Clothes intertwined with nanotech will treat eczema

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Tiny capsules embedded in clothes can release essential oils when they come into contact with bacteria that cause skin infections. Credit: Pexels/ Valeria Boltneva

Tiny capsules embedded in the clothes we wear could soon be used to counteract the rise of sensitive skin conditions.

"As people are getting older, they have more sensitive skin, so there is a

need to develop new products for skin treatment," said Dr Carla Silva, chief technology officer at the Centre for Nanotechnology and Smart Materials (CENTI) in Portugal.

This increased sensitivity can lead to painful bacterial infections such as dermatitis, otherwise known as eczema. Current treatments use silver-based or synthetic antibacterial elements, but these can create environmentally harmful waste and may have negative side effects.

To combat these bacterial infections in an eco-friendly way the EU-funded SKHINCAPS project is combining concentrated plant oil with nanotechnology.

Their solution puts these so-called essential oils into tiny capsules that are hundreds of times smaller than the width of a human hair. Each one is programmed to release its payload only in the presence of the bacteria that cause the skin infections.

This means that each capsule is in direct contact with the affected skin as soon as an infection occurs, increasing the effectiveness of the treatment.

According to Dr Silva, who is also project coordinator of SKHINCAPS, the nano-capsules are attached to the clothing material using covalent bonding, the strongest chemical bond found in nature. This ensures the capsules survive the washing machine and that they are invisible to whoever is wearing them.

This nanotechnology has a lifespan equal to that of the garment, though the active ingredients contained in the nano-capsules will run out earlier depending on the extent of the skin infection, and thereby on how much of the treatment is released when the clothing is worn.

The nano-capsules will prove invaluable for chronic eczema sufferers and those with high levels of stress, as well as the elderly and diabetics, who are particularly vulnerable to developing such infections.

And it's not just essential oils that could be held in the capsules.

The project is also demonstrating the use of nano-capsules loaded with paraffin, a waxy solid with the ability to absorb and release energy, in thermal clothing. The melting or crystallisation point of paraffin is around the temperature of human skin, meaning that the capsules can keep users cool by absorbing energy as the paraffin melts, or warm them up by releasing energy when it crystallises again.

This could not only improve the day-to-day comfort of those less able to control their body temperatures, such as young children, but also help sportspeople to control their temperature better while exercising.

SKHINCAPS is also adding nano-capsules loaded with vitamins and antioxidants to create anti-ageing cosmetics. The shell of this type of nano-capsule will protect their contents from decay due to sunlight exposure or change in temperature, releasing the anti-ageing ingredients only when they come into contact with skin at the right temperature and pH, maximising their effectiveness.

Cosmetics

Another EU-funded project developing nano-cosmetics is PEPTICAPS. They are putting vitamins, such as A, B, C and D, as well as antioxidants, inside nano-capsules to repair skin damage caused by chemical or sun exposure.

Dr Damien Dupin, the head of the biomaterials unit at IK4-CIDETEC, a research centre in Spain, is the project coordinator of PEPTICAPS, and

highlights the importance of protecting ourselves in the chemical-rich world we live in.

"In everything we are touching now there are chemical products," he said. "For example, latex gloves – fifty years ago no one used them, now everyone does … and some people get redness and itching."

PEPTICAPS' nano-capsules are filled with a special cocktail of vitamins that can protect or repair skin when exposed to harmful chemicals, but they don't release them until the conditions outside the capsule require them to do so.

This occurs when there is a change in pH and/or the release of an enzyme when skin irritation occurs. They could be used in creams, lotions and facial masks to help healthy skin recover after chemical or sunlight damage.

The project has been testing the nano-capsules on a laboratory-grown epidermis, an important layer of the skin, made from human skin cells donated by patients after cosmetic surgery. One advantage of this approach is that the skin layer can be irritated in the same way as real skin, providing realistic and validated results, without using animal testing.

The team have been able to show that their treatment is more efficient and penetrates deeper into the epidermis than products currently available in shops. The PEPTICAPS project expects the first cosmetic products to contain the nano-capsules to be available by 2019, in time to make SKHINCAPS a possible competitor.

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