

# Microorganisms and Biofilms

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### Nanoparticles production and inclusion in *Staphylococcus Aureus* incubated with Polyurethane: an electron microscopy analysis

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The interaction of *S. aureus* with polyurethane is studied with electron and ion microscopy instrumentation (SEM, FIB and TEM). Biodestruction is a corrosion process of natural and artificial materials operated by microorganisms; it is remarkable for the polymeric materials commonly used in medicine, especially in prosthetic stomatology where polyurethane occupies a special position. Prostheses in the oral cavity are constantly attacked by microorganisms and their colonization often concurs in the destruction of the artificial materials. Moreover biodegradation is associated to the release of allergenic substances, toxic to the human body. Scanning Electron Microscope (SEM) and Focused Ion Beam (FIB) are used to evaluate the damage of artificial materials in the different stages of chemical and physical factors in the external interaction with microorganisms (adherence, environment, bacteria can form a biofilm formation of microcolonies and biofilm). Transmission Electron Microscope (TEM) is directly related to the increase of the complementary technique to identify and trace biodegradation capacity. This study shows that submicron/nano particles found in bacterial cells (*Staphylococcus aureus*) incubated with polyurethane (a material commonly used for prosthesis in odontostomatology) are a consequence of biodestruction. Formation of small particles of polyurethane occurs under the influence of bacterial enzymes (esters). The presence of polyurethane nanoparticles into bacterial vesicles suggests that the internalization process occurs through endocytosis... TEM and FIB/SEM are a suitable set of correlated instruments and techniques for this multi facet investigation: polyurethane particles influence the properties of *Staphylococcus aureus* from the morpho-functional standpoint that may have undesirable effects on the human body. *S. aureus* and *Candida albicans* are symbiotic microorganisms; it was observed that *C. albicans* has a similar interaction with polyurethane and an increment of the biodestruction capacity is expected by its mutual work with *S. aureus*.