Investigating the effect of surface topography on hydrophobicity and bacterial attachment of polystyrene

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In this paper, we report the investigation on effect of surface topography (roughness) and hydrophobicity (contact angle measurement) on bacteria adhesion for polystyrene material. The surfaces of polystyrene substrates were patterned using UV-laser radiation with a wavelength of 193 nm at different conditions. Different surface topographies were fabricated and then measured by an optical surface profiler and contact angle measurements. For bacterial adhesion experiments, an assay of Escherichia coli (E.coli) has been developed and used for bacterial adhesion measurements on both as received and the modified polystyrene surfaces. The method is based upon the staining of attached bacterial cells with the nucleic acid-binding, green fluorescent DAPI stain. The preliminary results show that laser-assisted modification by using laser ablation (wavelength λ=193nm) can make polystyrene substrates either more hydrophilic (with oxygen) or more hydrophobic (with air). The contact angle can be varied from 37° to 108°. The results on bacterial attachment show that the polystyrene substrates as received have no bacteria attached, indicating a good anti-bacterial performance. The treated substrates show some bacterial attachment and, in particular, the surfaces with high contact angle have much higher numbers of bacterial cells attached. This indicates that such laser-assisted process with air can make polystyrene surfaces more attractive to E. coli bacteria.