Mechanical Disruption as a Source of Electrified Water

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Keywords: *vapor electricity, electrified interfaces, electric double layer, charge carriers.*

Introduction

Aqueous aerosols are widely found on Earth's atmosphere and they participate from any anthropic environment. Most natural and anthropic gaseous environments contain water droplets with diameters ranging from a few nanometers (e.g. close to waterfalls) to a few millimeters (e.g. in rain). They display significant surface areas (e.g. 30 m^2/g for 100 nm droplets) that produce a host of interfacial phenomena. Many scientific disciplines study water and other liquid droplets in the atmosphere paying greater or lesser attention to their electrification but there is no consensus on the mechanisms for droplet charging and divergent views are found in recent literature. In fact, non-electroneutral water[1] is far more often found than neutral water and **Fig. 1** resumes some natural sources of electrified water in many environments.

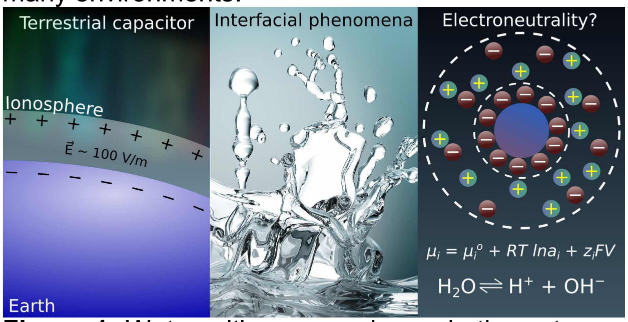

Figure 1. Water with excess charge is the outcome of many different events triggered by electric fields or by interfacial phenomena that produce non-electro-neutral water, either liquid, solid or vapor, due to excess H^+ or OH^- concentration.[2]

Results e Discussion

We show here that aerosols produced by a nebulizer based on splashing contains both positive and negative droplets, as shown in **Fig. 2**, this means, it is bipolar but the overall aerosol charge is usually non-zero. Charge distribution within the aerosol is by itself fractal, as previously observed in other cases of mechano-chemical charge formation that is an important mechanism for producing triboelectricity in solids. The present information added to other authors' work lead to a particle charging mechanism based on charge partition at interfaces combined to the variability of interfacial area/volume ratio in aqueous droplets, thus explaining the formation of bipolar aerosol. The demonstration of charge bipolar distribution within aerosols contributes to explain the ubiquity of electric charge patterns in solid surfaces that is receiving growing evidence and contributes to understand both beneficial and damaging outcomes of electrostatic charging.

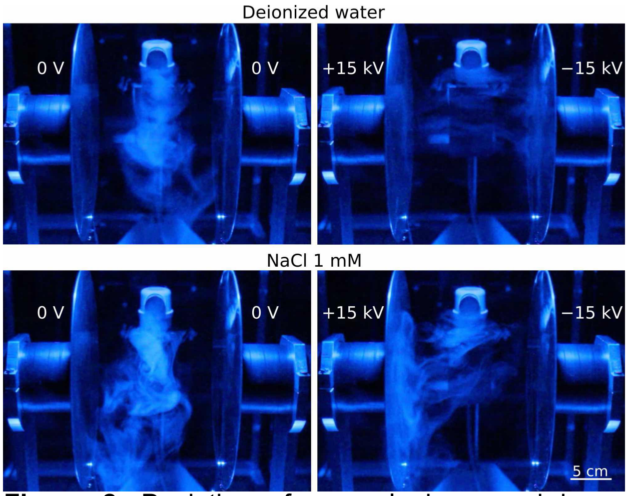

Figure 2. Deviation of aerosols immersed in an electric field. When a voltage is applied to the electrodes, aerosol formed from deionized water deflects mainly towards the negative copper electrode, unlike the aerosol from NaCl solution that deflects mainly towards the positive electrode.[3]

Conclusion

The findings outlined in this work show that water is often non-electroneutral and that it contributes in many ways to impart non-electroneutrality to other substances. Beyond, the visual observation of aerosol flow under an electric field reveals that opposing currents coexist in adjacent cells, analogous to Bénard convective cells.

Acknowledgements

Supported by CNPq and Fapesp (Brazil) through Inomat, National Institute (INCT) for Complex Functional Materials. TALB holds fellowship from CNPq.

[1] Burgo, T. A. L.; Galembeck, F.; Pollack, G. H. *J. Electrostat*. **2016**, 80, 30.

[2] Burgo, T. A. L.; Galembeck, F. *JBCS*. **2015**, 27, 229.

[3] Burgo, T. A. L.; Galembeck, F. *Colloids and Interface Science Communications* **2015**, 7, 7.