Investigation of Strong Cell Adhesion to Amine-rich PlasmaPolymers

Lenka Zajickova [1], Jirina Medalova [1], Petra Cernochova [1], Miroslav Michlicek [1], Satoshi Hamaguchi [2], and David Necas [1]

[1]Masaryk University, Czech

[2]Osaka University, Japan

Plasma polymerization is able to prepare thin films with aminefunctional groups important for bioapplications. It was observed in severalstudies that amine surfaces are efficient platform for cell cultivation butdetails still need to be investigated because the conditions of plasmapolymerization influence the amount of functional groups as well as the filmstability in aqueous media. We have shown recently that mouse myoblast C2C12cells exhibited strong adhesion to plasma polymerized cyclopropylamine (PP-CPA)films because the application of trypsin for 5 min (standard treatment time)did not result in the detachment of majority of the cells as in the case ofcontrol (uncoated) sample [1]. This effect could be used in tissue engineeringbut at first it is necessary to understand its origin related to the chemicalstructure of amine plasma polymers. Therefore, PP-CPA films were prepared inlow pressure capacitively coupled discharge (13.56 MHz) at various energeticconditions. The amount of nitrogen and amine groups in the films was varied asrevealed by film analyses. Some insight into the film growth was also obtainedby molecular dynamic simulations. The cell adhesion for different types ofcells after 24 hours of the incubation (standard conditions in high glucoseDMEM with 10 $\%_0$FBS and antibiotics) was studied after the application oftrypsin for different time from 10 to 40 min. Strongly decreased detachment forthe cells on amine surfaces was observed even after the longest time. The short-term developed adhesion of the cellswas studied by single cell force spectroscopy by attaching a cell to the tiplesscantilever. The maximum adhesion force and work of cell removal was increasedfor the tests on PP-CPA surfaces.

[1] A. Manakhov, M. Landová, J. Medalová, M. Michlíček, J. Polčák, D. Nečas, L. Zajíčková, Cyclopropylamine plasma polymers for increased cell adhesion and growth, Plasma Processes and Polymers 14 (2017) e1600123

We would like to thank JPK Instruments for lending us CellHesion200 with JPK NanoWizard 4AFM software.