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Parameters of tap water treated by cold plasma discharges over the surface and inside water

M. El Shaer, M. Mobasher, M. Habib, M. Samir

PEARLZ (Plasma & Energy Applications Research Laboratory, Zagazig), Faculty of Engineering, Zagazig University, Zagazig, Egypt

Cold plasma applications in many fields, as plasma medicine and plasma agriculture, involve discharges in air above water surface or directly inside water. We have measured parameters of tap water as pH value, ORP, conductivity and nitrate concentration for two types of discharges: pin-water surface DBD above water and pin to plate corona discharge inside water. In the first case, pH is nearly constant on the beginning of discharge time and decreases for longer time giving acidic water, while conductivity, ORP and nitrate concentration increase. For discharge inside water, pH remains constant, as well as conductivity, ORP and nitrate remains at normal level. From these results, we see that acidic medium needed for sterilization is better obtained by discharges in air outside water while for drinking water and agriculture, discharges inside water are more suitable.

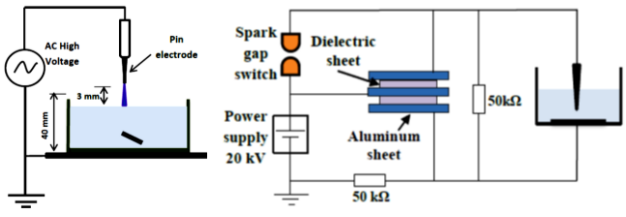
1. Introduction

In plasma medicine and plasma agriculture different discharge schemes are applied outside or inside water [1]. This influences the physical and chemical properties of treated water. Two types of discharges are considered, pin-water surface dielectric barrier discharge (DBD) above water surface and pin to plate corona discharge inside water. During plasma treatment, tap water parameters as pH, ORP, conductivity and nitrate concentration are measured.

2. Experimental setup

Pin-water surface DBD occurs between a needle above water surface and a counter electrode placed outside the glass container bottom, as shown in Fig. 1-a. An AC signal of 5.7 kHz and 2 KV is used.

Needle to plate corona in water is made by discharging a single tri-plate Blumlein capacitor of 2 nF charged by DC high voltage, as shown in Fig.1-b. Water parameters as pH value and conductivity are measured using HI98129 meter, ORP by HI98120 meter and nitrate by test kit HI3874.

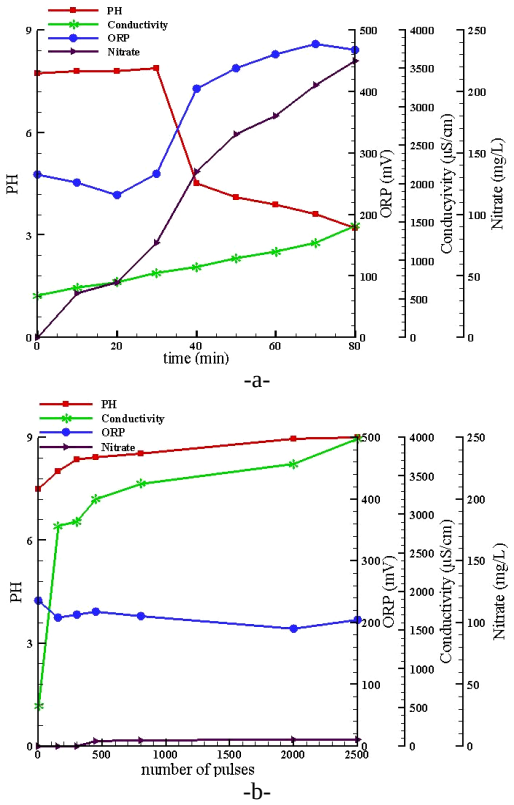


-a- -b-

Fig. 1, a- pin-water surface DBD, b- pin to plate Corona

3. Results

pH, conductivity, ORP and nitrate concentration for tap water under pin-water surface DBD outside water and pin to plate corona inside water are shown in Fig 2 -a and 2-b.



-a-

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Fig. 2, water parameters for discharges outside water (a) and inside water (b)

4. Conclusion

Depending on applications requiring certain tap water parameters, we choose between discharge initiated in air outside water surface or inside water.

5. References

[1] P. Bruggeman, C. Leys, J. Phys. D: Appl. Phys. 42 (2009) 053001.