Research & Reviews: Journal of Pharmaceutical Analysis

Extended Abstract
Vol. 9, Iss. 2
2020

Biopolymer Congress 2018: Synthesis of phospholipid biosurfactants and characterization of interfacial property and environmental compatibility for cosmetic products application

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Interest in biosurfactants has been rising rapidly in recent years due to its diversity, environmentally friendly nature such as nontoxicity and excellent biodegradability, high production potential, selectivity, and high efficiency. performed even at harsh operating conditions such as high and very high temperatures or low pH. In this study, phospholipid biosurfactants with excellent biodegradability properties were synthesized from renewable vegetable oils such as sunflower oil, snapper oil, cotton oil, palm oil, and coconut oil for cosmetic products application and the structure of the resulting products was described by FT-IR, 1H NMR Spectroscopies, and 13C NMR. The synthesized phospholipid biosurfactants have been found to be highly surface active and very effective in reducing interface free energy from interface properties measurements such as CMC, static and dynamic surface tension, emulsification activity, wet property and foam property. Assessment of oral oral poisoning (LD50) showed that the synthesized phospholipid biosurfactants are nontoxic and the primary biodegradability has been found to be 99%, indicating the high bioavailability. Acute dermal irradiation test showed that the synthesized biosurfactants are free of dermal irritation problem and extremely dilute. It was also observed from an eye trauma test that the synthesized biosurfactants do not cause an eye irritation problem. The newly synthesized phospholipid biosurfactants can be used in cosmetic materials application because they are highly surface active, very effective in reducing interface free energy, nontoxic, non-irritating, very thin, and easy being bioavailable.

Biosurfactants in the food industry have potential as food-producing ingredients and antiadhesive agents. Biosurfactants reduce surface and interface tension, thereby promoting the formation and stability of emulsions. Other biosurfactants activities in food processing include: controlling the agglomeration of fat globules, stabilizing aerated systems, improving the texture and shelf-life of starch-based products, and improving the consistency and texture of fixed products on fat (Muthusamy et al., 2008). In bakery and ice cream manufacturing, biosurfactants are used to: control consistency, extend freshness, and solubilize flavored oils. They are also used as fat stable and anti -pattering agents when cooking oil and fat. Addition of rhamnolipid biosurfactant improves stability in dough; the texture, size, and preservation of bakery products; and cream properties of butter, croissants, and frozen sugars products (Muthusamy et al., 2008).

The new strategy for controlling the adherence of microorganisms to the food contact surface and thus preventing biofilm formation is the incorporation of biosurfactants. Bacterial bio-organisms can be sources of contamination, which can lead to food damage and disease spread (Muthusamy et al., 2008).

However, mathematical modeling is complicated once it deals with the metabolism of living organisms, which makes the behavior of the system somewhat predictive. In these cases, gradient-based numerical methods are not used because they often get stuck at lower levels in the area. On the other hand, Artificial Intelligence is used to model and augment high complexity systems, such as biochemical processes, where the use of precision techniques is very limited (Link & Weuster-Botz, 2006, Pappu & Gummadi , 2017, Dhanarajan et al., 2017). They are considered to be the correct way to find the best solution because they are

This work is partly presented at 8th World Congress on Biopolymers & Bioplastics on June 28-29, 2018 at Berlin, Germany

based on probability rules (Chowdhury & Garai, 2017).

Micelles were detected at pH of 6.8 or higher by the authors, in which the carboxyl groups of the RLs are completely neutralized. As can be seen, costs are highly interconnected in RL-based liposomes, and this issue needs to be considered when designing delivery systems for biological use, considering that the conditions of use may not. favorable in terms of stability (Shete et al., 2006).

Most of the scarce work on biosurfactant-based liposomes has been limited to the development of alternatives to the use of viruses in transmission methods. Antibiofilm biosurfactants have been studied in previously developed works in our laboratory (Monteiro et al., 2011, 2012; Domingues et al., Submitted for publication), and our group are now working on methods for studying such molecules in biofilm control with liposomes (Dias-Souza et al., unpublished data).

A liposome vector containing DNA biosurfactant beta-d-glucoside beta-d-glucoside was developed by Maitani et al. (2006) for herpes simplex thymidine kinase gene therapy virus. Liposomes were prepared with cholesterol 3 [N-(N ′, N′-dimethylaminoethane) -carbamoyl] (DC-Chol), l- dioleoylphosphatidylethanolamine (DOPE), and a biosurfactant was added to each compound, being beta-sitosterol beta-d -glucoside (Sit-G). For gene expression selectivity, the thymidine kinase (MK-tk) gene was used for the herpes simplex virus thymidine kinase (HSV-tk) gene, using a luciferase system for analysis. Sit-G liposomes had better performance compared to MEL liposomes in terms of transfection efficiency of the luciferase signal gene, and the authors suggested that Sit-G-liposome may be a potential vector for gene HSV-tk gene.

To increase the delivery efficiency of the cationic liposome systems, Shim et al. (2009) added surfactin in the liposomal membrane prepared by DOPE and EDOPC, in different concentrations (1–30%). Surfactin, a lipopeptide composed of B. subtilis, consists of a closed-loop heptapeptide with hydroxy fatty acid C13 - C15. In all compositions tested by the authors, the size of the vesicles did not exceed 200 nm. The use of surfactin increased the rate of cellular delivery of siRNA in Hela cell lines, and transfection efficiency depended on the percentage of surfactin used. Fluorescence microscopy experiments showed that EDOPC-based cationic liposomes with 3% surfactin showed a more intense fluorescence signal in human Hela cells than liposomes without surfactin, suggesting that surfactin enhanced the efficiency of the liposomes in this assemblage.

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