New biological and safer soaps

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An international research team led by Professor Charles Gauthier from the Institut national de la recherche scientifique (INRS) has discovered a new molecule with potential to revolutionize the biosurfactant market.

The team's findings have been published in *Chemical Science*, the Royal Society of Chemistry's flagship journal.

Surfactants are synthesized from petroleum and are the main active ingredient in most soaps, detergents, and shampoos. Biosurfactants, produced by bacteria, are safer and can replace synthetic surfactants.

Rhamnolipid molecules are some of the safest surfactants known and are particularly attractive, thanks to their biodegradability, minimal toxicity, and amenability to be produced from industrial waste. But there's a problem. They are made using Pseudomonas aeruginosa, a pathogenic bacterium harmful to humans.

"If we want to fully gain the benefits of rhamnolipids, we need to grow these pathogenic bacteria on a huge scale. And because that's a health risk, the industry is looking for alternatives," explained Professor Gauthier. The molecules produced by these bacteria are usually mixed with other compounds or virulence factors, making them trickier to use.

To address the problem, the research team identified molecules that resemble rhamnolipids in Pantoea ananatis, a non-pathogenic bacterium. The team was then able to chemically synthesize these molecules, called ananatosides, in the laboratory, raising the possibility that they could be produced on a larger scale than using bacteria. The industry is already showing interest in these promising new biosurfactants.

A look at the structure

The new molecule comes in two different forms, A and B. Ananatoside A structure is described as closed, while B is open. The molecule A is closed in on itself to form a loop. The process that closes the loop is called lactonization, and it has also been achieved with rhamnolipids to create new molecules.

The team has shown that the lactonized form has a large impact on the biological action of the molecules. It minimizes the surface-active properties of rhamnolipids and renders them toxic.

Now the researchers want to characterize further new biosurfactants and make the molecules more stable.

More information: Total synthesis, isolation, surfactant properties, and biological evaluation of nanatosides and related macrodilactone-containing rhamnolipids. *Chemical Science* DOI: 10.1039/D1SC01146D

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