Biosurfactants: production, applications and future potential

Eduardo J. Gudiña, Ana I. Rodrigues, Lígia R. Rodrigues, José A. Teixeira

CEB - Centre of Biological Engineering, Universidade do Minho, 4710-057 Braga, Portugal
Group: B.Factory, BIOSYSTEMS | Line: Industrial and Food Biotechnology and Bioengineering

Surfactants are one of the most important classes of industrial chemicals in terms of production volume. These compounds exhibit a wide variety of applications in several industries and are present in nearly every product and aspect of our daily life. They can be found in detergents, laundry formulations, household cleaning products, cosmetics, herbicides or pesticides, and are also used in bioremediation, agriculture, food, pharmaceutical, textile, paper or the petroleum industries, among others. Most conventional surfactants available nowadays are derived from non-renewable resources and their use may lead to significant ecological problems due to their toxicity and low biodegradability. In the recent years, an increase in environmental awareness has led to much more interest in the use of renewable-based, biodegradable and more environmentally friendly surfactants. Among them biosurfactants, surface-active compounds synthesized by microorganisms, are attracting a pronounced interest due to their potential advantages over their synthetic counterparts, and to the fact that they could replace some of the synthetics in many environmental and industrial applications. They exhibit similar or better performances when compared with chemically synthesized surfactants, and due to their biological origin, they are less toxic and more easily biodegradable. Despite the clear advantages and the potential applications of biosurfactants, their overall use is hampered by their high production costs and their limited structural variation in contrast to chemically produced surfactants. In our group, several biosurfactant-producing microorganisms have been isolated from crude oil samples in the last years. In most of the cases, the biosurfactants produced by those isolates were similar to other previously reported (e.g., surfactin, rhamnolipids). However, a novel low molecular weight bioemulsifier, which structure is completely different to those previously reported, was also identified [1]. Biosurfactant production by these microorganisms was optimized through the development of alternative low-cost culture media containing exclusively agro-industrial wastes and by-products (i.e., sugarcane molasses, corn steep liquor, olive oil mill wastewater), which significantly contributed to reduce their production costs and, at the same time, allowed the valorization of those residues [2]. The biosurfactants produced exhibited a better performance when compared with several commonly used chemical surfactants, making them promising candidates for several applications, including microbial enhanced oil recovery and bioremediation.

References

[1] Gudiña, EJ; Pereira, JFB; Costa, R; Evtuguin, DV; Coutinho, JAP; Teixeira, JA; Rodrigues, LR, Novel bioemulsifier produced by a *Paenibacillus* strain isolated from crude oil, *Microbial Cell Factories* 14, 14, 2015. doi:10.1186/s12934-015-0197-5.

[2] Gudiña, EJ; Rodrigues, AI; de Freitas, V; Azevedo, Z; Teixeira, JA; Rodrigues, LR, Valorization of agro-industrial wastes towards the production of rhamnolipids, *Bioresource Technology* 212, 144-150, 2016. doi:10.1016/j.biortech.2016.04.027.