Resistance of plasma polymers to sterilization techniques used in biomedical applications

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Thin films of plasma polymers have been frequently suggested for use in biomedical applications. Versatility of precursors used for plasma polymerization allows modification of surfaces with interfacial layers of very different bioresponsive properties. It is also generally recognized that artificial materials to be used in contact with biological media should undergo preliminary sterilization to eliminate any form of microbial life. Sterilization techniques, however, may induce irreversible changes in plasma polymers and may be detrimental for their performance as bioactive coatings. This problem is rarely addressed to [1, 2] and can be considered as overlooked in the literature.

This work studies the effect of three most commonly used sterilization techniques (UV treatment, dry heat and autoclaving) on physical, chemical and cell adhering properties of plasma polymers. Hydrophobic fluorocarbon, bioadhesive amino-containing and non-fouling PEO-like plasma polymers were prepared by rf magnetron sputtering and plasma-assisted thermal vapor deposition. Their thermal stability, tolerance to hydrolysis and ability to maintain biological performance after sterilization was studied. It was found that the fluorocarbon and amino-containing films were most chemically prone to autoclaving due to hydrolysis whereas the PEO-like plasma polymers exhibited the strongest chemical changes after the dry heat treatment due to thermal degradation/oxidation. It was concluded that no universal sterilization method exists that assures preservation of the properties of all kinds of plasma polymers. Resistance of each plasma polymer towards sterilization methods has to be tested individually.

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References

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