Hydrogen peroxide production in water treated by non-thermal plasma in different atmospheres

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1 Introduction

Chemical properties of distilled water treated by non-thermal plasma reactor were studied. Hydrogen-peroxide production, pH value and conductivity in distilled water were measured after plasma-treatment in air and argon as feed gases.

2 Materials and methods

Water falling film dielectric barrier discharge (DBD) reactor (Fig. 1) was used for water treatment [1]. Direct contact of water film with plasma in this reactor enables efficient transfer of reactive species generated in plasma to liquid phase. For optimization of reactive species production frequency and amplitude of the applied voltage were varied.

3 Results and Discussion

Chemical characterization of water treated by DBD generated in different gases shows that hydrogen peroxide production in argon reaches yield of 0.78 g/kWh, while in air it was 0.19 g/kWh (Fig. 2). Both measurements were made with 35 W of power dissipated in plasma.

Moreover, significant influence of gas atmosphere was observed in measurements of pH value and conductivity which imply that production of ions is about 15 times greater in water treated with plasma generated in air than in argon (Table. 1).

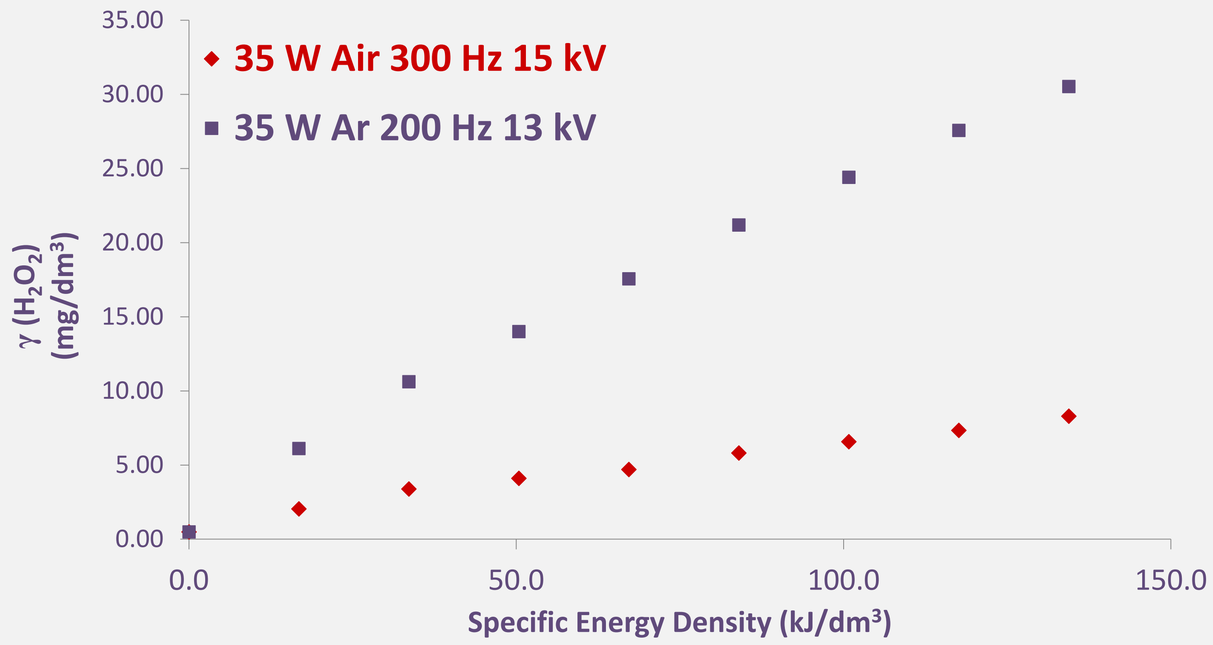

Fig 2. Dependence of H_2O_2 content of Specific Energy yield (SED) in water - Air and Ar as feed gases with 35 W of discharge power

4 Conclusion

Advanced oxidation using this type of non-thermal plasma reactor enables production of active species in situ, while working in ambient conditions.[1]

Effectiveness of plasma treatment was already confirmed with degradation of some waterborne pharmaceuticals. [2]

This opens opportunities for new studies of plasma oxidation of pharmaceuticals in aquatic environments.

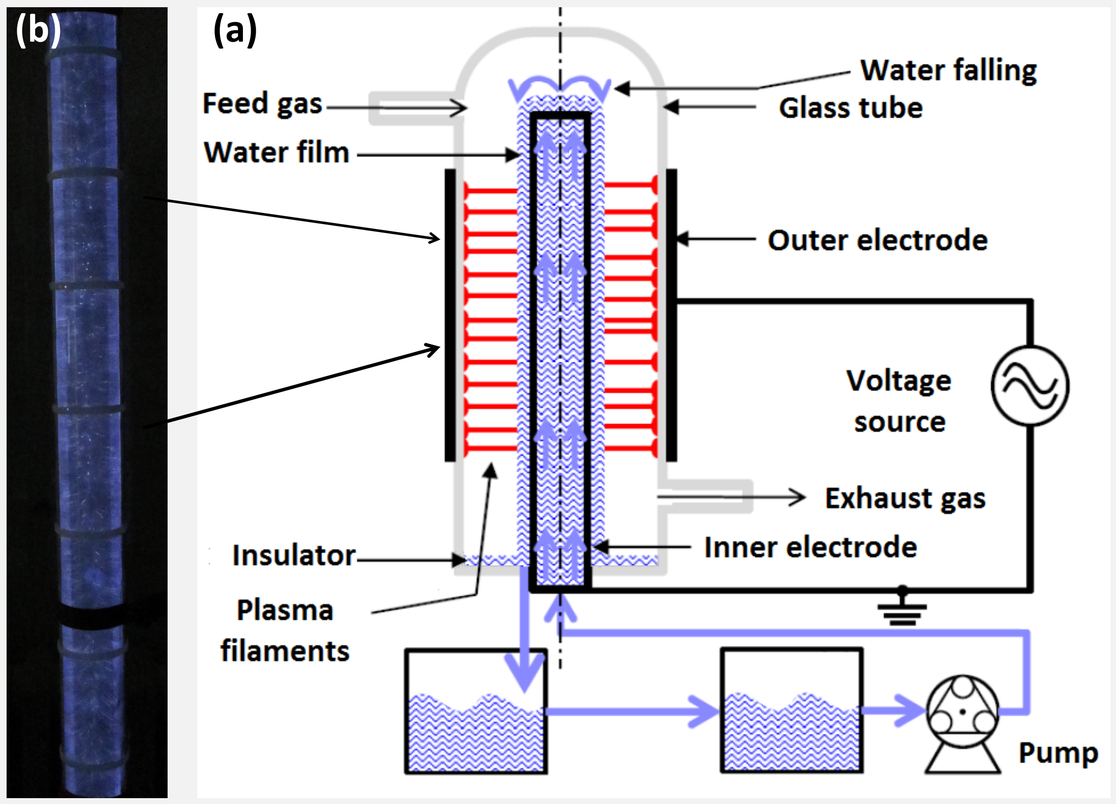

Fig 1. Experiment scheme using water falling film dielectric barrier discharge (DBD) plasma reactor (a) and side-on photograph of discharge of argon with water (b)

Table 1. Values of [H+] and conductivity of treated water for plasma discharge generated in Air and Ar as feed gas with 35 W of discharge power

SED 140 (kJ/dm^3)	Air 35 W	Ar 35 W
[H+] (mol/dm^3)	1.07 E-03	6.2 E-05
Conductivity (μS/cm)	238.0	10.4

Acknowledgments

This study was supported by the Ministry of Education, Science and Technological development of the Republic of Serbia through projects 172030 and 171034.

References

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