Treatment of DMEM and RPMI 1640 cell medium by DBD type atmospheric pressure plasma jet

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Here we will present the results of the plasma treatment of the DMEM and RPMI 1640 cell culture mediums. Both mediums were treated by Dielectric Barrier Discharge (DBD) type of atmospheric pressure plasma jet. After treatment concentrations of RONS were determined by spectrophotometry and colorimetric methods.

1. Introduction

Plasma medicine is interdisciplinary research field that combines studies in physics, biology, chemistry and medicine [1]. The use of plasma on living cells and tissues has already been thoroughly investigated. Recently, indirect application previously prepared Plasma Activated Medium (PAM) on cells has also attracted great attention, since the cells are normally surrounded or covered with various biological fluids. Therefore, the chemistry induced by the plasma in the aqueous state becomes essential and crucial for the biological outcomes in the treatment of different cell types [2].
In this work we have investigated effects of plasma treatment on cell culture mediums DMEM and RPMI 1640. Atmospheric pressure plasma jets able to generate reactive oxygen and nitrogen species in medium which is then used as PAM.

2. Experimental setup

The physical and chemical properties and potential application of PAM depends on different plasma sources which are employed as well as different medium. We have used two configurations (with one and two electrodes) of dielectric barrier discharge (DBD) type of the APPJ system powered by kHz sine wave high-voltage power supply system (Fig. 1). Helium was used as working gas with the 2 slm gas flow. The distance between the ending of the APPJ tube and surface of the sample, which was contained in a well of a micro-titter plate, was 5 mm. After the treatment the effects of plasma were investigated by spectrophotometry and colorimetric methods. Concentrations of nitrite ions, nitrate ions and hydrogen peroxide were determined and correlated with the different type of medium.

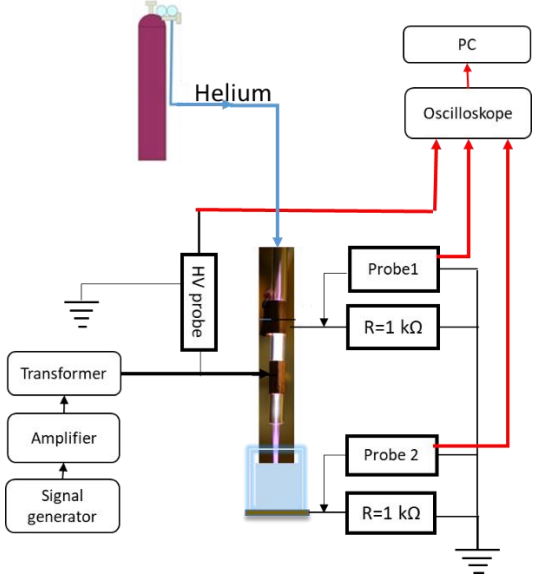

Fig. 1. Schematic diagram of plasm treatment medium by DBD jet

3. Results and discussion

Figure 2 shows the increase in concentrations of reactive species in two different media RPMI 1640 and DMEM after 5 minutes of treatment by 2 electrodes DBD atmospheric pressure plasma jet. Before treatment, the concentration of hydrogen peroxide and nitrate was 1 mg/l and 32 mg/l respectively, while

there was no nitrite in RPMI 1640 medium. There were not reactive species measured by colorimetric and spectrophotometry methods in DMEM medium before the treatment. Although the treatment conditions are the same, the concentration of hydrogen peroxide in PAM-RPMI 1640 is more than 6 times higher than in PAM-DMEM, while the concentration of nitrites is twice as high. Nitrate concentration in PAM-RPMI 1640 also increased after treatment while in PAM-DMEM the colorimetric method did not show any nitrates after treatment as well as before treatment. The differences in concentrations stem from the different chemical compositions of these two mediums that induces different chemical reactions during plasma treatment. Consequently, different concentrations of reactive species in PAM will give different effects on the cells.

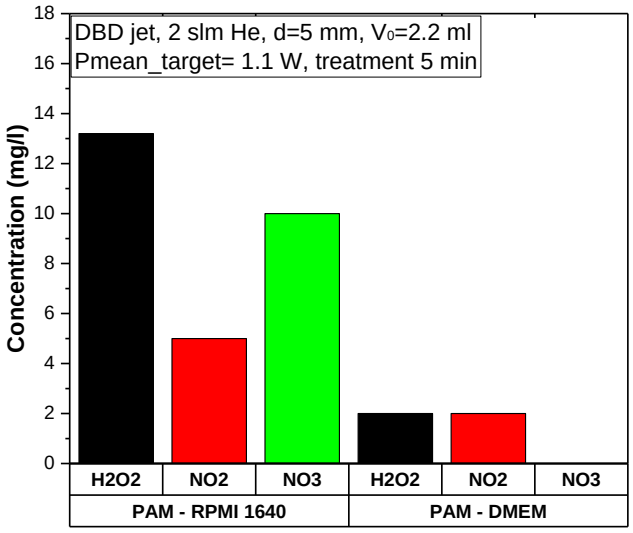

Fig. 2. Increase in reactive species concentrations in PAM-RPMI 1640 and PAM-DMEM after 5 min of treatment and 1.1 W power deposited in the plasma treatment by DBD jet

4. Conclusion

In order to achieve the desired influence of PAM on the cells, the first step is to investigate the effects of plasma treatment on the medium after treatment. It was shown that PAM properties depends on plasma source, treatment time feeding gas and power deposited in the plasma treatment. Here we investigated the influence of the composition of liquid, i.e. type of medium on plasma RONS production. The experimental results show that employment of a Dielectric Barrier Discharge (DBD) type of atmospheric pressure plasma jet produces different RONS concentrations in mediums RPMI 1640 and DMEM while operating with the same working gas and at the same power.

5. Acknowledgments

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6. References

[1] Weltmann K D, Kindel E, von Woedtke T, Hähnel M, Stieber M and Brandenburg R 2010 Atmospheric-pressure plasma sources: Prospective tools for plasma medicine *Pure Appl. Chem.* **82** 1223–37

[2] D. Graves, *J. Phys. D: Appl. Phys*. **45**, 263001 (2012)