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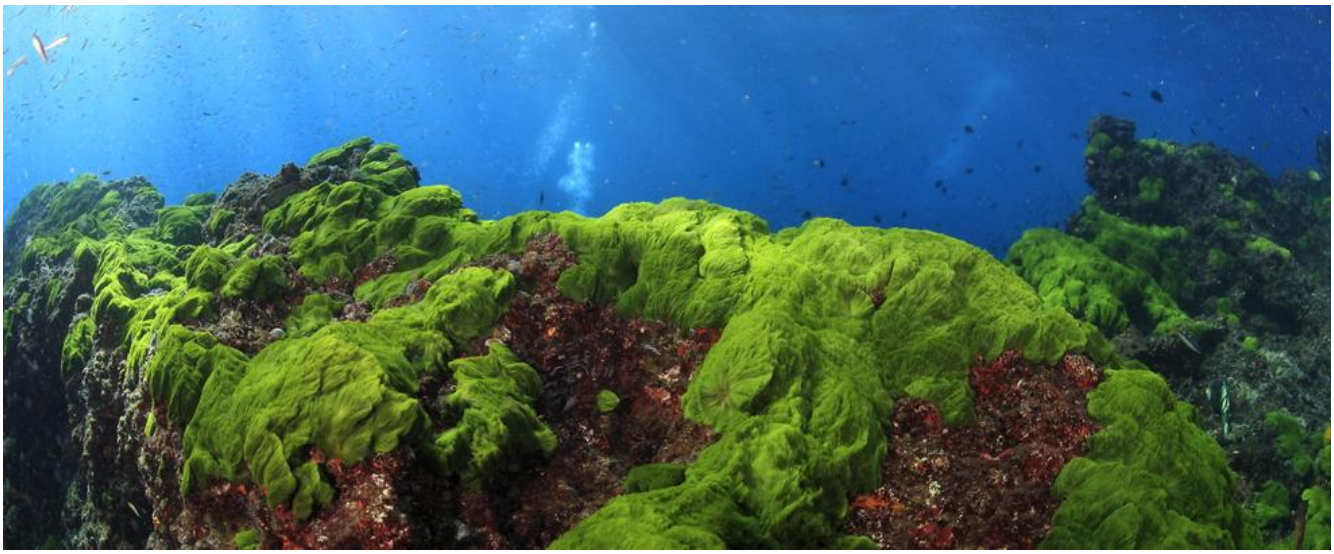

Algae, fungi and bacteria set to give the beauty sector a facelift

Antioxidant-making bacteria and ultraviolet-resistant algae – natural products are being harnessed to create a new breed of health-giving 'cosmeceuticals'.

17 June 2015 - By BENEDICT O'DONNELL

Nature-based cosmetics could also have environmental benefits for the EUR 142 billion beauty products sector, as they use much less energy to produce.

Antioxidants, for example, are notably used in skin creams to counter the degradation of living cells. Today, they are produced in energy-intensive processes that use potentially hazardous catalysts and form unsavoury by-products.

The idea is to replace them with molecules derived from nature.

In the cosmetics industry, manufacturing processes tend to be performed above 100 °C. In contrast, biochemical reactions take place at ambient temperature and standard pressure, meaning their potential for saving energy interests manufacturers and environmentalists alike.

According to Professor Vincenza Faraco at the University of Naples Federico II, Italy, a well-tailored natural enzyme could catalyse the same reaction more efficiently, without the environmental drawbacks.

She coordinates the European OPTIBIOCAT research project, which is working to replace industrial catalysts – molecules that facilitate chemical reactions – with enzymes in the production of antioxidants for the cosmetics industry. It's technology that, once perfected, could be adapted for use by other chemicals companies.

Biocatalysts

To date, OPTIBIOCAT has analysed over 800 genomes from bacteria and fungi to find DNA sequences that produce promising biocatalysts. Consortium partners rework the gene code to tailor the molecule it produces to applications in the cosmetics industry. The improved DNA is synthesised artificially and incorporated into different microbes that can produce it on an industrial scale.

‘We grow microscopic fungi in glass vessels pumped with air and nutrients,’ said Dr Laura Leonov of Dyadic, the Netherlands. ‘Their newly inserted genes tell them how to transform food into the biocatalysts that we want.’

Dyadic is one of eight small- and medium-sized enterprises (SMEs) working alongside a large cosmetics company to help the EU-funded OPTIBIOCAT project bring its advances to the market. Although the company has been selling enzymes for over a decade, Dr Leonov said that producing biocatalysts for the production of fine chemicals is a new challenge.

It’s not just the catalysts, nature could also be a rich source of raw materials for cosmetics. Dr Emmanouil Flemetakis, a biochemist at the Agricultural University of Athens, Greece, who heads up the AlgaeCom research project, which has been funded by the EU, is searching for ingredients in what he describes as one of the last unexploited reservoirs of biodiversity on the planet: marine algae.

Comparatively little is known about the tens of thousands of microalgae species living in the seas around us. While land plants have been screened over millennia for food and medicine, only a handful of algae have ever been farmed.

Marine plants present enticing prospects for sustainable development. Needing neither fresh water nor arable land to grow, they do not compete with existing crops for the production of biomass or food. Still, Dr Flemetakis believes that their true potential lies beyond these sectors. He is interested in their DNA.

Microalgae have adapted to conditions ranging from the South Pole to hydrothermal vents at the bottom of the ocean. They were one of the first forms of life on earth. They invented the process of photosynthesis and started the production of oxygen that brought all other species on the planet into existence.

To harness their resourcefulness, Dr Flemetakis’ group has worked with SME partners in Spain and Greece. Together, they have perfected methods to screen entire algae-genomes.

The tests not only identify organic compounds that could substitute synthetic chemicals in the cosmetics industry. They also study the impact of these molecules on human skin cells and identify molecules that could confer novel properties on existing products.

‘Some algae have evolved natural defences to biotic stresses, like oxidative stress and UV radiation,’ said Dr Flemetakis. These biomolecules could endow cosmetics with pharmaceutical properties – turning them into cosmeceuticals.

The upshot of all of this is that researchers are getting the chance to work out new techniques that could replace industrial chemicals in other sectors with biomolecules. That’s a big one as life’s building blocks are abundant, biodegradable and react in water as their main solvent. They produce no hazardous waste and do away with risks of raw material shortages.

‘The opportunities of biotechnology are just emerging,’ said Dr Flemetakis. ‘Scientists are looking everywhere for interesting molecules to put to good use. What better place to start than in one of the oldest and most versatile organisms on the planet?’

More info

OPTIBIOCAT

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