Microencapsulation in textiles

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Introduction

The consumer's needs, demands and expectations of a healthier and more comfortable life are greater every day even when it comes to clothing. Today textiles can be treated so that they protect one from all kinds of adverse conditions yet at the same time are comfortable. The properties of textiles and their offer are increasingly diverse. Clothes can be water resistant, anti-microbial, non-flammable etc. This kind of properties can be achieved with special chemical compounds that are bound to the surface of the fibre by different techniques like padding, coating, immersion, etc.

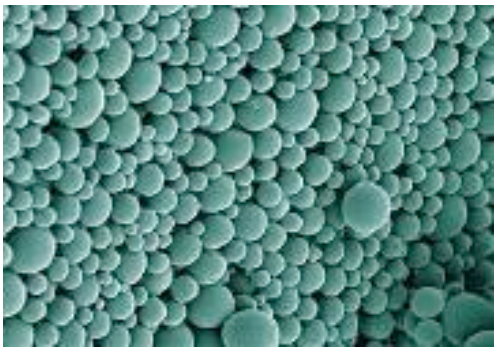
One of the processes as a mean of applying different finishes and properties on textiles is microencapsulation.

The use of microencapsulation in the textile industry keeps on growing especially in the textile industries of Western Europe, Japan, and North America (Nelson 2002).

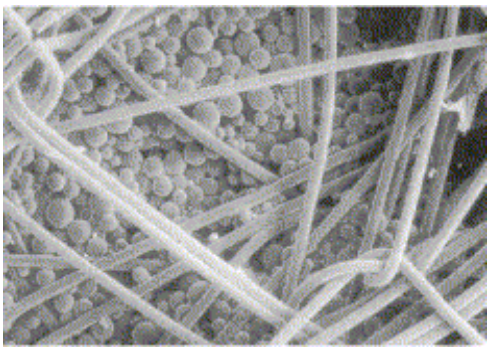
Microencapsulation

Microencapsulation is the cost effective and long lasting method in storing volatile substances over a long period of time (http://www.celessence.co.uk/micro.htm, 2000]). Microcapsules are available with a wide range of products. These products have different properties related to the nature of the encapsulated substances.

Microcapsules are small particles a size of between one and several hundred micrometers composed of liquid, solid or gas core and a coat, which protects the core material from external conditions. The intention of microencapsulation besides the protection of core substances is also separation of the reactants, controlled release, reduction of toxicity, reduction of volatility, etc.



a



b

Figure 1: a) microcapsules, b) microcapsules coated on the surface of fabric

The polymer used for the coat may be natural or synthetic and it depends of the coat if microcapsule is permeable or not. Regarding to the purpose of use the suitable microcapsules are chosen.
The impermeable coats can be ruined by:

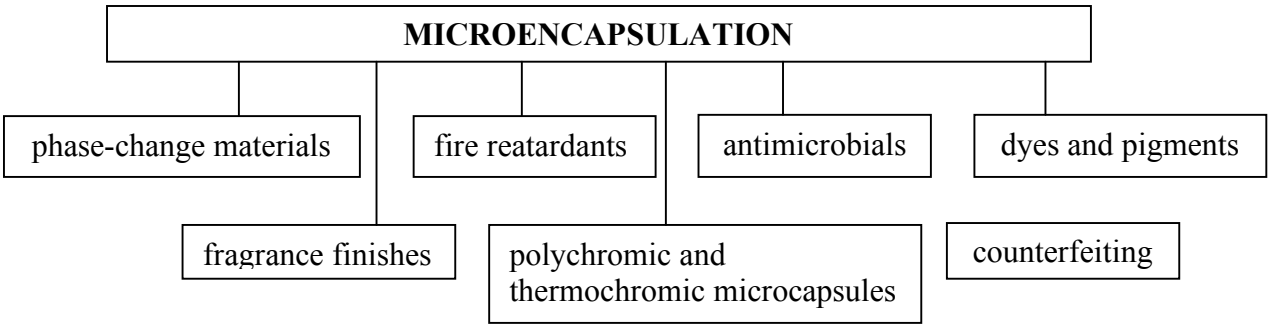
- outer force
- high temperature,
- light
- solvent or water

In other words they can break, melt or burn down, decompose, dry up or dissolve. In medicine the impermeable capsules containing medicament are used. They dissolve at the appropriate pH value and the active substance is released (Leskovšek, 2005).

The permeable coats of microcapsules continually release the core substances. The release can be slow or sustained (Leskovšek, 2005).

Microcapsules can be applied to textiles by padding, coating, spraying or immersion. For all these methods a binder is required. It may be acrylic, polyurethane, silicone, starch, etc. Its role is to fix the capsules onto the fabric and to hold them in place during washing and wear. Microcapsules can be applied to silk, cotton, synthetic fibre, etc. and may contain perfumes, dyes, antimicrobials, phase change materials, vitamins and other substances (http://pro.wanadoo.fr/euracli/en/textile.htm, 2000).

The use of microcapsules in textiles



Phase-change materials

The intention of microencapsulation of phase-change materials is to reduce the influence of extreme variations in temperatures. Phase-change materials are materials that change the aggregation from solid to liquid within certain range of temperature. In this way the thermoregulation of clothing is achieved and the constant temperature is provided. PCM capsules were first applied by the NASA in the early 1980s for use in space suits. Today these kinds of microcapsules are applied to different materials, vests, parkas, snowsuits, blankets, mattresses, duvets etc (Nelson, 2002).

Fragrance finishes

Numerous trials have been made at adding fragrances directly to fibre and fabrics, but the aroma vanished after one or two wash cycles. By the use of microencapsulation fragrances are able to

remain on fabric for a longer period of time. Microcapsules may contain essential oil flavours like lavender, rosemary, pine and other for the effect of aromatherapy. This is used mainly to help with insomnia, headache, and to prevent bad odour. The Slovenian producer Aero Celje has developed microcapsules with essential oil that were applied to shoe sock (Leskovšek, 2005).

Vitamins and moisturisers are also applied to all types of textile substrates, including hosiery and underwear.

Fire retardants

Fire retardants applied to textile products often cause the reduction of softness. To conquer these problems microcapsules with fire retardant core were developed. They are applied to fabrics used in military applications like tentage (Nelson, 2002).

Polychromic and thermochromic microcapsules (colour-changing technology)

The application of polychromic and thermochromic microcapsules can be found in textiles like product labelling and medical and security applications. One of the colour changing systems changes colour in response to temperature, this is thermochromatic and the other changes colour in response to UV light, the photochromatic. Today even microencapsulated thermochromathic dyes are produced that change colour at specific temperature - in response of human contact (Nelson, 2002).

Antimicrobials

Bacteria are often related to the notion of bad smell or disease and in textile industry the loss of useful properties of fabric often refers to microbiological decay of fibres. To prevent this problem the importance and demands of antimicrobial finishes continue to grow, especially for textiles for medical and technical use. To realize these functionalities, nanotechnology offers a lot of new possibilities (http://www.flok.ru/news/FLOCK%20News_7.2006_e.pdf, 2006).

Antimicrobial finishes can be applied to textiles also by microencapsulation. The release of active substances of microcapsules with antimicrobial agent is slow or sustained.

Textiles with antimicrobial finishes are known in the market by different names, like Bacterbril, Biofresh, Terital, Trevia Bioactive, Amicor etc (Leskovšek, 2005).

Counterfeiting

Microencapsulation can be used to deal with the problem of illegal copying in high added value textiles and in branded and designer goods with providing a hidden yet clear marking system. Microcapsules applied to label contain a colour former or an activator. By the use of UV light or a solvent, microcapsules break open, the content is released, colour is developed and in this way detection is achieved (Nelson, 2002).

Conclusion

The possibilities of application of microcapsules to textiles described in this paper are just some of the most interesting. Today there is almost no field where microcapsules would not be presented. Encapsulation became a very powerful tool, because it is invisible and comes to life at the slightest touch.

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