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Microencapsulation - A Technique for Intelligent Textile

KEYWORDS

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ABSTRACT *Microencapsulation is a smart technology used in technical textile to create smart and intelligent textiles which have various function. Microcapsules are used which are made of ethyl cellulose, resin and gelatin, which contains various active ingredients such as perfumes, deodorants, moisturizer, vitamins, nutrients medicinal ingredients etc. These microcapsules are applied on textiles with various mediums such as spraying, coating, and padding.These microcapsules release their contents at appropriate time by using different release mechanisms, depending on the end use of encapsulated products. This technology has been used in several fields including pharmaceutical, agriculture, food, printing, cosmetic, textile and Defence.This review paper highlights the major reasons behind microencapsulation, important techniques of microencapsulation and application of microencapsulated products in different areas of science and technology.*

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 are increasingly diverse. Clothes can be water resistant, anti-microbial, and nonflammable 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.

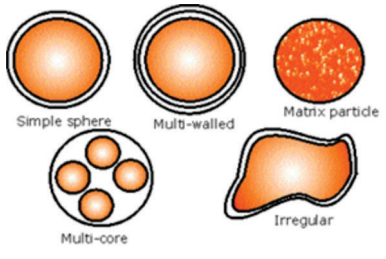
One of the processes as a means of applying different finishes and properties on textiles is microencapsulation.

The use of microencapsulation in the industries keeps on growing especially in the textile industry.

1.1 Microencapsulation

Micro-encapsulation is a process in which tiny particles or droplets are surrounded by a coating to give small capsules many useful properties. In its simplest form, a microcapsule is a small sphere with a uniform wall around it. The material inside the microcapsule is referred to as the core, internal phase, or fill, whereas the wall is sometimes called a shell, coating, or membrane. Most microcapsules have diameters between a few micrometers and a few millimeters.

Microencapsulated fabrics are among the latest generation of intelligent textiles. Microencapsulation involves encapsulating liquid or solid substances in tiny thin-walled natural or synthetic bubbles. Microspheres gradually release active agents by simple mechanical rubbing, which ruptures the membrane over time.



Microcapsule shapes

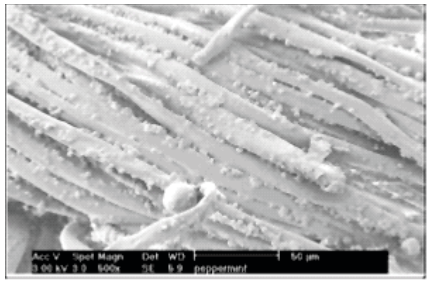
Source – Microcapsules Innovations

1.2 Ways to Apply on Textile

- In the polymer
- Physical containment
- On the fabric by padding
- In a coating
- Spraying
- Transfer printing
- Injecting into the yarn

For all these methods a binder is required. It may be acrylic, polyurethane, silicone, starch etc. Its role is to fix the capsules into fabrics and to hold them in place during wash and wear.

The textile fibers on which microcapsules are used are cotton, silk, nylon, polyester, natural leather, artificial leather, woven, knits, Non wovens etc. Also it can be applied to all kind of clothing such as suits,casuals, underwear,shirts, blouses,socks, stockings, handkerchieves, gloves etc.



Electron micrograph of fabric after padding aroma capsules (Source –Microencapsulation in Textile Industry by Slavica Siler Marinkovic, Dejan Bezbradica,Petar Skundric)

1.3 Microcapsules can contain

- A perfume, scent
- A active ingredients for cosmetic textiles (Moisturizer, Freshner, Toner)
- An odour absorbing product, Deodorants
- Bactericides, acaridices, insect repellents.
- Dyes or ink
- PCM(Phase Changing Material)
- Vitamins, Nutrients,
- Drugs ,Pharmacological Products,
- Enzymes
- Fire Retardants
- Water proofing agents
- Anti-Microbial

And the material for coating used are

- Ethyl cellulose
- Polyvinyl alcohol
- Gelatin

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- Sodium alginate
- Resin

1.4 Application of Microencapsulation Techniques in Textiles
Microencapsulation adds quality to the products of textile Industry because, encapsulation works inside the fabric, filling the spaces between the fibers with an ultra-thin layer of polymer that is breathable, yet impermeable to both water and wind. Encapsulation imparts greater water repellency, abrasion resistance and stain resistance.

Polyamide resins, urea resins, guanamine resins melamine resins are used for encapsulation.

1. Textiles with Temperature Control – It was used in 1980 by NASA for space suit to manage the thermal properties & help in maintaining body heat. For this purpose Phase Changing Material (PCM) are used. Phase Changing Material encapsulates paraffin based Phase Changing Material (PCM) in plastic shells. The PCM below 37°C remains in solid state, above this temperature it turns into liquid, storing surplus body heat .When it solidifies again, the PCM releases body heat stored in the plastic shells and distributes it evenly around the body. The fabrics treated with PCM microcapsules are capable of storing at least 10 times more heat than untreated product. It is used in vests, snowsuits, blankets, mattresses etc.

2. Textiles with Sunscreen and Antioxidants –Exposure to UV rays is a health hazard and prolonged exposure can cause skin cancer. These rays passes the cloth and it is not safe for children, soldiers and people who work outside. Therefore protective clothes are developed with sunscreen in microcapsules. An organic sunscreen (e.g. Octyl-Methoxy- cinnamate and oxybenzone) is encapsulated. Along with sunscreen Vitamin E is also used.

Vitamin E is encapsulated and applied to fabrics that directly contact the skin, such as underwear, T shirts, shirts, blouses, stockings, socks, gloves. This microcapsules are broken upon friction with the skin and vitamin E is absorbed.

3. Microencapsulation in Cosmetic Textiles – Vitamins, essential oil (Lavender, Aloe Vera) anti-ageing agents, skin cooling agents are used in cosmetics textiles though microencapsulation. Shower and bath gels often use microcapsules for controlled release fragrance, moisturizer and vitamins. The active ingredients are encapsulated and are released by different mechanism. One method is light friction created between the microcapsules and the skin. After rubbing the active ingredients are released and absorbed by the skin.

The cosmetic textile treatment can be applied to a wide range of fabrics for bedding, underwear, T-Shirts, stockings and socks.

4. Fire Retardants – Microencapsulation technique is used to improve the safety of the fabrics. Microencapsulation fire retardants Di- Ammonium Hydrogen Phosphate is applied on cotton, cotton –polyester in various fields such transportation, jackets, tents, military application and fire proof fabrics.

5. Polychromic and thermo chromic Capsule – It changes the colour with changes in temperature and light. The fabrics are not thermo or photochromic but their microencapsulated colorings are. Photochromic ink change from clear when indoors to coloured when taken outdoors. They change colours in response to exposure to UV light from sunlight, black lights etc.

UV lights changes the chemical structure of PC materials and makes it absorb colours like dyes. One of the example is colour changing T shirt.

The product with microcapsules changes its colours as the temperature rises and changes back to its original colours as the temperature falls. It can be used in printing, fabric dyes, brochures, cups etc.

Microcapsules with thermochroic active substances can be applied to bandages in order indicate an increase in temperature of wound area.

6. Textile with Fragrance – Microcapsules contain essential oil flavors like Lavender, rosemary, pine for aroma therapy. Textile may also contain the smell of branded perfume. These fragrances can survive around 20 to 25 washing cycle. The microcapsules comprise natural and synthetic fragrances, perfumes, scents, essence and rupture by an adequate abrasion and emit fragrance.

7. Antimicrobials – Bacteria in the cloth leads to bad smell or disease and loss of textile properties is related to microbial decay of fibers. Antimicrobial finishes in the form of micro capsules can be applied to the textile.

8. Insect proofing agents- Textiles containing keratinous material are highly susceptible to attack by the larvae of clothe moths. The damage to the woolen textiles by moth larvae throughout the world is estimated to cost millions of dollars. The damage more commonly occurs from carpet beetles. Insect resisting agents whether synthetic or natural can be applied by microencapsulation technique to protect woolen textiles from moths.

9. Medical Uses of Microencapsulation – The antibiotic microcapsules and other healing substances in bandages provides the prolonged release of these compounds and infrequent changes of buildings. They are used in treatment of dermatological conditions, such as eczema and inflammation associated with leg ulcers. Due to this new technology bandages may be left in position for upto 2 weeks. Zinc oxide is the main ingredient and along with this other ingredient includes calamine, coaltar (a fungicide),clioquinol and ichthammol (antibacterial) and parahydroxy Benzoates (parabens) are used. Researchers at University of Rochester, New York, USA are developing a developing a bandage that changes colour according to type of bacteria Present in the wound. The bandage will instantly diagnose which kind of Antibiotic will work on it.

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.

REFERENCES –

1. S.Y.Cheng, C.W.M. Yuenz , C.W. Kan , K.K.L. Cheuk , (2008) "Development of Cosmetic Textiles Using Microencapsulation Technology", Research Journal of Textile and Apparel, Vol. 12 Iss: 4, pp.41 - 51
2. Mathias Berlinger,Eddy Szczerbinski,(2010), " MICROENCAPSULATION for Textiles" THE INSTITUTE OF TEXTILE SCIENCE St-Hyacinthe
3. technology.tki.org.nz/Resources/Case...materials.../Smart-Fibres/Microencapsulation.
4. Bojana Boh and Emil Knez(2006), "Microencapsulation of essential oils and phase change materials for application in textile products."Indian Journal of Fiber and Textile Research,Vol 31,pp 72-82.
5. Microencapsulation in textiles. B. Ocepek and P. Forte-Tavčer. University of Ljubljana, Faculty of Natural Sciences and Engineering,. Snežniška ...2008.
6. Slavica siler,Marinkovic,Dejan Bezbradica,PetarSkundric, "MICROENCAPSULATION IN TEXTILE INDUSTRY" Faculty of Technology and Metallurgy ,Belgrade,Serbia,Montenegro. Scientific Paper.
7. Gordon Nelson, Application of microencapsulation in textiles, International Journal of Pharmaceutics 242 (2002) 55–62.
8. Pant Suman and Pathak Suchita, (2012) insect control measures for woolen textiles, vol. 61. No. 11.pp 31-34.