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# Physico-chemical Challenges on the auto assembly of natural polymers on cosmetic surfaces

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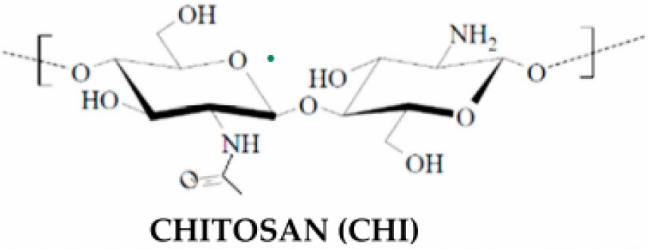
## PURPOSE OF THE ABSTRACT

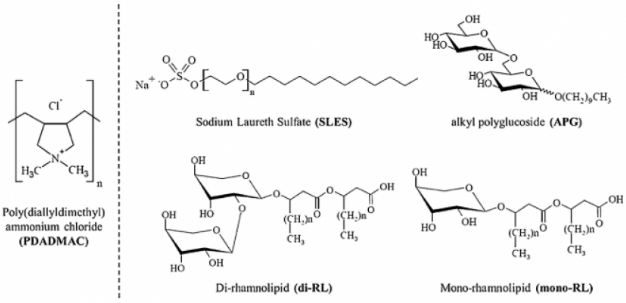
Polymer-surfactant systems have many technological and industrial applications such as: fabrication of functional materials and coatings, personal care and pharmaceutical products, food science, paints, anti-icing liquids, tertiary oil recovery, and paper industry. Mixtures containing polymers and surfactants are especially important on the development of formulations for shampoos and hair conditioners.
We have studied the self-assembly in solution of a natural polymers ( chitosan) as well as biosurfactants (rhamnolipids) in binary mixtures comparing the results with classical petrochemical ingredients as surfactant sodium laureth sulfate (SLES) or poly( diallyl- dimethyl-ammonium chloride (PDADMAC) . The combination is of particular interest in formulation. In particular, we have also studied binary mixtures formed with sugar-based rhamnolipids (RL) and alkylpolyglucoside (APG). The reason being in this case that glycolipid biosurfactants provide good physico-chemical properties and can be considered potential good substitutes of synthetic surfactants, with a better environmental impact and lower toxicity.

Dynamic Light Scattering (DLS) and turbidimetry measurements, together with electrophoretic mobility measurements, have been used for characterizing the polyelectrolyte ? surfactant complexation in bulk.
The adsorption of such mixtures onto solid surfaces mimicking the negative surface charge of damaged hair has been followed by two complementary techniques: Ellipsometry and Dissipative Quartz Crystal Microbalance (D-QCM). The combined information has provided important insights on the conditioning effects and lubrication (water content) of the polymer - surfactants mixtures. The topography of the layers obtained by Atomic Force Microscopy (AFM) allows us to obtain further insights on the conditioning performance of the formulation.
In all cases the adsorption onto the solid surface of the aggregates formed in the bulk is enhanced with the surfactant concentration increase. This behavior can be ascribed to the bigger size of the aggregates formed in the bulk and their high surface charge which favors their deposition onto negatively solid surfaces. Furthermore, first SCF calculations agree qualitatively with experimental results, even the applied model presents some differences with the real experimental scenario. The performance of PDADMAC ? sugar based surfactant complexes has been found to be governed by the charge of the surfactant, the number of sugar rings present in their structure and the length of the hydrocarbon length. Results show that the structure of different sugar-based surfactants, especially rhamnolipids, conditions the adsorption potential of polyelectrolytes in model washing systems. To conclude, the future is extremely bright. There is a significant opportunity to transform biopolymers, such as CHI and cellulose, by changing the molecular weights, molecular distributions, functional groups (including counter-ions), and so on. Such diversity means the powerful tools and methodologies presented above

are extremely important in guiding chemists in designing and developing new, better-performing and more sustainable polymers.

## FIGURES




### FIGURE 1
chitosan

Polysacharide use in the study

### FIGURE 2
Model ingredients

Ingredients used in the mixtures used


## KEYWORDS
BIOSURFACTANT | CHITOSAN | COSMETICS | POLYMER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