Super sunscreen from fjord bacteria

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Norwegian researchers have recently discovered a microorganism with very special properties – a bacteria living in Trondheim Fjord. Credit: Morguefile

A microorganism living in Trondheim Fjord will provide you with better protection against skin cancer and malignant melanomas.

Norwegian researchers have recently discovered a microorganism with very special properties – a bacteria living in Trondheim Fjord with the Latin name Micrococcus luteus. It possesses a trait which is rare and highly sought-after by medical science and the cosmetics industry – a pigment which can absorb long-wavelength UV radiation (in the range 350-475 nanometres).

Links with cancer

Long-wavelength UV radiation is linked to many forms of skin cancer and malignant melanomas. Currently, there are no sunscreens on the market able to filter out this type of radiation.

However, the Norwegian company Promar AS has taken out patents for both the manufacture and use in future sunscreens of a light-filtering substance extracted from this bacterium. This has been achieved with the help of researchers at SINTEF.

At SINTEF, researchers have been working with what is known as bioprospecting for many years. This branch of science involves the exploration for organisms in the natural environment possessing traits useful in industrial applications, as fatty acids, antibiotics, enzymes and suchlike.

A bacterial library in the lab

The backdrop to this project involved activities taking place at SINTEF and NTNU by which we collected a variety of different microorganisms from the water surface in Trondheim Fjord. These organisms had one thing in common. They possessed a variety of naturally-occurring light-absorbing pigments. "This is why they are very colourful", says Trygve Brautaset, Project and Research Manager at SINTEF. The end result was an entire "library" of such microorganisms.

At about the same time, the Norwegian company Promar AS had been working on the idea of manufacturing a substance with a propertie lacking in sunscreen products currently on the market – the ability to filter out long-wavelength UV radiation.

This is why SINTEF and NTNU were contracted to look for a pigment with this trait. After investigating hundreds of different bacteria, the researchers found Mirococcus luteus in "the library". It ticked all the boxes. The microscopic organism, no bigger than 1-2 micrometres across, was found to contain a particular carotenoid, known to organic chemists as sarcinaxanthin. This pigment absorbs sunlight at just the wavelength which Promar wanted to provide protection against. By adding sarcinaxanthin to sunscreen, harmful solar radiation is absorbed by the cream before it reaches the skin. However, commercial production of the carotenoid required some tricky genetic engineering.

Produced by bacteria

Firstly, the pigments produced by the bacteria had to be characterized using a variety of chemical techniques designed to identify the desired sarcinaxanthin carotenoid. Subsequently, the genes used by the bacterium to synthesise sarcinaxanthin had to be isolated. Finally, the research team had to transfer all the genes into a host bacterium. The aim was to create an artificial bacterium able to produce sarcinaxanthin sufficiently effectively to be of commercial interest.

"After about two years' intensive work SINTEF had the first examples of this bacterium ready", says Brautaset. "We have now synthesised a sarcinaxanthin-producing bacterium which can be cultivated.

We will now be carrying out tests to see if we can produce it in so-called fermenters (cultivation tanks) in the laboratory. This represents an excellent method for the effective production of sarcinaxanthin in volumes large enough to make industrial applications possible", he says.

Large scale production

Managing Director Audun Goksøyr at Promar AS strongly believes that commercial production of the substance, recently named UVAblue, is a real possibility. And the market will welcome it with open arms. "We have been in France talking to many of the world's largest cosmetics manufacturers", he says. "Everyone we talked to was very interested in making use of this type of sunscreen factor in their products", says Goksøyr.

Among the reasons for this is that the cells which generate malignant melanomas are located deep in the skin. It is primarily long-wavelength UV radiation which penetrates to these cells when we sunbathe. By preventing this radiation from penetrating the skin will be an excellent way of averting the development of this highly lethal form of cancer. It will also act as an anti-wrinkle agent.

From expensive to economic

The challenge now is to implement large-scale commercial production of UVAblue. This means that the price of the product must be reduced. "We will continue to work on this together with the research team in Trondheim", says Goksøyr. "The key to success will be to find out how we can acquire sufficient high-quality growing media for the bacteria producing the sought-after pigment. Such bacteria currently rely on nutritional sources which should be reserved for human consumption, and as such are not sustainable or commercially viable on industrial scales. But we believe we will succeed", says Goksøyr.

Provided by SINTEF

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