some plants and insects (such as the Lotus leaf) is the result of low surface energy and a unique dual-size surface topography[1]. The hydrophobically structured surface minimizes the contact area between the surface and a water droplet. As a result, water cannot spread out and water droplets roll around removing dirt particles on the surface. This effect opens the door to a large list of potential applications going from waterproof textiles to stain resistant paints. But despite all the interest and amount of work devoted to this research area very few commercial products offering water repellent surfaces/products are available. The main challenge is to build stable and mechanically resistant nanostructured coatings that provide long-term hydrophobicity and self-cleaning properties.

The objective of this work is to obtain nanostructured textiles with good water, oil and stain repellency and high wash fastness. These textiles should be easy to clean and dirt particles should not adhere to the surface so that they can be easily cleaned off. Such textile coatings/finishes can be used for the protection of everyday items, such as apparel, home textiles and industrial fabrics.

The biggest challenges to develop such coatings are to achieve a high fash fastness and a smooth touch, and in this respect nanotechnology plays a very important role:

- A minimum load of chemicals is important for a smooth touch. This can be achieved thanks to nanoparticles, since a thin coating will not affect the breathability and touch of the fabrics.
- The particles must be evenly distributed, avoiding agglomeration or migration, in order to provide high effectiveness.
- Good particle adhesion onto the textile is a key point to achieve a high wash fastness and mechanical resistance.
- Coating with nanoparticles has as additional advantage that the particles cannot be detected by human eye, and therefore, no changes in the colour of the textile are observable.

In addition to all these points, the treatment with nanoparticles should be cost effective and have a better performance versus established fluorocarbon chemistry and be easy and safe to apply, with no health risk for the customers/end users.

Following a newly developed concept, based on shape-retaining organic core-shell nanoparticles (prepared via emulsion polymerization), we could produce nanostructured cotton fibres, with high wash-fastness (up to 30 home laundries). The resulting textiles show better water and oil repellency than standard fluorocarbon emulsions and a self-cleaning effect. Thanks to the thin coating and the small size of the particles, the breathability and touch of the end fabrics are not affected. Abrassion tests on non-treated and nanostructured cotton fabrics showed no exposure to nanoparticles: all the coatings had an excellent particle adhesion.

References

(1) Neinhuis, C.; Barthlott, W. *Ann. Botany* **1997**, *79*, 667.