Biotechnological potential and antimicrobial activity of biosurfactant-lipase conjugates immobilized on biopolymers.

The urgent need for new antimicrobial compounds nowadays remains of major concern due to the newly emerging human and food pathogens, the majority of which have become almost insensitive to existing antimicrobial agents and synthetic fungicides. Some biosurfactants are suitable alternatives to synthetic antimicrobial agents, and they may be used as safe and effective therapeutic agents. Despite their potential and their biological origin, only a few studies have been carried out on their possible applications in biomedical and food fields. Biofilms formed by pathogenic bacteria are one of the most important reasons for multidrug resistance. One of the major limitations in the biofilm treatment is the existence of intensive matrices, which greatly block the diffusion of antimicrobial agents. The lipases have the potential to degrade the extracellular matrix resulting in release of planktonic cells and its constituents which are more easily accessible to antimicrobials. To our knowledge, no research work has been conducted hitherto on the antimicrobial activity of biosurfactant-lipase conjugates.

Hydrogels are three-dimensional networks formed by long-chain polymers. Depending on their rheological and bioadhesive behavior, may adhere to the surface of application for long periods of time, allowing the extended release in time of the substances in the site of application, with clear advantages in terms of ease of application and/or removal. Hence, hydrogels are particularly interesting in the treatment of topical wounds due to their intrinsic low toxicity, potential for extended release of drugs, and characteristics of bioadhesiveness. In order to impart bactericidal properties to biopolymer hydrogels, they are enriched with substances displaying a biological activity. Also, hydrogels containing antibacterial substances may be used as a promising biomaterials in food industries.

The objective of this research is to assess antibacterial and antibiofilm activities of biosurfactant-lipase conjugates against pathogenic bacteria *Escherichia coli*, *Enterococcus faecalis*, *Enterococcus hirae*, *Pseudomonas aeruginosa*, *Staphylococcus aureus*, *Bacillus cereus*, *Campylobacter* spp., and *Salmonella* spp. The study will be included forming antibacterial alginate, chitosan/alginate and bacterial cellulose hydrogels by the incorporation of biosurfactant-lipase conjugates. Physical property changes of the hydrogels due to biosurfactant-lipase incorporation will be also investigated.

Antimicrobial compounds are applied to reduce, inhibit or delay the growth of microorganisms on the surface of food products. Contamination of foodstuffs by mycotoxin-producing fungi is an increasingly severe problem. Several strategies including chemical, physical and biological methods have been investigated to reduce fungal and mycotoxins contamination. Among them, biological control is one of the most promising approaches to overcome mycotoxins contamination. Biosurfactants have been reported as promising biocontrol agents against toxigenic fungi, due to their ability of reducing fungal growth and mycotoxins production. Furthermore, these compounds are easily biodegradable, being a healthier and environmental friendly alternative to the synthetic fungicides.

Our research hypothesis assumes that the results obtained in the project will be a step further towards a better understanding the mechanism of action of biosurfactant-lipase conjugates involved in inhibition of growth of pathogenic microorganisms, bacterial biofilm formation and mycotoxin production by some fungi species.