

Preliminary Studies of Antibiofouling Properties in Wrinkled Hydrogel Surfaces

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Abstract : In this study, it was explored the formation and the morphological differences between wrinkled hydrogel patterns obtained via generation of surface instabilities. The slight variations in the polymerization conditions produce important changes in the material composition and pattern structuration. The compounds were synthesized using three main components, i.e. an amphiphilic monomer, hydroxyethyl methacrylate (HEMA), a hydrophobic monomer, trifluoroethyl methacrylate (TFMA), and a hydrophilic crosslinking agent, poly(ethylene glycol) diacrylate (PEGDA). The first part of this study was related to the formation of wrinkled surfaces using only HEMA and PEGDA and varying the amount of water added in the reaction. The second part of this study involves the gradual insertion of TFMA into the hydrophilic reaction mixture. Interestingly, the manipulation of the chemical composition of this hydrogel affects both surface morphology and physicochemical characteristics of the patterns, inducing transitions from one particular type of structure (wrinkles or ripples) to different ones (creases, folds, and crumples). Contact angle measurements show that the insertion of TFMA produces a slight decrease in surface wettability of the samples, remaining however highly hydrophilic (contact angle below 45°). More interestingly, by using confocal Raman spectroscopy, important information about the wrinkle formation mechanism is obtained. The procedure involving two consecutive thermal and photopolymerization steps lead to a “pseudo” two-layer system. Thus, upon photopolymerization, the surface is crosslinked to a higher extent than the bulk and water evaporation drives the formation of wrinkled surfaces. Finally, cellular, and bacterial proliferation studies were performed to the samples, showing that the amount of TFMA included in each sample slightly affects the proliferation of both (bacteria and cells), but in the case of bacteria, the morphology of the sample also plays an important role, importantly reducing the bacterial proliferation.

Keywords : antibiofouling properties, hydrophobic/hydrophilic balance, morphologic characterization, wrinkled hydrogel patterns

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